R21 Curriculum

B.Tech. in Computer Science and Engineering

JIS University
Agarpara, Kolkata

SEMESTER-1							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT1001	Mathematics I	3	1	0	4
2	BS	YPH1001	Physics	3	1	0	4
3	ES	YCS1001	Basic Electronics	3	0	0	3
4	ES	YCS1002	Engineering Mechanics	3	0	0	3
5	ES	YCS1003	Basic Problem Solving	2	1	0	3
6	HS	YED1001	English for Communication	2	0	0	2
PRACTICAL							
7	BS	YPH1101	Physics Laboratory	0	0	3	1.5
8	ES	YCS1101	Basic Electronics Laboratory	0	0	3	1.5
9	ES	YCS1102	Engineering Drawing and Graphics	0	0	3	1.5
10	HS	YED1101	Language Laboratory	0	0	2	1
TOTAL				**16**	**3**	**11**	**24.5**

SEMESTER-2							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT2001	Mathematics II	3	1	0	4
2	BS	YCH2001	Chemistry	3	0	0	3
3	ES	YCS2001	Basic Electrical Engineering	3	0	0	3
4	ES	YCS2002	Fundamentals of Programming	2	1	0	3
PRACTICAL							
5	BS	YCH2101	Chemistry Laboratory	0	0	3	1.5
6	ES	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	1.5
7	ES	YCS2102	Programming Practices I	0	0	3	1.5
EMBEDDED(THEORY + PRACTICAL)							
8	ES	YCS2301	Workshop Practice	1	0	3	2
MANDATORY NON-CGPA COURSE							
9	MC	YCS2501	Universal Human Values and Professional Ethics	3	0	0	0
10	MC	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	0
TOTAL				**15**	**2**	**15**	**19.5**

SEMESTER-3							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**

THEORY							
1	BS	YMT3001	Discrete Structures	3	0	0	3
2	BS	YMT3002	Probability and Statistics	3	0	0	3
3	PC	YCS3001	Digital Circuits and Logic Design	3	1	0	4
4	PC	YCS3002	Data Structures and Algorithms	3	1	0	4
5	OE	YCS3003	Object Oriented Programming	3	0	0	3
PRACTICAL							
6	PC	YCS3101	Digital Circuits Laboratory	0	0	3	1.5
7	PC	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	1.5
8	OE	YCS3103	Object Oriented Programming Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS3501	Behavioral and Interpersonal Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS3201	Innovative Project I	0	0	3	1.5
TOTAL				**15**	**2**	**15**	**23**

SEMESTER-4							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS4001	Computer Organization and Architecture	3	0	0	3
2	PC	YCS4002	Design and Analysis of Algorithms	3	1	0	4
3	PC	YCS4003	Data Base Management System	3	0	0	3
4	PC	YCS4004	Formal Language and Automata	3	0	0	3
5	HS	YMG4001	Economics for Engineers	2	0	0	2
PRACTICAL							
6	PC	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	1.5
7	PC	YCS4102	Algorithms Laboratory	0	0	3	1.5
8	PC	YCS4103	Data Base Management System Laboratory	0	0	3	1.5
9	PC	YCS4104	Programming Practices II	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
10	MC	YCS4501	Constitution of India	3	0	0	0
SESSIONAL (ONLY INTERNAL EVALUATION)							
11	PROJ	YCS4201	Innovative Project II	0	0	3	1.5
TOTAL				**17**	**1**	**15**	**22.5**

SEMESTER-5							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS5001	Operating Systems	3	0	0	3
2	PC	YCS5002	Embedded Systems	3	0	0	3
3	PC	YCS5003	Introduction to Data Science	3	0	0	3
4	PC	YCS5004	Advanced Computer Architecture	3	0	0	3
5	OE		Elective I	3	0	0	3
		YCS5005	Multimedia Technology				
		YCS5006	Operations Research				
		YCS5007	Communication Engineering				
PRACTICAL							
6	PC	YCS5101	Operating Systems Laboratory	0	0	3	1.5
7	PC	YCS5102	Embedded Systems Laboratory	0	0	3	1.5
8	PC	YCS5103	Data Science Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS5501	Environmental Science	3	0	0	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS5201	Innovative Project III	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**21**

SEMESTER-6							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS6001	Computer Networks	3	0	0	3
2	PC	YCS6002	Software Engineering	3	0	0	3
3	PC	YCS6003	Compiler Design	3	0	0	3
4	PC	YCS6004	Cryptography and Network Security	3	0	0	3
5	OE		Elective II	3	0	0	3
		YCS6005	Internet Technology				
		YCS6006	E-Commerce and ERP				
		YCS6007	Cloud Computing				
		YCS6008	Java Programming				
PRACTICAL							
6	PC	YCS6101	Computer Networks Laboratory	0	0	3	1.5
7	PC	YCS6102	Software Engineering Laboratory	0	0	3	1.5
BLENDED (MOOC + INTERNAL ASSESSMENT)							
8	OE	YCS6401	MOOCS Elective I	3	0	0	3
MANDATORY NON-CGPA COURSE							
9	MC	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS6201	Innovative Project IV	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**22.5**

SEMESTER-7							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG7001	Value and Ethics in Profession	2	0	0	2
2	PE		Elective III	3	0	0	3
		YCS7011	Artificial Intelligence				
		YCS7012	Machine Learning				
		YCS7013	Data Warehousing and Data Mining				
3	PE		Elective IV	3	0	0	3
		YCS7011	Artificial Intelligence				
		YCS7012	Machine Learning				
		YCS7013	Data Warehousing and Data Mining				
PRACTICAL							
4	PE	YCS7101	Stream Lab 1: Artificial Intelligence and Machine Learning	0	0	4	2
BLENDED(MOOC + INTERNAL ASSESSMENT)							
5	OE	YCS7401	MOOCS Elective II	3	0	0	3
SESSIONAL(ONLY INTERNAL EVALUATION)							
6	PROJ	YCS7204	Project I	0	0	6	3
MANDATORY NON-CGPA COURSE							
7	MC	YCS7501	Social Awareness	3	0	0	0
		YCS7502	History of Science and Technology				
		YCS7503	Indian Liberal Arts				
TOTAL				**14**	**0**	**10**	**16**

SEMESTER-8							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG8001	Principles of Management	2	0	0	2
2	PE		Elective V	3	0	0	3
		YCS8011	Data Analytics				
		YCS8012	Natural Language Processing				
		YCS8013	Deep Learning				
3	PE		Elective VI	3	0	0	3
		YCS8011	Data Analytics				
		YCS8012	Natural Language Processing				
		YCS8013	Deep Learning				
PRACTICAL							
4	PE	YCS8101	Stream Lab 2: Artificial Intelligence and Machine Learning	0	0	4	2
SESSIONAL(ONLY INTERNAL EVALUATION)							
5	PROJ	YCS7204	Project II	0	0	6	3
MANDATORY NON-CGPA COURSE							
6	MC	YCS8501	Indian Culture and Tradition	3	0	0	0
TOTAL				**11**	**0**	**10**	**13**

Credit Distribution Ratio:

Category	Credit Allocation As per Autonomy	Credit Allocation As per AICTE
Humanities, Social Sciences & Management Courses	9	12*
Basic Sciences Courses	24	25*
Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc	23	24*
Professional Core Courses	61.5	48*
Professional Elective Courses relevant to chosen	16	18*
Open Elective Courses-Electives from other technical and /or emerging subjects	16.5	18*
Project work, seminar and internship in industry or elsewhere	12	15*
Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracurricular activities		
Total	162	160*

Credit Distribution in details:

A. Humanities, Social Sciences & Management Courses (HS)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YED1001	English for Communication	2	0	0	2	2
2	YED1101	Language Laboratory	0	0	2	2	1
3	YMG4001	Economics for Engineers	2	0	0	2	2
4	YMG7001	Value and Ethics in Profession	2	0	0	2	2
5	YMG8001	Principles of Management	2	0	0	2	2
		Total Credit:					**9**

B. Basic Sciences Courses (BS)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YMT1001	Mathematics I	3	1	0	4	4
2	YPH1001	Physics	3	1	0	4	4
3	YPH1101	Physics Laboratory	0	0	3	3	1.5
4	YMT2001	Mathematics II	3	1	0	4	4
5	YCH2001	Chemistry	3	0	0	3	3
6	YCH2101	Chemistry Laboratory	0	0	3	3	1.5
7	YMT3001	Discrete Structures	3	0	0	3	3
8	YMT3002	Probability and Statistics	3	0	0	3	3
		Total Credit:					**24**

C. Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc. (ES)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS1001	Basic Electronics	3	0	0	3	3
2	YCS1101	Basic Electronics Laboratory	0	0	3	3	1.5
3	YCS1002	Engineering Mechanics	3	0	0	3	3
4	YCS1102	Engineering Drawing and Graphics	0	0	3	3	1.5
5	YCS1003	Basic Problem Solving	2	1	0	3	3
6	YCS2001	Basic Electrical Engineering	3	0	0	3	3
7	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	3	1.5
8	YCS2002	Fundamentals of Programming	2	1	0	3	3
9	YCS2102	Programming Practices I	0	0	3	3	1.5
10	YCS2301	Workshop Practice	1	0	3	4	2
		Total Credit:					**23**

D. Professional Core Courses (PC)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	YCS3001	Digital Circuits and Logic Design	3	1	0	4	4
2	YCS3101	Digital Circuits Laboratory	0	0	3	3	1.5
3	YCS3002	Data Structures and Algorithms	3	1	0	4	4
4	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	3	1.5
5	YCS4001	Computer Organization and Architecture	3	0	0	3	3
6	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	3	1.5
7	YCS4002	Design and Analysis of Algorithms	3	1	0	4	4
8	YCS4102	Algorithms Laboratory	0	0	3	3	1.5
9	YCS4003	Data Base Management System	3	0	0	3	3
10	YCS4103	Data Base Management System Laboratory	0	0	3	3	1.5
11	YCS4004	Formal Language and Automata	3	0	0	3	3
12	YCS4104	Programming Practices II	0	0	3	3	1.5
13	YCS5001	Operating Systems	3	0	0	3	3
14	YCS5101	Operating Systems Laboratory	0	0	3	3	1.5
15	YCS5002	Embedded Systems	3	0	0	3	3
16	YCS5102	Embedded Systems Laboratory	0	0	3	3	1.5
17	YCS5003	Introduction to Data Science	3	0	0	3	3
18	YCS5103	Data Science Laboratory	0	0	3	3	1.5
19	YCS5004	Advanced Computer Architecture	3	0	0	3	3
20	YCS6001	Computer Networks	3	0	0	3	3
21	YCS6101	Computer Networks Laboratory	0	0	3	3	1.5
22	YCS6002	Software Engineering	3	0	0	3	3
23	YCS6102	Software Engineering Laboratory	0	0	3	3	1.5
24	YCS6003	Compiler Design	3	0	0	3	3
25	YCS6004	Cryptography and Network Security	3	0	0	3	3
		Total Credit:					**61.5**

E. Professional Elective Courses relevant to chosen specialization/Branch (PE)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS7011	Artificial Intelligence	3	0	0	3	3
	YCS7012	Machine Learning					
	YCS7013	Data Warehousing and Data Mining					
2	YCS7011	Artificial Intelligence	3	0	0	3	3
	YCS7012	Machine Learning					
	YCS7013	Data Warehousing and Data Mining					
3	YCS7101	Stream Lab 1: Artificial Intelligence and Machine Learning	0	0	4	4	2
4	YCS8011	Data Analytics	3	0	0	3	3
	YCS8012	Natural Language Processing					
	YCS8013	Deep Learning					
5	YCS8011	Data Analytics	3	0	0	3	3
	YCS8012	Natural Language Processing					
	YCS8013	Deep Learning					
6	YCS8101	Stream Lab 2: Artificial Intelligence and Machine Learning	0	0	4	4	2
		Total Credit:					**16**

F. Open Elective Courses-Electives from other technical and / or emerging subjects (OE)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS3003	Object Oriented Programming	3	0	0	3	3
2	YCS3103	Object Oriented Programming Laboratory	0	0	3	3	1.5
2	YCS5005	Multimedia Technology	3	0	0	3	3
	YCS5006	Operations Research					
	YCS5007	Communication Engineering					
4	YCS6005	Internet Technology	3	0	0	3	3
	YCS6006	E-Commerce and ERP					
	YCS6007	Cloud Computing					
	YCS6008	Java Programming					
5	YCS6401	MOOCS Elective I	3	0	0	3	3
6	YCS7401	MOOCS Elective II	3	0	0	3	3
		Total Credit:					**16.5**

G. Project work, seminar and internship in industry or elsewhere (PW)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS3201	Innovative Project I	0	0	3	3	1.5
2	YCS4201	Innovative Project II	0	0	3	3	1.5
3	YCS5201	Innovative Project III	0	0	3	3	1.5
4	YCS6201	Innovative Project IV	0	0	3	3	1.5
5	YCS7204	Project I	0	0	6	6	3
6	YCS8201	Project II	0	0	6	6	3
		Total Credit:					**12**

H. Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracur-ricular activities] (MC)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS2501	Universal Human Values and Professional Ethics	3	0	0	3	0
2	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	3	0
3	YCS3501	Behavioral and Interpersonal Skills	0	0	3	3	0
4	YCS4501	Constitution of India	0	0	3	3	0
5	YCS5501	Environmental Science	0	0	3	3	0
6	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	3	0
7	YCS7501	Social Awareness	0	0	3	3	0
	YCS7502	History of Science and Tech-nology					
	YCS7503	Indian Liberal Arts					
8	YCS8501	Indian Culture and Tradition	0	0	0	3	0
		Total Credit:					**0**

Semester 1 Curriculum and Syllabus

SEMESTER-1							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT1001	Mathematics I	3	1	0	4
2	BS	YPH1001	Physics	3	1	0	4
3	ES	YCS1001	Basic Electronics	3	0	0	3
4	ES	YCS1002	Engineering Mechanics	3	0	0	3
5	ES	YCS1003	Basic Problem Solving	2	1	0	3
6	HS	YED1001	English for Communication	2	0	0	2
PRACTICAL							
7	BS	YPH1101	Physics Laboratory	0	0	3	1.5
8	ES	YCS1101	Basic Electronics Laboratory	0	0	3	1.5
9	ES	YCS1102	Engineering Drawing and Graphics	0	0	3	1.5
10	HS	YED1101	Language Laboratory	0	0	2	1
TOTAL				**16**	**3**	**11**	**24.5**

Course Code	YMT1001			
Course Title	Mathematics I			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the basic knowledge of matrix algebra, function of several variables and Improper integral. At the end of the course, the students will be able to solve engineering problems.

Course Outcome:

CO1: To understand and remember the distinctive characteristics of matrix algebra and calculus

CO2: To understand the theoretical concept of vector space and apply the concepts to solve problems

CO3: To understand and remember definite and improper integrals and apply the concept to solve problems

CO4: To understand the concept of functions of several variables and apply the concept to solve problems

Course Content:

Module 1: Matrix Algebra **[11L]**

Matrix Algebra: Inverse and rank of a matrix; Orthogonal matrix and its properties, trace of a matrix, Consistency and inconsistency of linear systems of equations, Solution of linear system of equation by Gauss elimination, matrix inverse method. Eigenvalues and eigenvectors; Cayley-Hamilton Theorem, Diagonalization of a matrix.

Module 2: Vector Spaces **[15L]**

Vector Spaces: Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map. Inner product spaces, Gram-Schmidt orthogonalization.

Module 3: Definite and Improper integral **[6L]**

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties.

Module 4 : Calculus **[6L]**

Calculus: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 5 : Function of Several variables **[10L]**

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian, Maxima and minima

of functions of two variables, Method of Lagrange multipliers.

Text/Reference Books:

1. E. Kreyszig, "Advanced Engineering Mathematics (9*th* Edition)", John Wiley & Sons.
2. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
3. T. Veerarajan, "Engineering Mathematics for First Year", Tata McGraw-Hill.
4. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers.
5. N.P. Bali and M.Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	2	-	-	-	-	-	1
CO2	3	2	-	3	-	3	-	-	-	-	-	1
CO3	3	2	2	1	-	1	-	-	-	-	-	1
CO4	2	3	1	3	-	1	-	-	-	-	-	1

Course Code	YPH1001
Course Title	Physics
Category	Basic Science
LTP & Credits	L T P Credits 3 1 0 4
Total Contact Hours	48
Pre-requisites	None

Learning Objective:

The aim of the course is to provide the students with adequate exposure about the basic principles of physics along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome:

CO1: To understand and remember the basic principle of Classical mechanics, Relativistic Mechanics, Quantum Mechanics and statistical mechanics and microscopic phenomena

CO2: To analyse and differentiate interference and diffraction ,

CO3: To understand the working principle of laser, optical fiber and holography amplifier and analyze its various applications enhance the knowledge in modern optics

CO4: To To understand and apply the knowledge in modern physics

Course Content:

Module 1: Mechanics [10L]

Representation of vector, scalar and vector fields, partial derivative of vector, gradient of scalar field, divergence and curl of vector field.

Friction, conservation laws, rigid body, moment of inertia, acceleration of rigid body, Mass energy Equivalence, Concept of photon.

Module 2: Quantum Theory [6L]

Black body Radiation spectrum, Wein's law , Rayleigh – Jeans law, Quantum theory of radiation, Wave mechanics, wave particle duality, De Broglie waves, Bohr's quantization rules, Phase and group velocities, Davission-Germer Experiment, Heisenberg Uncertainty Principle, Wave function and its significance, Schrodinger's wave equation.

Module 3: Laser, Fibre Optics and Holography [5L]

Laser: Spontaneous and stimulated emission of radiation, Population inversion, Einstein's coefficients, Concept of three and four level laser, Construction and working of Ruby laser, He-Ne lasers, Laser Applications.

Module 4 : Statistical Mechanics and Applications [5L]

Introduction to Statistical mechanics, Concept of energy levels and energy states. Classical limits of quantum statistics, Concept of Fermi level. Fermi level in metals,

Fermi level for intrinsic and extrinsic semiconductors (pictorial representations on temperature dependence and doping concentration viz. p type, n-type).

Module 5 : Electromagnetic Induction **[4L]**

Magnetic flux, Faraday's law of electromagnetic induction, electromotive force, Ampere's circuital law, Maxwell's equation.

Module 6 : Dielectrics **[4L]**

Types of dielectric, relation between dielectric constant and electric susceptibility, po-larizability, Clausius- Mossotti Equation, application of dielectric materials

Module 7 : Magnetic properties of materials **[2L]**

Magnetic flux density, magnetic permeability, magnetic susceptibility, classification of magnetic materials, diamagnetic materials, paramagnetic materials, Curie law.

Text/Reference Books:

1. A. Beiser, "Concepts of Modern Physics", McGraw Hill India.
2. D. K. Bhattacharya and P. Tandon, "Engineering Physics", Oxford India.
3. B. Lal and N. Subramanyam, "A Text Book Of Optics", S. Chand & Co.
4. I. Dominic and A Nahari, "A Text Book of Engineering Physics", Owl Book Publishers.
5. E. Hecht, "Optics", Pearson Education.
6. N. Mehta, "Applied Physics for Engineers", PHI Ltd.
7. J. C Palais, "Fiber Optic Communications", Pearson Education.
8. B. K. Pandey and S. Chathurvedi , "Engineering Physics", Cengage Learning.
9. J. Philip , "A text book of Engineering Physics", Educational Publishers.
10. B. Premlet , "Engineering Physics, McGraw Hill India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	3	2	-	-	3	-	-	3
CO2	2	2	1	1	1	1	-	-	-	-	-	3
CO3	1	3	1	2	2	1	-	-	1	-	-	3
CO4	2	2	2	1	1	1	-	-	1	-	-	3

Course Code	YCS1001
Course Title	Basic Electronics
Category	Engineering Science
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course the students will learn about the fundamental behavior and principle of operations of various electronic devices and circuits. At the end of the course, the students will be able to design useful electronic subsystems like rectifier, amplifier, oscillator, etc.

Course Outcome:

CO1: To understand and remember the principle of operation of semiconductor devices

CO2: To understand and analyze the operations of P-N junction diode, bipolar and field-effect transistors and solve design problems

CO3: To understand and remember the principle of working of operational amplifier and demonstrate its various applications

Course Content:

Module 1: Fundamentals of semiconductor **[6L]**

Conductors, Insulators, and Semiconductors: crystal structure, Fermi Dirac function, Fermi level, Energy band diagrams, valence band, conduction band, and band gap. Intrinsic and extrinsic (p-type and n-type) semiconductors, drift and diffusion current
— expression only (no derivation), mass action law, charge neutrality in semiconductor,
Einstein relationship in semiconductor, Numerical problems.

Module 2: P-N Junction Diode and its Applications **[8L]**

p-n junction diode, characteristics and parameters, diode approximations, static and dynamic resistance of diode, V-I characteristics and current expression of diode, temperature dependencies of V-I characteristics. p-n junction breakdown: conditions, avalanche and Zener breakdown, Concept of Junction capacitance, Zener diode and characteristics.
Diode half wave and full wave rectifiers (centre tapped and bridge) circuits and operation, ripple factor without filter, efficiency, reduction of ac ripples using filter circuit (Qualitative analysis). Design of diode clipper and clamper circuit: explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module 3: Bipolar Junction Transistor **[6L]**

BJT operation: PNP and NPN transistors, transfer characteristics, current conduction mechanism. Common Emitter, Common Base, Common Collector configurations and static characteristics, junction biasing condition for active, saturation and cut-off modes, DC load line and quiescent point, base bias, voltage divider bias, numerical problems.

BJT-based oscillator – design issues, numerical problems.

Module 4: Field Effect Transistor **[6L]**

Classification of field-effect transistors: JFET, MOSFET, operating principle of JFET. Drain and transfer characteristics of JFET (n-channel and p-channel), CS, CG, CD configurations, Relation between JFET parameters.

FET as an amplifier and as a switch: graphical analysis. E-MOSFET (n- channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems.

Module 5 : Feedback and Operational Amplifier **[8L]**

Concept of feedback: positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation.

Operational amplifier: electrical equivalent circuit, ideal characteristics, non-ideal characteristics of op-amp – offset voltages, bias current, offset current, slew rate; common-mode rejection ratio and bandwidth. Inverting and non-inverting amplifier: closed loop voltage gain, concept of virtual ground. Applications op-amp: adder, differentiator and integrator. Numerical problems.

Module 6 : Electronic Instruments and Measurements **[2L]**

Basics of measurement, cathode-ray and digital-storage oscilloscopes, measurement of voltage, frequency and phase; signal generators and analytical instruments.

Text/Reference Books:

1. J. Millman.,C. Halkias and C. D. Parikh, "Integrated Electronics", McGraw-Hill Education.
2. D. A. Bell, "Electronic Devices and Circuits" Oxford University Press.
3. D. P. Kothari and I. J. Nagrath, "Basic Electronics" McGraw-Hill Education.
4. J. D. Ryder, "Electronic Fundamentals and Applications" Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	3	-	2	-	-	2
CO2	1	2	2	1	2	2	3	-	3	-	-	2
CO3	1	1	3	2	2	2	3	-	3	-	-	2

Course Code	YCS1002
Course Title	Engineering Mechanics
Category	Engineering Science
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course the students will learn how to apply Newtonian physics to relatively simple real-life applications. Specifically, topics on statics, dynamics and elementary strength of materials will be covered.

Course Outcome:

CO1: To understand and remember the representation of force, moments and analyze friction-based systems in static condition

CO2: To determine the centroid of an area and calculate moment of intertia of a section

CO3: To apply conservation of momentum and energy principle for particle dynamics and rigid body kinematics

CO4: To explain and analyze the concept of virtual work, rigid body dynamics and systems under vibration

Course Content:

Module 1: Introduction to Engineering Mechanics [6L]

Force systems: basic concepts, particle equilibrium in 2-D and 3-D, rigid body equilibrium, system of forces, coplanar concurrent forces.

Components in space: resultant, moment of forces and its application, couples and resultant of force system, equilibrium of system of forces, free body diagrams, equations of equilibrium of coplanar and spatial Systems.

Module 2: Friction and Basic Structural Analysis [5L]

Types of friction, limiting friction, laws of friction, static and dynamic Friction.

Motion of bodies, wedge friction, screw jack and differential screw jack.

Equilibrium in three dimensions, method of sections, method of joints, determine if a member is in tension or compression, simple trusses, zero force members, beams, frames and machines.

Module 3: Centroid and Centre of Gravity [5L]

Centroid of simple figures from first principles, centroid of composite sections.

Centre of gravity and its implications, area moment of inertia, moment of inertia of plane sections from first principles, theorems of moment of inertia, moment of inertia of standard and composite sections; Mass moment inertia of circular plate, cylinder, cone, sphere, hook.

Module 4: Virtual Work and Energy Method **[5L]**

Virtual displacements, virtual work for particle and ideal system of rigid bodies, degrees of freedom.

Active force diagram, systems with friction, mechanical efficiency.

Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium, applications of energy method for equilibrium, stability of equilibrium.

Module 5 : Fundamentals of Particle Dynamics [10L]

Rectilinear motion, plane curvilinear motion (rectangular, path, and polar coordinates), 3-D curvilinear motion, relative and constrained motion. Newton's second law (rectangular, path, and polar coordinates).

Work: kinetic energy, power, potential energy. Impulse: momentum (linear, angular), impact (Direct and oblique).

General principles in dynamics: types of motion, instantaneous centre of rotation in plane motion, D'Alembert's principle and its applications in plane motion and connected bodies, work energy principle and its application in plane motion of connected bodies, kinetics of rigid body rotation.

Module 6 : Mechanical Vibrations **[5L]**

Basic terminology, free and forced vibrations, resonance and its effects, degree of freedom. Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

Text/Reference Books:

1. H. Shames, "Engineering Mechanics", Prentice-Hall.
2. R. C. Hibbler, "Engineering Mechanics: Principles of Statics and Dynamics" Pearson Press.
3. F. P. Beer and E. R. Johnston, "Vector Mechanics for Engineers (Vol. I – Statics, Vol. II - Dynamics)" Tata McGraw-Hill.
4. Ruina and R. Pratap, "Introduction to Statics and Dynamics" Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	3	-	-	1	-	-	-
CO2	3	2	2	1	1	1	-	-	1	-	-	-
CO3	2	2	3	2	1	1	-	-	1	-	-	-
CO4	2	2	2	2	1	1	-	-	1	-	-	-

Course Code	YCS1003			
Course Title	Basic Problem Solving			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	2	1	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Algorithmic skill is a fundamental skill in modern times, and this course provides the students with the foundations of computational problem solving. The course emphasizes on principles and methods rather than on systems and tools.

Course Outcome:

CO1: Understand the basic model of computation

CO2: Apply algorithmic thinking to understand, define and solve problems

CO3: Design and implement algorithms for a given problem

Course Content:

Module 1: Introduction to Computation [8L]
Model of computation, stored-program concept, hardware and software. Number representation: basic concepts, decimal and binary.

Module 2: Problem Solving and Algorithmic Thinking [8L]
Overview – problem definition, logical reasoning. Flowcharts – symbols used, examples. Algorithm – definition, practical examples, properties, representation, algorithms vs programs. Elementary concepts about time complexity.

Module 3: Algorithmic Thinking [8L]
Constituents of algorithms – Sequence, Selection and Repetition, input-output. Computation – expressions, logic. Problem Understanding and Analysis – problem definition, input-output, variables, name binding. Data organization: lists, arrays, etc., algorithms to programs.

Module 4: Problem Solving with Algorithms [12L]
Examples and case studies, sorting and searching, statistical calculations. Numerical methods – solution of equations, root finding, solution of differential equations, integration.

Text/Reference Books:

1. D.D. Riley and K. A. Hunt, "Computational Thinking for the Modern Problem Solver", CRC Press.
2. P. F. Luccio, "Computational Thinking: First Algorithms, then Code" Springer.
3. S. S. Sastry, "Introductory Methods of Numerical Analysis" Prentice-Hall of India.
4. R. G. Dromey, "How to Solve it by Computer" Prentice-Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	-	-	2	-	-	3
CO2	1	1	2	1	2	2	-	-	2	-	-	3
CO3	1	2	2	1	1	1	-	-	2	-	-	3

Course Code	YED1001
Course Title	English for Communication
Category	Humanities
LTP & Credits	L / T / P / Credits: 2 / 0 / 0 / 2
Total Contact Hours	24
Pre-requisites	None

Learning Objective:

In this course, the students will develop communicative competence in English so as to make them industry-ready, with special emphasis on knowledge in grammar and English writing.

Course Outcome:

CO1: To learn how to employ communication skills in the workplace

CO2: To understand and learn about the use of the different elements of English

CO3: To develop requisite skills for effective reading and comprehension of texts

CO4: To learn how to compose formal, written communication

Course Content:

Module 1: Communication in a Globalized World [4L]

Communication skills: definition and practical dimension. Use of technology in contemporary communication, communication in workplaces. Dimensions of workplace communication: ethics, cross-cultural contexts and virtual contexts.

Module 2: Functional Grammar [8L]

Articles and prepositions. Direct and indirect verbs, subject-verb agreement. Tense and voice, phrases and clauses, direct and indirect speech.

Module 3: Reading Comprehension [6L]

Reading purposes and skills: skimming, scanning and intensive reading. Reading comprehension: fictional and non-fictional prose. One-word substitution and sentence meeting.

Module 4: Writing Skills [6L]

Business emails: enquiry, order, complaint, job application and formal invitations. Minutes of meeting, proposals, notices. Importance of punctuation in writing.

Text/Reference Books:

1. Wren and Martin (Revised by N. D. V. Prasada Rao), “High School English Grammar and Composition”, S. Chand Publishing.
2. S. A. Beebe and T. P. Mottet, “Business and Professional Communication – Principles and Skills and Leadership” Pearson Education.
3. Sethi and B. Adhikari, “Business Communication” Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	-	1	1	1	1	2	-	2	2
CO2	1	2	1	-	-	1	1	1	-	3	-	-
CO3	1	-	3	-	2	1	1	2	1	1	2	1
CO4	1	3	2	-	2	1	1	3	-	-	1	1

Course Code	YPH1101			
Course Title	Physics Laboratory			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The objective of this course is to revise the basic concepts of physics through standard set of experiments to correlate them with the corresponding theory.

Course Outcome:

CO1: To discover an idea of different measurements and errors

CO2: To understand and apply basic laws of physics and experiments

CO3: To practice and generate experimental skills in different areas of physics and applications

Suggestive List of Experiments:

1. General idea about Measurements and Errors i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment. ii) Proportional error calculation using Carrey Foster Bridge. **[2 days]**
2. Determination of wavelength of light by Newton's ring method. **[1 day]**
3. Determination of wavelength of light by Laser diffraction method. **[1 day]**
4. Determination of Planck's constant using photoelectric cell. **[1 day]**
5. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment. **[2 days]**
6. Determination of Stefan's constant. **[1 day]**
7. Determination of band gap of a semiconductor. **[1 day]**
8. Study of dispersive power of material of a prism. **[1 day]**
9. Measurement of nodal and antinodal points along transmission wire and measurement of wave length. **[1 day]**
10. Determination of wave length of light by Fresnel's bi-prism method. . **[1 day]**

Text/Reference Books:

1. B. L. Flint and H. T. Worsnop, "Advanced Practical Physics for Students", Asia Publishing House.
2. M. Nelson and J. M. Ogborn, "Advanced Level Physics Practicals", Heinemann Educational Publishers.

3. S. Panigrahi and B. Mallick, "Engineering Practical Physics", Cengage Learning.
4. I. Prakash and Ramakrishna, "A Text Book of Practical Physics", Kitab Mahal.
5. D. P. Khandelwal, "A Laboratory Manual of Physics for Undergraduate Classes", Vani Publication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	1	-	1	-	-	1
CO2	3	1	2	1	1	1	-	-	2	-	-	1
CO3	1	2	2	2	2	1	-	-	1	-	-	1

Course Code	YCS1101
Course Title	Basic Electronics Laboratory
Category	Engineering Science
LTP & Credits	L / T / P / Credits: 0 / 0 / 3 / 1.5
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this laboratory course, the students will learn to analyze and evaluate the functionality of various electronic components and their use in designing rectifiers, amplifiers and oscillators.

Course Outcome:

CO1: To study and evaluate the characteristics of basic electronic components (diode, transistor, FET)

CO2: To design and evaluate circuits like rectifier, amplifier and oscillator

CO3: To study and differentiate the functionality of operational amplifier and design adder, differentiator and integrator circuits

Suggestive List of Experiments:

1. Familiarization with testing and measuring instruments like oscilloscope, power supply, signal generator. **[1 day]**
2. Study the I-V characteristics of junction diode / zener diode. **[1 day]**
3. Design of half-wave and full-wave rectifier circuits and analyze their functionality.. **[2 days]**
4. Study the transfer characteristics of bipolar transistor. **[1 day]**
5. Design amplifier circuits using bipolar transistors and verify their operation. **[1 day]**
6. Design oscillator circuits using bipolar transistors and verify their operation. **[1 day]**
7. Study an operational amplifier chip and analyze its functionality. **[1 day]**
8. Design of non-inverting and inverting amplifiers using operational amplifiers. **[1 day]**
9. Design of adders, integrators and differentiators using operational amplifiers. Design an operation amplifier circuit to solve a given differential equation. **[2 days]**

Text/Reference Books:

1. J. Millman, C. Halkias and C. D. Parikh, “Integrated Electronics”, McGraw-Hill Education.
2. D. A. Bell, “Electronic Devices and Circuits”, Oxford University Press.
3. D. P. Kothari and I. J. Nagrath, “Basic Electronics”, McGraw-Hill Education.
4. J. D. Ryder, “Electronic Fundamentals and Applications”, Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	2	1	-	2	-	-	1
CO2	1	2	2	1	2	2	-	-	1	-	-	1
CO3	2	2	2	1	2	1	-	-	2	-	-	1

Course Code	YCS1102
Course Title	Engineering Drawing and Graphics
Category	Engineering Science
LTP & Credits	L / T / P / Credits: 0 / 0 / 3 / 1.5
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course, the students will learn how to draw and model a system, component, or process that meets desired needs within realistic constraints. It will help students to use the techniques, skills, and modern engineering tools and communicate effectively.

Course Outcome:

CO1: To explain basic concepts of Engineering Graphics and visual aspects of design

CO2: To understand and apply common drafting tools with the knowledge of drafting standards

CO3: To apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints

CO4: To produce part models, carry out assembly operation and show working procedure of a designed project work using animation

Suggestive List of Experiments:

1. Introduction to Engineering Drawing: Lines, Lettering's, Dimensioning and Scales **[1 day]**
2. Geometrical Constructions and Curves. **[1 day]**
3. Projection of Pints ,Lines, and Lamina. **[1 day]**
4. Projection of Solids. **[1 day]**
5. Section of Solids. **[1 day]**
6. Development of Surfaces. **[1 day]**
7. Orographic Projections **[2 days]**
8. Isometric projections. **[2 days]**
9. Overview of Computer Graphics. **[2 days]**

Text/Reference Books:

1. N.D. Bhatt, V.M. Panchal and P.R. Ingle, "Engineering Drawing", Charotar Publishing House.
2. M.B. Shah and B. C. Rana, "Engineering Drawing and Computer Graphics", Pearson Education

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	-	-	-	-	1	2	1	-	-
CO2	2	1	2	-	1	1	-	2	1	2	1	1
CO3	2	1	3	2	3	-	-	2	2	2	1	1
CO4	2	1	3	3	3	1	1	2	2	2	2	2

Course Code	YED1101			
Course Title	Language Laboratory			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	0	0	2	1
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this laboratory course, the students will be exposed to the need of English in workplace, and to equip them with good language skills, communication skills and soft skills.

Course Outcome:

CO1: To apply different skills of technical communication in English

CO2: To use correct pronunciation when speaking English

CO3: To use appropriate techniques for effective and active listening

CO4: To learn to tell clearly and coherently in the professional arena

Suggestive List of Experiments:

1. Learn about phonetics and pronunciation guide (Introduction of phonetics and phonetic table, tongue and lip movements for vowels and consonants, monophthongs/diphthongs, voiced/un-voiced, aspirated/unaspirated, minimal pairs, syllables, stress and intonation). **[4 days]**
2. Training on listening and comprehension (Active listening and its techniques, academic listening versus business listening, listening activities: answering questions, form filling, summarizing news bulletin, presentation, video clip, lecture, story). **[6 days]**
3. Training on speaking skills (Basic parameters of speaking, fluency-focused activities: JAM, conversational role plays, speaking using picture, group discussions and personal interviews). **[6 days]**
4. Laboratory project work (Making 5-minute animation video with voiceover, OR making a 10-minute documentary film). **[8 days]**

Text/Reference Books:

1. P. Ladefoged, “A Course in Phonetics”, Harcourt Brace Jovanovich College Publishers.
2. J. Sullivan, “Simply Said: Communicating Better at Work and Beyond”, Wiley.
3. N. Leonardo, “Active Listening Techniques: 30 Practical Tooms to Hone your Communication Skills”, Rockridge Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	3	-	2	-	1	-	2	2	2	3
CO2	-	3	-	-	-	-	1	2	-	2	1	-
CO3	-	3	3	-	2	-	1	1	-	2	2	1
CO4	-	3	3	-	2	-	1	1	-	2	1	1

Semester 2 Curriculum and Syllabus

SEMESTER-2							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT2001	Mathematics II	3	1	0	4
2	BS	YCH2001	Chemistry	3	0	0	3
3	ES	YCS2001	Basic Electrical Engineering	3	0	0	3
4	ES	YCS2002	Fundamentals of Programming	2	1	0	3
PRACTICAL							
5	BS	YCH2101	Chemistry Laboratory	0	0	3	1.5
6	ES	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	1.5
7	ES	YCS2102	Programming Practices I	0	0	3	1.5
EMBEDDED(THEORY + PRACTICAL)							
8	ES	YCS2301	Workshop Practice	1	0	3	2
MANDATORY NON-CGPA COURSE							
9	MC	YCS2501	Universal Human Values and Professional Ethics	3	0	0	0
10	MC	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	0
TOTAL				**15**	**2**	**15**	**19.5**

Course Code	YMT2001
Course Title	Mathematics II
Category	Basic Science
LTP & Credits	L | T | P | Credits
	3 | 1 | 0 | 4
Total Contact Hours	48
Pre-requisites	None

Learning Objective:

In this course, the students will learn about the basic knowledge of double and triple integration, ordinary differential equation and laplace transform. At the end of the course, the students will be able to solve engineering problems.

Course Outcome:

CO1: To use mathematical tools to evaluate multiple integrals and vector integrals.

CO2: To apply mathematical tools for solving ordinary differential equations.

CO3: To understand the properties of Laplace Transform to evaluate multiple integrals.

CO4: To apply the concept of Laplace transform to solve ordinary differential equations.

Course Content:

Module 1: Multivariable Calculus (Integration) [12L]

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Module 2: First Order Ordinary Differential Equations [10L]

Solution of first order and first-degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for, solvable for solvable for and Clairaut's equation.

Module 3: Second Order Ordinary Differential Equations [12L]

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2nd order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

Module 4: Laplace Transform [14L]

Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of *t f(t)* , LT of $\frac{f(t)}{t}$, LT of derivatives of f (t), LT of $\int f(t)dt$, Evaluation of improper integrals using L^t LT of periodic and step T, functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Text/Reference Books:

1. E. Kreyszig, "Advanced Engineering Mathematics (9^{th} Ed.)", John Wiley & Sons.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill.
3. T. Veerarajan, "Engineering Mathematics for First Year", Tata McGraw Hill.
4. B. S. Grewal, "Higher Engineering Mathematics (20^{th} Ed.)", Khanna Publishers.
5. N. P. Bali and M. Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications.
6. G. B. Thomas and R. L. Finney, "Calculus and Analytic Geometry (9^{th} Ed.)", Pearson.
7. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India.
8. S. L. Ross, "Differential Equations (16^{th} Ed.)", Wiley India.
9. N. Piskunov, "Differential and Integral Calculus", Vol.I & Vol.II Mir Publishers.
10. E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall, India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	3	-	-	-	-	-	1
CO2	3	2	2	2	3	3	-	-	-	-	-	1
CO3	2	2	-	2	3	3	-	-	-	-	-	1
CO4	3	3	2	2	3	3	-	-	-	-	-	1

Course Code	YCH2001			
Course Title	Chemistry			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The concepts developed in this course will allow the students to quantify several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Course Outcome:

CO1: To describe the fundamental properties of atoms & molecules, atomic structure and periodic properties and acid-bases concepts.

CO2: To apply fundamental concepts of thermodynamics, electrochemistry in different engineering applications.

CO3: To develop the knowledge of modern organic chemistry in different engineering applications.

CO4: To apply the knowledge of water quality parameters, corrosion control & polymers to different industries and Design economically and new methods of synthesis nano materials.

CO5: To determine the structure of organic molecules using different spectroscopic techniques.

Course Content:

Module 1: Inorganic Chemistry [9L]

Atomic structure: Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Pauli's exclusion principle, Hund's rule, Aufbau principle and its limitation, Definition – Isotopes and Isobars. Periodic properties: Group trends and periodic trends in physical properties: electron affinity, electronegativity, polariz-ability, oxidation states, effective nuclear charges. Acids and Bases: Theories of Acids and Bases – Arrhenius Theory – Lowry – Bronsted Theory – Lewis Theory – Advantages of Lewis Theory – pH and pOH – Definition – Numerical problems – Indicator
–Buffer solution.

Module 2: Physical Chemistry [8L]

Thermodynamics and electrochemistry: Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications. Solution and colloids: Solutions: Definition, Methods of expressing concentration of a solution – Molarity, Molality, Normality, Mole fraction and Percentage Mass – Simple problems.

Module 3: Organic Chemistry **[6L]**

Fundamental organic chemistry: Concepts of inductive effect, resonance, hyperconjuga-tion, introduction to reactions involving substitution, addition, elimination, oxidation reduction. Stereochemistry: Chirality, optical activity, structural isomerism, enan-tiomers, diastereomers, configurations (D,L & cis trans), R/S-nomenclature, racemiza-tion.

Module 4: Industrial Chemistry **[10L]**

Water: Hardness, alkalinity, numerical. Corrosion: Definition – Types of Corrosion –Theories of corrosion, preventive measures. Polymers: Classification of polymers, conducting polymers, biodegradable polymers. Green Chemistry: Definition, Principle of green chemistry. Nano-Particles: Definition – Importance of Nano-particles. Synthesis of a commonly used drug molecule: Paracetamol, Aspirin.

Module 5: Spectroscopic techniques in Chemistry **[3L]**

Basic principle of infrared spectroscopy, UV-VIS spectroscopy, 1H Nuclear magnetic resonance spectroscopy and their application.

Text/Reference Books:

1. A. Bahl & A. Bahl, "A Text Book of Organic Chemistry (21st Ed.)", S. Chand & Company.
2. N. Krishna Murthy, N. Y. S. Murthy and V. Anuradha, "A Text Book of Engineering Chem-istry", Maruthi Publications.
3. S. Sengupta, "Organic Chemistry (11th Ed.)", Oxford University Press.
4. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", Tata-McGraw Hill.
5. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publisher.
6. R. B. Seymour, C. E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	-	2	3	-	-	-	-	1
CO2	2	2	1	1	-	1	-	-	-	1	-	1
CO3	3	3	3	-	-	-	-	-	3	3	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	3	3	3	3	1	1	1	1	-	-	2	2

Course Code	YCS2001			
Course Title	Basic Electrical Engineering			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the fundamentals of electrical circuits, in particular DC and AC circuits, transformers and rotating machines.

Course Outcome:

CO1: To understand and remember the working of basic electrical circuits, power distribution and safety measures.

CO2: To understand and analyze the functioning of DC and AC circuits.

CO3: To understand and remember the basic principles of transformers and rotating machines.

Course Content:

Module 1: DC Circuits Fundamentals **[9L]**

Electric circuits: linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, dependent source, node, branch, active and passive elements, Kirchhoff's laws, source equivalence and conversion. Network Theorems: superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Star-Delta conversions.

Module 2: AC Circuits Fundamentals **[9L]**

Sinusoidal quantities: average and RMS values, peak factor, form factor, phase and phase difference, concept of phasor diagram, V-I relationship in R, L, C circuits, R-L-C circuits in series and parallel with phasor diagrams, impedance and admittance, impedance triangle and power triangle, power factor, concept of resonance, simple problems (series and parallel circuit only), three-phase balanced circuits, concept of three-phase power measurement.

Module 3: Single-Phase Transformer **[5L]**

Single-phase transformer: brief idea on constructional parts, classifications, working principle. Problems on EMF equation, phasor diagram, equivalent circuit.

Module 4: Electrical Rotating Machines **[8L]**

DC Machines: constructional features, classifications, working principle of motor and generator. Simple problems on voltage equation. Three-phase Induction Motor: basic concept of three phase circuit and production of rotating magnetic field, working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problems.

Module 5: Electrical Installations **[5L]**

Power generation to distribution through overhead lines and underground cables with single line diagram.Earthing of electrical equipment, basic accessories: MCB, MCCB,

ELCB, SFU, Megger.

Text/Reference Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata-McGraw Hill.
2. V. Mittle and A. Mittal, “Basic Electrical Engineering”, Tata-McGraw Hill.
3. E. Hughes, “Electrical and Electronics Technology”, PHI/Pearson Education.
4. C. L. Wadhwa, “Basic Electrical Engineering”, Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	-	1	-	-	1
CO2	1	2	2	1	1	1	-	-	1	-	-	1
CO3	1	2	2	1	1	1	-	-	2	-	-	1

Course Code	YCS2002
Course Title	Fundamentals of Programming
Category	Engineering Science
LTP & Credits	L: 2, T: 1, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	Basic Problem Solving

Learning Objective:

The course is oriented to those who want to advance structured and procedural programming understating and to improve C programming skills. The major objective is to provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

Course Outcome:

CO1: Understand the basics of computer generations and system architecture.

CO2: Learn the way of design, execution and debug programs in C language.

CO3: Understand and learn the data types, loops, functions and apply to solve different problems.

CO4: Apply to the dynamic behavior of memory by the use of pointers through Functions.

CO5: Design and analyze modular programs using control structure, selection Union and understand the file handling.

Course Content:

Module 1: Fundamentals of Computer System [6L]

History of Computer - Generation of Computer - Classification of Computers - Basic structure of Computer System - Primary & Secondary Memory, Processing Unit, Input & Output devices Overview of Procedural vs Structural language, compiler and assembler.

Module 2: Introduction to C Programming [5L]

Modular Programming, Structure vs Object oriented programming, C Fundamentals - Variable and Data Types: The C character set identifiers and keywords, data type & sizes - variable names, declaration, statements - Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion - C expressions, precedence and associativity, Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields.

Module 3: Branching, Decision making and Looping [9L]

Statement and blocks, if - else, switch case - goto and labels, Loops - while, for, do while - break and continue - One-dimensional arrays, Two-dimensional arrays - Multidimensional arrays. Passing an array to a function Character array and string - array of strings, Passing a string to a function - String related functions.

Module 4: Functions and Pointers in C [10L]

Function types, function prototypes, functions returning values - functions not returning values, scope rules - function recursion - auto, external, static and register variables Functions - C preprocessor and macro - Pointers, Pointer and Array, Pointer and String
- Pointer and functions - Dynamic memory allocation.

Module 5: Structures and File handling in C [6L]

Basic of structures, arrays of structures - structures and pointers, structures and functions - formatted and unformatted files - fopen, fclose, fgetc, fputc, fprintf, fscanf function - Command line arguments.

Text/Reference Books:

1. B. W. Kerninghan & D. M. Ritchie, "The C Programming Language (16^{th} Ed.)", PHI/ Pearson Education.
2. Y. Kanetkar, "Let us C (15^{th} Ed.)", BPB Publication.
3. E. Balagurusamy, "Programming in ANSI C (15^{th} Ed.)", Tata-McGraw Hill.
4. K. R. Venugopal & S. R. Prasad, "Mastering C (7^{th} Ed.)", Tata-McGraw Hill.
5. R. Thareja, "Introduction to C Programming (4^{th} Ed.)", Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	1	1	-	-	2	-	1	1
CO2	2	1	2	-	1	1	-	-	2	-	1	2
CO3	2	2	-	-	1	1	-	-	2	-	1	2
CO4	2	2	1	-	1	1	-	-	2	-	1	2
CO5	2	3	2	-	1	1	-	-	2	-	1	2

Course Code	YCH2101			
Course Title	Chemistry Laboratory			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To impart the students with scientific approach and to familiarize them with experiments in chemistry required to solve engineering problems and practical implementation of fundamental concepts.

Course Outcome:

CO1: To utilize the fundamental laboratory techniques for analyses such as titrations, separation/purification and spectroscopy.

CO2: To learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.

CO3: To be able estimate the ions/metal ions present in domestic/industry waste water.

CO4: To be able to analyze and gain experimental skill.

CO5: To design innovative experiments applying the fundamentals of chemistry.

Suggestive List of Experiments:

1. Determination of alkalinity in the given water sample. **[1 day]**
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution. **[2 days]**
3. Determination of available chlorine in bleaching powder. **[1 day]**
4. Determination of chloride content in water sample. **[1 day]**
5. Determination of iron content in the given water sample by Mohr's method. **[1 day]**
6. pH- metric titration. **[1 day]**
7. Viscosity of an addition polymer like polyester by viscometer. **[1 day]**
8. Thin layer chromatography. **[1 day]**
9. Element detection and functional group identification in organic compounds. **[1 day]**
10. Preparation of Bakelite and Urea formaldehyde resin. **[1 day]**
11. Innovative experiments (any one) **[1 day]**
    a. Synthesis of Nano particles
    b. Green synthesis

Text/Reference Books:

1. G. Svehla and B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", PHI/ Pearson Education.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning.
3. M. Arif, "Engineering Chemistry Lab Manual", Owl publishers.
4. J. Ahad, "Engineering Chemistry Lab Manual", Jai Publications.
5. R. K. Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers.
6. S. C. George and R. L. Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	-	-	-	-	-	-	-	1
CO2	3	3	3	3	-	1	-	-	-	1	-	1
CO3	3	3	3	-	-	-	-	-	-	-	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	3	3	3	3	1	1	1	1	-	-	2	2

Course Code	YCS2101
Course Title	Basic Electrical Engineering Laboratory
Category	Engineering Science
LTP & Credits	L / T / P / Credits: 0 / 0 / 3 / 1.5
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course the students will learn about the basic electrical components, machineries, instruments and safety measures.

Course Outcome:

CO1: To identify and apply common electrical equipment and instruments.

CO2: To develop electric networks using various components and analyze the circuit behavior.

CO3: To apply and analyze the basic characteristics of transformers and electrical machines.

Suggestive List of Experiments:

1. Familiarization with basic safety precautions (earthing), measuring instruments (voltmeter, ammeter, wattmeter), resistor, capacitor, inductor. **[1 day]**
2. Verification of Thevenin's and Norton's theorem. **[1 day]**
3. Verification of superposition and maximum power transfer theorem. **[1 day]**
4. Characteristics of fluorescent, tungsten and carbon filament lamps. **[1 day]**
5. Electrical analysis of R-L-C series circuit. **[1 day]**
6. Three-phase power measurement using two wattmeter method. **[1 day]**
7. Demonstration of cut-out sections of machines: DC machine (commutator-brush arrangement), Induction machine (squirrel-cage rotor). **[1 day]**
8. Measurement of primary and secondary voltage and current of single-phase transformer: short-circuit and open-circuit tests. **[1 day]**
9. Torque-speed characteristics of DC machine and three-phase induction motor. **[2 days]**
10. Characteristics of single-phase energy meter. **[1 day]**
11. Starting, reversing and speed control of DC shunt motor. **[1 day]**

Text/Reference Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata-McGraw Hill.
2. V. Mittle and A. Mittal, "Basic Electrical Engineering", Tata-McGraw Hill.

3. E. Hughes, “Electrical and Electronics Technology”, Pearson.

4. C. L. Wadhwa, “Basic Electrical Engineering”, Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	1	-	-	1	-	-	1
CO2	2	2	2	1	-	1	-	-	1	-	-	1
CO3	1	2	2	2	1	1	-	-	1	-	-	1

Course Code	YCS2102
Course Title	Programming Practices I
Category	Engineering Science
LTP & Credits	L T P Credits 0 0 3 1.5
Total Contact Hours	36
Pre-requisites	Basic Problem Solving

Learning Objective:

The course is oriented to those who want to advance structured and procedural programming understating and to improve C programming skills. The major objective is to provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

Course Outcome:

CO1: Learn and understand the DOS system commands and familiarize with C programming environment.

CO2: Learn and translate the algorithms into simple programs and understand the flowchart design and test.

CO3: Understand and implement conditional branching, iteration and recursion.

CO4: Apply and analyze various C programs with Arrays, Pointers, Structures, Union along with functions.

CO5: Apply programming to solve matrix addition and multiplication problems and understand the file handling.

Suggestive List of Experiments:

1. Familiarization with basic DOS commands and programming design with the help of Flowcharts using Raptor. **[1 day]**
2. Familiarization with C programming environment, Variable types and type Conversions, Simple computational problems using arithmetic expressions. **[1 day]**
3. Branching and logical expressions, Problems involving if-then-else structures. **[1 day]**
4. Loops, while and for loops, Iterative problems e.g., sum of series, patterns print. **[2 days]**
5. 1D Arrays: searching, sorting, 1D Array manipulation, 2D arrays and Strings, Matrix problems, String operations. **[2 days]**
6. Functions, call by value, Simple functions implementations, function recursion. **[2 days]**
7. Pointers, structures and dynamic memory allocation, Union. **[2 days]**
8. File handling, file reading, writing, copying etc. **[1 day]**

Text/Reference Books:

1. B. W. Kerninghan & D. M. Ritchie, "The C Programming Language (16th Ed.)", PHI/ Pearson Education.
2. Y. Kanetkar, "Let us C (15th Ed.)", BPB Publication.
3. E. Balagurusamy, "Programming in ANSI C (15th Ed.)", Tata-McGraw Hill.
4. K. R. Venugopal & S. R. Prasad, "Mastering C (7th Ed.)", Tata-McGraw Hill.
5. R. Thareja, "Introduction to C Programming (4th Ed.)", Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	-	2	1	-	1	-	1	-
CO2	2	2	2	1	1	2	2	-	1	-	1	2
CO3	3	2	-	1	1	2	1	-	2	-	1	2
CO4	3	2	1	1	1	2	2	-	1	-	1	2
CO5	3	3	2	1	1	2	1	-	2	-	1	2

Course Code	YCS2301			
Course Title	Workshop Practice			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	1	0	3	2
Total Contact Hours	48			
Pre-requisites	None			

Learning Objective:

To understand the basic knowledge of workshop practice and safety. To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking, Cutting etc. To expose students to different types of manufacturing/ fabrication processes.

Course Outcome:

CO1: To learn and design components with their own hands.

CO2: To illustrate practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

CO3: To produce and design small devices of their interest for project or research purpose

Suggestive List of Experiments:

1. Introduction to Workshop Practice & Theoretical Discussions **[1 day]**
2. Machine Shop. **[2 days]**
3. Fitting Shop. **[2 days]**
4. Carpentry Shop. **[2 days]**
5. Welding Shops. **[2 days]**
6. Electrical Electronics House Wiring & Soldering. **[2 days]**
7. Smithy Shop. **[2 days]**
8. Casting Shop. **[1 day]**
9. Plastic Moulding & Glass Cutting. **[2 days]**

Text/Reference Books:

1. S. K. Hajra Choudhury, A. K. Hajra Choudhury, and N. Roy, “Elements of WorkshopTech-nology”, Media promoters and Publishers.
2. P. N. Rao, “Manufacturing Technology”, Tata-McGraw Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	1	-	1	-	2	1	-	2
CO2	3	3	2	2	1	-	1	-	2	1	-	2
CO3	3	2	2	2	1	1	1	1	2	2	3	2

Course Code	YCS2501			
Course Title	Universal Human Values and Professional Ethics			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	Universal Human Values and Professional Ethics			

Learning Objective:

The course shall help the students appreciate the essential complementarily between "VAL-UES" and "SKILLS" to ensure sustained happiness and prosperity, which are the core aspirations of all human beings. It shall facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. It shall help the student to have Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcome:

CO1: Understand the importance of human values and ethics in the study and application of acquired knowledge in multiple domains for the wellbeing of the planet.

CO2: Understand the importance and role of natural acceptance and experiential validation in the daily practices and living in harmony with the society as a whole.

CO3: Understand and distinguish between the ego and the self, the importance of present moment and awareness, with a realization that desires arise out of the ego.

CO4: Understand the importance of creativity, participation, interconnectedness in the nature, sustainable solutions to the existing problems, and grasp the right utilization of their knowledge in their own discipline of study.

Course Content:

Module 1: Course Introduction Need, Basic Guidelines, Content and Process for Value Education [6L]

Understanding the need, basic guidelines, content and process for Value Education, Self Exploration–what is it? - its content and process; 'Natural Acceptance' and experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself [6L]

Understanding human being as a co-existence of the sentient 'I' and the material

'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the

characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Swasthya, Practice Exercises and Case Studies will be taken up in Practice Session.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human - Human Relationship [9L]

Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family, Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence [4L]

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence, Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics [11L]

Natural acceptance of human values ,Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations.

Text/Reference Books:

1. R.R Gaur, R. Sangal, G. P. Bagaria, "A foundation course in Human Values and professional

Ethics", Excel books.

2. R.R. Gaur, R. Sangal, G. P. Bagaria, "A foundation course in Human Values and professional Ethics – Teachers Manual", Excel books.
3. B. L. Bajpai, "Indian Ethos and Modern Management", New Royal Book Company.
4. P.L. Dhar, R.R. Gaur, "Science and Humanism", Commonwealth Publishers.
5. S. George, "How the Other Half Dies", Penguin Press.

6. I. Illich, “Energy & Equity”, The Trinity Press.

7. D. H. Meadows, D. L. Meadows, J. Randers, W. W. Behrens, “limits to Growth”, Universe Books.

8. S. Palekar, “How to practice Natural Farming”, Pracheen(Vaidik) Krishi Tantra Shodh.

9. A Nagraj, “Jeevan Vidya ek Parichay”, Divya Path Sansthan.

10. E.F. Schumacher, “Small is Beautiful: a study of economics as if people mattered”, Blond & Briggs.

11. A.N. Tripathy, “Human Values”, New Age International Publishers.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	2	2	2	-	1	-	2
CO2	2	2	2	-	-	2	-	2	-	1	-	2
CO3	2	2	2	-	-	-	2	2	-	1	-	2
CO4	3	2	2	2	-	3	3	3	-	1	-	3

Course Code	YCS2502
Course Title	National Service Scheme (NSS)
Category	Mandatory Non-CGPA Course
LTP & Credits	L T P Credits 0 0 3 0
Total Contact Hours	36
Pre-requisites	a) Knowledge on Data Analysis, b) Aims to do Social Service

Learning Objective:

This course will give a better understanding about the community in which student volunteers want to work and their relation along with identify the needs and problems of the community and involve them in problem-solving. They will develop capacity to meet emergencies and natural disasters, practice national integration and social harmony and utilize their knowledge in finding practical solutions to individual and community problems.

Course Outcome:

CO1: To develop knowledge about disadvantages of society and the process to be required to overcome it.

CO2: To propagate national integration among society.

CO3: To organize social campaign in society to aware people on their legal rights, health rights, cultural rights, environmental rights etc.

CO4: This subject makes students disciplined and helps the students to become a social campaigner.

Course Content:

Module 1: National Service Scheme [10L]

History and its Objectives, Organizational structure of N.S.S. at National, State, University and College Levels, Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation.

Module 2: National Integration [6L]

Need of National integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems.

Module 3: Special Programme [6L]

Legal awareness, Health awareness, First-aid Career guidance, Leadership training - cum - Cultural Programme, Globalization and its Economic Social Political and Cultural impacts.

Module 4: Special Camping programme [7L]

Nature and its objectives, Selection of camp site and physical arrangement Organization
of N.S.S. camp through various committees and discipline in the camp, Activities to be undertaken during the N.S.S. camp. Use of the mass media in the N.S.S. activities.

Module 5: N.S.S. Regular Activities [7L]

Traffic regulation, working with Police Commissioner's Office, Working with Health De-

partment, Blind assistance, Garments collection, Non-formal education 'Environmental Education, Awareness and Training (EEAT)', Blood donation.

Text/Reference Books:

1. H.Y.Siddiqui, “Social Work and Human Relations”, Rawat Publications.
2. R.R.Shastri, “Social Work tradition in India”, Welfare Research Organization.
3. S. Singh and S.P. Srivastava , “Social Work Education in India, Challenge and opportunities”, New Royal Book Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	-	3	1	3	1	1	1	-
CO2	1	-	-	1	-	3	1	2	1	1	1	-
CO3	-	1	1	1	1	3	1	2	1	1	1	-
CO4	1	-	-	-	1	3	1	3	-	1	1	-

Semester 3 Curriculum and Syllabus

SEMESTER-3							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT3001	Discrete Structures	3	0	0	3
2	BS	YMT3002	Probability and Statistics	3	0	0	3
3	PC	YCS3001	Digital Circuits and Logic Design	3	1	0	4
4	PC	YCS3002	Data Structures and Algorithms	3	1	0	4
5	OE	YCS3003	Object Oriented Programming	3	0	0	3
PRACTICAL							
6	PC	YCS3101	Digital Circuits Laboratory	0	0	3	1.5
7	PC	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	1.5
8	OE	YCS3103	Object Oriented Programming Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS3501	Behavioral and Interpersonal Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS3201	Innovative Project I	0	0	3	1.5
TOTAL				**15**	**2**	**15**	**23**

Course Code	YMT3001			
Course Title	Discrete Structures			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn about the mathematical foundations of computer science. The specific topics that would be covered include propositional calculus and proof techniques, set theory and other derived algebraic structures, recurrence relations, and the theory of graphs. The course will be very helpful for the students as it acts as prerequisite for various next level courses like algorithms, automata theory, artificial intelligence, etc.

Course Outcome:

CO1: To explain the distinctive characteristics of propositional logic and its applications.

CO2: To demonstrate the applications of various proof techniques.

CO3: To explain the basic concepts of sets, relations, functions and various algebraic structures.

CO4: To understand the concept of recurrence relations and methods of solution.

CO5: To explain and analyze the concept of graphs and various graph algorithms.

Course Content:

Module 1: Propositional Logic **[6L]**

Introduction to Propositional Calculus: Propositions, Logical Connectives, Conjunction, Disjunction, Negation. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Bi-conditional statements, Logical Equivalence, Tautology. Conjunc-tive and disjunctive normal forms.

Module 2: Proof Techniques **[6L]**

Forward proof, proof by contradiction, contrapositive proofs, proof by mathematical induction, proof of necessity and sufficiency.

Module 3: Sets, Relations and Functions **[8L]**

Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations. Finite and infinite seta, countable and uncountable sets. Algebraic structures with one binary operation: semigroups, monoids and groups. Algebraic structures with two binary operations: rings and fields.

Module 4: Recurrence Relations **[6L]**

Recurrence relations: Formulation of different counting problems in terms of recurrence relations. Solution of recurrence relations with constant coefficients by (i) iterative method, (ii) characteristic roots method, (iii) generating functions method.

Module 5: Introduction to Graphs **[10L]**

Graphs and their basic properties: digraphs, weighted graph, connected and disconnected graph, bipartite graph, complement of a graph, regular graph, complete graph, walk, path, circuit, Euler graph, cut set, cut vertices, adjacency and incidence matrices of a graph, isomorphism. Graph coloring problem, planar graphs, trees.

Text/Reference Books:

1. C. L. Liu, “Elements of Discrete Mathematics”, Tata McGraw-Hill.
2. J-P. Tremblay and R. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, McGraw-Hill Education.
3. S. K. Chakraborty and B. K. Sarkar, “Discrete Mathematics”, Oxford University Press.
4. R. Graham, D.E. Knuth and O. Patashnik, “Concrete Mathematics: A Foundation for Computer Science”, Addison-Wesley.
5. N. Deo, “Graph Theory with Applications to Engineering and Computer Science”, Prentice-Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	1	1
CO2	2	1	2	-	2	1	-	-	-	-	-	1
CO3	2	3	2	2	-	-	-	-	-	-	1	1
CO4	-	2	3	2	1	-	-	-	-	-	-	1
CO5	1	-	2	1	1	2	-	-	-	-	1	1

Course Code	YMT3002
Course Title	Probability and Statistics
Category	Basic Science
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course the students will learn about the basic knowledge of probability and statistics. At the end of the course, the students will be able to solve different real life problems in the field of artificial intelligence, data science etc.

Course Outcome:

CO1: To explain and demonstrate the distinctive characteristics of probability distribution.

CO2: To analyze the probability of real world uncertain phenomena by identifying probability distribution that fits the phenomena.

CO3: To explain and demonstrate the distinctive characteristics of statistics.

CO4: To apply and analyze the uses and limitations of statistical analysis.

Course Content:

Module 1: Basic Probability **[3L]**

Sample space and events, probability, axioms of probability, some elementary theorems, conditional probability, Baye's Theorem.

Module 2: Random Variable and Distribution **[12L]**

Discrete and continuous random variable, Probability density function and probability mass function for single variable only, Distribution function and its properties, Definitions of Expectation and Variance, properties and examples, Some important discrete distribution: Binomial and Poisson distribution and related problems. Some important continuous distribution: Normal, uniform and Exponential distributions and related problems.

Module 3: Basic Statistics **[9L]**

Measures of central tendency, Measure of dispersion, Measure of skewness and kurtosis, Correlation, regression and rank correlation.

Module 4: Applied Statistics **[12L]**

Curve fitting by the method of least squares: fitting of straight lines, second-degree parabolas and more general curves. Sampling, Testing of hypothesis: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Small samples Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text/Reference Books:

1. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons.
2. B. S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers.
3. N. G. Das, “Statistical Methods (Combined Volume)”, Tata-McGraw Hill.
4. R. Garg and C. Prasad, “Advanced Engineering Mathematics”, Khanna Publishers.
5. S. Ross, “A First Course in Probability”, Pearson Education India.
6. W. Feller, “An Introduction to Probability Theory and its Applications, Vol. 1”, Wiley.
7. J. E. Freund and R. E. Walpole, “Mathematical Statistics”, Prentice Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	-	-	2	1
CO2	3	2	1	1	-	-	-	-	-	-	1	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	3	2	2	1	-	-	-	-	-	-	1	1

Course Code	YCS3001			
Course Title	Digital Circuits and Logic Design			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None			

Learning Objective:

In this course, the students will be taught about the representation of numbers in a computer system, and how digital circuits can be designed using logic gates and flip-flops. Also, the process of digital-to-analog and analog-to-digital conversion shall be covered. After the completion of this course, the students will be in a better position to learn and understand the basic operation of a computer system and how the various functional blocks can be implemented.

Course Outcome:

CO1: To explain the binary number system, and its importance in digital circuit design.

CO2: To classify and analyze various ways of minimizing switching functions.

CO3: To understand the process of designing combinational logic circuits.

CO4: To understand the process of designing sequential logic circuit modules.

CO5: To understand and remember the process of analog-to digital and digital-to-analog conversion.

Course Content:

Module 1: Number Systems and Binary Codes [7L]

Introduction to number systems: decimal, binary, octal, hexadecimal. Conversion from one number system to another.
Signed number representation: sign-magnitude, 1's complement and 2's complement. Addition and subtraction of numbers.
Binary codes: BCD, excess-3 code, Gray code.

Module 2: Logic Families and Minimization of Switching Functions [10L]

Logic gates and their functionalities.
Logic families: TTL, nMOS, CMOS, pass transistor logic. Realization of gates.
Boolean algebra, truth tables and switching functions. Minimization of completely and incompletely specified switching functions: Karnaugh Map and Quine-McCluskey methods.

Module 3: Combinational Logic Circuits [9L]

Realization of Boolean functions using NAND/NOR gates. Half-adder, full-adder and ripple-carry adder/subtractor.
Decoders, Encoders and Multiplexers: applications in logic design.

Module 4: Sequential Logic Circuits [9L]

Clocks, flip-flops and latches.

Types of flip-flops: SR, D, JK, T; Edge-triggered and master-slave flip-flops.
State table and state diagram, state minimization, synthesis of finite state machines (FSMs).

Module 5: Counters and Registers [6L]

Synchronous and asynchronous counters, up/down counters. Applications of counters. Registers: parallel-in parallel-out and shift registers, linear feedback shift register (LFSR).
Applications of registers in data paths.

Module 6: D/A and A/D Conversion Techniques [7L]

Boolean algebra, truth tables and switching functions. Minimization of completely and incompletely specified switching functions: Karnaugh Map and Quine-McCluskey methods.
Digital-to-analog converters: principle of operation, weighted resistor and resistive ladder D/A converters.
Analog-to-digital converters: resolution and accuracy. Types of A/D converters: flash type, counter type, successive-approximation type.

Text/Reference Books:

1. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory (3rd Ed.)", Cambridge University Press.
2. M. Morris Mano, "Digital Design (3rd Ed.)", Pearson.
3. G. De Micheli, "Synthesis and Optimization of Digital Circuits", Tata-McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	2	-	-	2	-	1	2
CO2	1	3	3	-	-	2	-	-	2	-	1	1
CO3	2	2	2	1	2	2	-	-	2	-	1	2
CO4	2	2	2	1	2	2	-	-	2	-	1	1
CO5	2	2	2	-	1	2	-	-	2	-	1	2

Course Code	YCS3002			
Course Title	Data Structures and Algorithms			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Fundamentals of Programming			

Learning Objective:

In this course, the students will be taught about the significance of non-linear data structures with respect to the access and organization of data, various algorithmic approaches to write programs to solve problems in different engineering domains by using different data structures, merits and demerits of altered algorithms in terms of time-complexity.

Course Outcome:

CO1: To differentiate how the choices of data structure and algorithm methods impact the performance of program.

CO2: To solve problems based upon different data structure and also write programs.

CO3: To identify appropriate data structure and algorithmic methods in solving problem.

CO4: To discuss the computational efficiency of the principal algorithms for sorting, search-

ing, and hashing.

CO5: To compare and contrast the benefits of dynamic and static data structures implementations.

Course Content:

Module 1: Introduction of Data Structure **[11L]**

Concepts of data structures, Abstract Data Type.
Algorithms and programs, basic idea of pseudo-code, Properties of an algorithm.
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.
Array: Different representations – row major, column major.
Sparse matrix – its implementation and usage, Array representation of polynomials. Linked List: Singly linked list – operations, Doubly linked list – operations.
Circular linked list – operations, Linked list representation of polynomial and applications.
Binary codes: BCD, excess-3 code, Gray code.

Module 2: Linear Data Structure **[10L]**

Stack and its implementations (using array and linked list).
Applications (Infix, Prefix, and Postfix with their conversions, Postfix Evaluation). Queue, circular queue, de-queue.
Implementation of queue- linear and circular (using array and linked list).

Recursion:Principles of recursion - use of stack, tail recursion.
Applications - The Tower of Hanoi, Eight-queen problem.

Module 3: Nonlinear Data Structure **[18L]**

Trees: Basic terminologies, forest, tree representation (using array and linked list).
Binary trees - binary tree traversal (pre-, in-, post- order).
Threaded binary tree – operations.
Binary search tree- operations (creation, insertion, deletion, searching). Concept of Max-Heap and Min-Heap (creation, deletion).
Height balanced binary tree – AVL tree (insertion, deletion with examples only).
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS)
– concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge). Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods).

Module 4: Searching and Sorting **[9L]**

Sorting Algorithms: Bubble sort, Insertion sort, Selection sort – with notion of complexity.
Quick sort, Merge sort – with complexity, Radix sort – with complexity.
Searching: Sequential search, Binary search, Interpolation Search– with complexity.
Hashing: Hashing functions, Collision resolution techniques.

Text/Reference Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed, "Fundamentals of Data Structures of C", Universities Press.
2. S. Lipschutz, "Data Structures", Tata McGraw Hill Education (India) Private Limited.
3. A. M. Tanenbaum, "Data Structures in C", Pearson.
4. R. Thareja, "Data Structures Using C", Oxford.
5. A.K. Rath, A. K. Jagadev, "Data Structure Using C", Scitech Publications.
6. T. H. Coreman, "Introduction to Algorithms", MIT Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	-	-	-	-	3	-	2
CO2	2	2	1	2	1	2	3	2	2	-	-	2
CO3	2	2	1	2	1	2		-	2	3	-	2
CO4	2	1	2	2	1	2	-	-	-	-	-	2
CO5	3	2	2	2	1	3	-	-	-	-	-	2

Course Code	YCS3003
Course Title	Object Oriented Programming
Category	Open Elective
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	Fundamentals of Programming

Learning Objective:

This course introduces the student to the concepts of C++ in computer science. The course will allow the students to acquire knowledge to make functions, files with emphasis on different object oriented paradigm used in C++.

Course Outcome:

CO1: To study the process of interaction between objects, classes and functions.

CO2: To acquire basic knowledge of Object Orientation with different properties. **CO3:** To analyze various string handling functions with various I/O operations. **CO4:** To remember basic code reusability feature with respect to Inheritance.

Course Content:

Module 1: C++ Introduction **[8L]**

Introduction to C++ and object-oriented concepts, C++ Standard Library, Basics of a Typical C++ Environment, Pre-processors Directives, illustrative C++ programs. Header Files and Namespaces, library files. Introduction to objects and object-oriented programming, Encapsulation (Information Hiding), Access Modifiers: Controlling access to a class, method, or variable (public, protected, private, package), Other Modifiers, Polymorphism: Overloading, Inheritance, Overriding Methods, Abstract Classes, Reusability, Class' behaviors.

Module 2: Classes and Data Abstraction **[7L]**

Introduction, Structure Definitions, Accessing Members of Structures, Class Scope and accessing Class Members, Separating Interface from Implementation, Controlling Access Function And Utility Functions, Initializing Class Objects: Constructors, Using Default Arguments With Constructors, Using Destructors, Classes : Const(Constant) Object And Const Member Functions, Object as Member of Classes, Friend Function and Friend Classes, Using This Pointer, Dynamic Memory Allocation with New and Delete, Static Class Members, Container Classes And Integrators, Proxy Classes, Function overloading.

Module 3: Inheritance and Polymorphism **[9L]**

Operator Overloading, Inheritance, and Virtual Functions and Polymorphism: Fundamentals of Operator Overloading, Restrictions On Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading, ¡¡, ¿¿ Overloading Unary Operators, Overloading Binary Operators.

Introduction to Inheritance,

Base Classes And Derived Classes, Protected Members, Casting Base-Class Pointers to Derived-Class Pointers, Using Member Functions, Overriding Base–Class Members

in a Derived Class, Public, Protected and Private Inheritance, Using Constructors and Destructors in derived Classes, Implicit Derived–Class Object To Base- Class Object Conversion, Composition Vs. Inheritance. Introduction to Virtual Functions, Abstract Base Classes and Concrete Classes, Polymorphism, New Classes and Dynamic Binding, Virtual Destructors, Polymorphism, Dynamic Binding.

Module 4: Files and I/O Streams and Templates **[6L]**

Files and Streams, Creating a Sequential Access File, Reading Data From A Sequential Access File, Updating Sequential Access Files, Random Access Files, Creating A Random Access File, Writing Data Randomly To a Random Access File, Reading Data Sequentially from a Random Access File. Stream Input/Output Classes and Objects, Stream Output, Stream Input, Unformatted I/O (with read and write), Stream Manipulators, Stream Format States, Stream Error States. Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters, Templates and Inheritance, Templates and Friends, Templates and Static Members.

Module 5: Exception Handling **[6L]**

Introduction, Basics of C++ Exception Handling: Try Throw, Catch, Throwing an Exception, Catching an Exception, Rethrowing an Exception, Exception specifications, Processing Unexpected Exceptions, Stack Unwinding, Constructors, Destructors and Exception Handling, Exceptions and Inheritance.

Text/Reference Books:

1. H. M. Deitel, "Instructor's Manual: C++ how to Program", Prentice Hall.
2. S. Lipschutz, "Data Structures", Tata McGraw Hill Education (India) Private Limited.
3. E. Balagurusamy, "Object-Oriented Programming with C++", Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	2	3	-	3
CO2	3	2	-	-	2	2	-	-	2		-	3
CO3	3	3	3	1	2	2	2	-	2	-	-	3
CO4	2	2	2	3	2	2	-	-	1	-	-	3

Course Code	YCS3101			
Course Title	Digital Circuits Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this laboratory course, the students will be conducting hands-on sessions for the design and implementation of combinational and sequential digital circuit modules, and also interfacing LED and 7-segment display units.

Course Outcome:

CO1: To understand and test the functionalities of basic gates.

CO2: To understand Boolean functions using various combinational circuit modules (like gates, multiplexer, decoder, etc.)

CO3: To understand and verify the functions of flip-flops and other sequential circuit elements (like counter, register, etc.)

CO4: To understand and analyze complex digital systems and verify the functionality.

Course Content:

1. Design a basic inverter using transistors, obtain the transfer characteristics, and measure the propagation delay. Repeat the experiment using an inverter chip. **[1 day]**

2. Given a Boolean function, minimize it and realize the function using NAND gates. Using 555 timer, design a rectangular waveform generator of a given frequency. **[1 day]**

3. Design full-adder using basic gates. Cascade two such full-adders to realize a 2-bit adder. Connect LEDs to observe the outputs, and verify the functionality. **[1 day]**

4. Verify the functionality of multiplexer and decoder chips. Implement a 4-variable Boolean function using 8-to-1 multiplexer. **[1 day]**

5. Implement RS and JK master-slave flip-flops using NAND gates and verify their functionalities. Verify the functionality of J-K flip-flop chip. **[1 day]**

6. Using JK or D flip-flops, design a 4-bit shift register and verify the functionality. Modify the designs to make it into (a) ring counter, (b) Johnson counter and verify the functionality. **[1**

day]

7. Design a 3-bit synchronous counter that counts in some arbitrary count sequence. Apply a square wave at the clock input, and analyze the waveforms observed. **[1 day]**

8. Design a 2-digit BCD counter, and display the count value on 7-segment display units. **[1 day]**

9. Design an 8-bit modulo-N counter for some arbitrary value of N. Connect a D/A converter at the output of the counter and observe the output waveform. Analyze the operation for various values of N. Use the circuit to display the transfer characteristic of a NOT gate on the oscilloscope. **[1 day]**

10. Design a data path consisting of an ALU, registers and multiplexers. Hence design the control path to compute the GCD of two numbers. **[1 day]**

Text/Reference Books:

1. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory (3rd Ed.)", Cambridge University Press

2. M. Morris Mano, "Digital Design (3rd Ed.).

3. G. De Micheli, "Synthesis and Optimization of Digital Circuits", Tata-McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	2	3	2	-	-	2	-	2	3
CO2	1	2	2	1	-	2	-	-	2	-	2	3
CO3	1	2	2	1	1	2	-	-	2	-	2	3
CO4	2	2	2	2	1	2	-	-	2	-	2	3

Course Code	YCS3102
Course Title	Data Structures and Algorithms Laboratory
Category	Programme Core
LTP & Credits	L / T / P / Credits: 0 / 0 / 3 / 1.5
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming

Learning Objective:

In this course, the students will learn about C program based implementation ofdifferent algorithmic approaches by using non-linear and linear data structures to solve problems in different engineering domains.

Course Outcome:

CO1: To choose appropriate data structure as applied to specified problem definition.

CO2: To compare operations like searching, insertion, deletion, traversing mechanism on various data structures.

CO3: To explain various practical applications of data structures.

CO4: To analyze how to store, manipulate and arrange data in an efficient manner.

CO5: To demonstrate how to implement various data structures using arrays and linked list.

Suggestive List of Experiments:

1. Experiments on arrays **[1 day]**
   Addition and Multiplication of Arrays
   Implementation of Sparse Matrices

2. Experiments on Abstract Data Types **[2 days]**
   Implementation of stack using Array
   Applications of stack –infix to postfix conversion, expression evaluation

3. Experiments on Linked List **[2 days]**
   Implementation of linked lists and its operations– insertion, deletion and reverse
   Implementation of stacks and queues using linked list.
   Polynomial addition and polynomial multiplication.

4. Experiments on Searching and Sorting **[2 days]**
   Searching: Linear Search, Binary Search
   Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort

5. Experiments on Non-linear Data Structures **[2 days]**
   Traversals of binary tree, Binary Search Tree (BST), Threaded binary tree
   Height balanced binary tree – AVL tree (insertion, deletion)
   B- Trees – insertion, deletion

6. Experiments on Hashing **[1 day]**
   Implementation of Hash tables and its operations – searching, inserting, and deleting, handling collisions.

7. Innovative Experiments **[2 days]**
   Case study of solving complex problems from various engineering domains using suitable data structures (e.g., mesh analysis in electrical circuits, event-driven simulation, etc.).

Text/Reference Books:

1. C. E. Balagurusamy, "Data Structures using C", McGraw Hill.
2. E. Horowitz, S. Sahni and S. Anderson-freed, "Fundamentals of Data Structures of C", Universities Press.
3. A. K. Sharma, "Data Structures using C", Pearson.
4. 4. R. Thareja, "Data Structures using C", Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	-	-	2	1	-	-
CO2	-	2	2	-	2	2	-	-	2	1	-	2
CO3	2	1	1	-	-	2	-	-	2	-	-	-
CO4	3	2	-	2	-	2	-	-	2	-	1	-
CO5	-	-	2	1	2	2	-	-	2	-	1	2

Course Code	YCS3103
Course Title	Object Oriented Programming Laboratory
Category	Open Elective
LTP & Credits	L | T | P | Credits
	0 | 0 | 3 | 1.5
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming

Learning Objective:

The main objectives of this course is to understand the fundamental principles and approaches of object oriented programming using C++.

Course Outcome:

CO1: To understand and remember object-oriented programming concepts using the C++ language.

CO2: To understand and analyze the principles of data abstraction, inheritance and polymorphism.

CO3: To understand and remember the concepts of virtual functions.

CO4: To understand formatted and unformatted I/O operations.

CO5: To apply exception handling.

Course Content:

1. Programming using basic features of C++.
   Executing programs in UNIX environment. Understand pre-processors directives, header Files and namespaces, library files, variables, data types, operators, control, basic loop control, through simple C++ programs. **[3 days]**

2. Functions and String Manipulation
   Writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures and unions.
   Longest common subsequence problem. **[2 days]**

3. Object Oriented Programming
   Programs to demonstrate fundamentals of classes, abstract class, virtual class, overriding, template class, constructors-destructors and deal with member functions, operator overloading and polymorphism (both static and dynamic), inheritance, derived class handling. **[2 days]**

4. Exception handling, Input/output and Dynamic Memory Management
   Write simple programs to demonstrate exception handling, I/O management, creation of linked list using dynamic memory management. **[3 days]**

5. Innovative Experiments
   Demonstrate read write operations from USB flash drive. Generate command line-based tic-tac-toe game. institute premises.

[2 days]

Text/Reference Books:

1. H. M. Deitel, “Instructor’s Manual: C++ how to Program”, Prentice Hall.
2. E. Balagurusamy, “Object-Oriented Programming with C++”, Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	-	-	1	-	-	1
CO2	3	2	2	-	1	2	-	-	1	-	-	2
CO3	2	3	2	3	1	2	-	-	2	-	-	1
CO4	1	-	-	-	1	2	-	-	1	2	-	2
CO5	2	1	1	-	1	2	1	-	2	-	-	2

Course Code	YCS3501
Course Title	Behavioral and Interpersonal Skills
Category	Mandatory Non-CGPA Course
LTP & Credits	L · T · P · Credits: 0 · 0 · 3 · 0
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course, the students will be taught about how to represent himself as a good human being and also able to learn to deal with different people with his/her interpersonal skillsets and behaviour. After the completion of this course, the students will be in a better position to learn and understand the basic interpersonal skills.

Course Outcome:

CO1: To understand how to handle workplace interpersonal communication in an effective manner.

CO2: To enhance the students skills with strong oral and written interpersonal communication.

CO3: To prepare students to critically analyze workplace situations and take appropriate decisions.

CO4: To prepare students campus ready through proper behavioral and interpersonal grooming.

CO5: To enhance skill set to design and frame team based Project Report and Presentation.

Course Content:

Module 1: Interpersonal Communication [9L]

The skills of Interpersonal Communication, Gender/Culture Neutrality, Rate of Speech, Pausing, Pitch Variation and Tone, Corporate Communication, Branding and Identity.

Module 2: Interpersonal Communication Vs Workspace Communication [9L]

Workplace Communication, Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.), Communication with Clients, Customers, Suppliers etc., Organizing/Participating in Business Meeting, Note Taking, Agenda, Minutes

Module 3: Business Etiquette and Corporate Life [9L]

Presenting oneself in the Business Environment, Corporate Dressing and Mannerism, Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.), E-mail Etiquette, Activity based Case Study.

Module 4: Movie Making : Corporate Business Meeting [9L]

Team based Brainstorming, Process Planning and Developing Plot, People management. Documentation and Scripting, Shooting the Movie: Location and Camera, Post Production and Editing, Movie Review: Feedback and Analysis.

Text/Reference Books:

1. P. Hartley, Interpersonal Communication,Routledge, 1993.
2. C.Garsten, Palgrave, Workplace Vagabonds: Career and Community in Changing Worlds of Work, Macmillan, 2008.
3. F.Moore, Ashgate,Transnational Business Cultures Life and Work in a Multinational Corporation,2005

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	3	-	-	2	-	1
CO2	1	3	3	-	-	-	3	-	-	2	-	-
CO3	-	-	2	1	2	2	-	-	-	2	-	1
CO4	-	-	2	1	2	2	-	-	-	3	-	-
CO5	2	-	2	-	1	2	-	-	-	3	-	1

Semester 4 Curriculum and Syllabus

SEMESTER-4							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS4001	Computer Organization and Architecture	3	0	0	3
2	PC	YCS4002	Design and Analysis of Algorithms	3	1	0	4
3	PC	YCS4003	Data Base Management System	3	0	0	3
4	PC	YCS4004	Formal Language and Automata	3	0	0	3
5	HS	YMG4001	Economics for Engineers	2	0	0	2
PRACTICAL							
6	PC	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	1.5
7	PC	YCS4102	Algorithms Laboratory	0	0	3	1.5
8	PC	YCS4103	Data Base Management System Laboratory	0	0	3	1.5
9	PC	YCS4104	Programming Practices II	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
10	MC	YCS4501	Constitution of India	3	0	0	0
SESSIONAL (ONLY INTERNAL EVALUATION)							
11	PROJ	YCS4201	Innovative Project II	0	0	3	1.5
TOTAL				**17**	**1**	**15**	**22.5**

Course Code	YCS4001
Course Title	Computer Organization and Architecture
Category	Professional Core
LTP & Credits	L | T | P | Credits 3 | 0 | 0 | 3
Total Contact Hours	36
Pre-requisites	a) Digital Circuits and Logic Design

Learning Objective:

In this course, the students will learn about the evolution of computer systems and development in computer organization and architecture, and the various functional units of a computer system with special emphasis on how instructions get executed. This course will cover the processor unit, the arithmetic and logic unit, the memory unit and input/output organization.

After the completion of this course, the student will better understand how exactly the programs are executed in a computer system.

Course Outcome:

CO1: To explain the process of instruction execution

CO2: To analyze and design control unit of a computer system

CO3: To analyze and design adder, multiplier and division unit

CO4: To analyze and design memory subsystems

CO5: To explain and classify various input/output data transfer techniques

Course Content:

Module 1: Evolution of Computer System **[4L]**

Introduction to computing system: computer organization and architecture, basic functional units of a computer, evolution of computers, stored-program concept, Von-Neumann and Harvard models

Module 2: Basic Operation of Computer **[7L]**

Instruction Set Architecture: CPU registers, instruction format and encoding, addressing modes, instruction set, instruction types, instruction decoding and execution, basic instruction cycle, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC).

Case study: MIPS Instruction set, MIPS assembly language programming.

Module 3: Processor Unit Design **[7L]**

Register transfer operations, internal single and multi-bus architecture.

Design of control unit: hardwired control unit design, microprogrammed control unit design, concept of control word and control store.

Horizontal, vertical and diagonal microprogrammed control unit design.

Module 4: Arithmetic Unit Design **[6L]**

Adder and subtractor, shift-and-add multiplication.
Signed multiplication: Booths algorithm, integer division, restoring and non-restoring division.
Floating point representation: IEEE floating point format, floating point arithmetic.

Module 5: Memory Unit Design **[7L]**

Basic memory types: Random Access Memory (RAM), Read Only Memory (ROM), Static RAM, Dynamic RAM.
Memory hierarchy, Cache memory: mapping techniques, Memory interleaving.

Module 6: Input Output Organization **[5L]**

I/O mapped I/O and Memory mapped I/O, Synchronous and Asynchronous serial data communication. Secondary memory: disk, flash memory.
I/O Data transfer techniques: Programmed I/O, Interrupt-driven I/O, Direct Memory Access (DMA).

Text/Reference Books:

1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization (5th Ed.)", Tata-McGraw-Hill.
2. W. Stallings, "Computer Organization and Architecture (6th Ed.)", Prentice Hall of India.
3. D. A. Patterson, and J. L. Hennessy, "Computer Organization and Design – The Hardware/ Software Interface", Morgan Kaufmann.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	2	-	-	1	-	1	2
CO2	1	1	3	-	-	2	-	-	2	-	1	2
CO3	2	2	2	2	2	1	-	-	1	-	-	2
CO4	2	2	1	2	2	1	-	-	2	-	-	2
CO5	2	1	1	-	1	1	-	-	1	-	-	2

Course Code	YCS4002			
Course Title	Design and Analysis of Algorithms			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	1	0	3
Total Contact Hours	36			
Pre-requisites	a) Fundamentals of Programming b) Data Structures and Algorithms			

Learning Objective:

It will covers topics such as algorithm complexity concepts and diverse algorithmic designs such as dividing and conquering, dynamic programming and greedy algorithms. The course will also include important search and sorting algorithms, graphs, and basic approaches of optimization.

Course Outcome:

CO1: To understand the concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation

CO2: To apply design principles and concepts to algorithm design

CO3: To understand and analyze the mathematical foundation in analysis of algorithms

CO4: To explain and classify different algorithmic design strategies

CO5: To analyze the efficiency of algorithms using time and space complexity theory

Course Content:

Module 1: Complexity Analysis **[7L]**

Time and space Complexity, Different asymptotic notations – their mathematical significance. Solving recurrences: substitution method, recurrence tree method, Master Theorem.

Module 2: Divide and Conquer **[9L]**

Basic concept, Examples: binary search, merge sort, quick sort and their complexity (all three cases). Heap sort and its complexity, Karatsuba algorithm.
Lower Bound Theory: Comparisons trees, Oracle and adversary argument, State space method.

Module 3: Dynamic Programming **[14L]**

Basic concepts, matrix chain manipulation, Strassen's algorithm, longest common subsequence, all-pair shortest paths (Floyd Warshall), single-source shortest path (Dijkstra, Bellman-Ford), 0/1 Knapsack problem, Travelling Salesman problem.
Greedy Method: Basic concept, Examples: fractional Knapsack problem, job sequencing with deadlines, minimum cost spanning tree using Prim's and Kruskal's method, Huffman encoding and decoding.
Backtracking: Basic concept, Examples: n-queens problem, graph coloring problem.
Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by rank.

Module 4: String Matching Problem [10L]

Different techniques: Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Amortized Analysis and Network Flow: Aggregate, Accounting, and Potential Method, Ford Fulkerson algorithm, Max-Flow Min-Cut.

Module 5: Notion of NP-Completeness [8L]

P class, NP class, NP hard class, NP complete class their interrelationship, Reductions and Polynomial time Reducibility, Satisfiability problem (3-SAT and 2-SAT), Cook-Levin's theorem, Clique decision problem, Vertex Cover problem.

Text/Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", MIT Press.
2. E. Horowitz and S. Shani, "Fundamentals of Computer Algorithms", Universities Press.
3. K. Mehlhorn and P. Sanders, "Data Structures and Algorithms", Springer.
4. A. Aho, J. Hopcroft and J. Ullman "Design and Analysis of Computer Algorithms", Addison-Wesley.
5. 5. D. E.Knuth, "The Art of Computer Programming (Vol. 3)", Addison-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	-	-	2	-	-	3
CO2	3	3	3	3	1	2	-	-	1	-	2	3
CO3	3	2	2	3	1	2	-	-	2	-	-	3
CO4	3	3	3	3	1	2	-	-	1	-	-	3
CO5	3	2	2	3	1	2	-	-	2	-	-	3

Course Code	YCS4003
Course Title	Data Base Management System
Category	Professional Core
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	a) Data Structures and Algorithms

Learning Objective:

In this course, the students will be able to learn the data models, conceptualize and depict a database system; design system using E-R diagram; learn SQL & relational database design; understand the internal storage structures using different file and indexing techniques; know the concepts of transaction processing, concurrency control techniques and recovery procedure.

Course Outcome:

CO1: To apply the knowledge of E-R diagram for an application

CO2: To explain the creation of the normalized relational database model

CO3: To analyze real world queries to generate reports from it

CO4: To determine whether the transaction satisfies the ACID properties

CO5: To create and maintain the database of an organization

Course Content:

Module 1: Introduction **[3L]**

Concept and overview of DBMS, data models.
Database languages, database administrator, database users, three-schema architecture of DBMS.

Module 2: Entity-Relationship and Relational Database Model **[9L]**

Basic concepts, design issues, mapping constraints, keys, entity-relationship diagram, weak entity sets, extended E-R features, case study on E-R model.
Structure of relational databases, relational algebra, relational calculus, extended relational algebra operations, views, modifications of the database.

Module 3: SQL and Integrity Constraints **[6L]**

Concept of DDL, DML, DCL.
Basic structure, set operations, aggregate functions, null values, domain constraints, referential integrity constraints, assertions, views, nested sub-queries.
Database security application development using SQL, stored procedures and triggers.

Module 4: Relational Database Design **[6L]**

AFunctional dependency, Different anomalies in designing a Database.
Normalization using functional dependencies, decomposition, Boyce-Codd Normal Form, 3NF. normalization using multi-valued dependencies, 4NF, 5NF, Case Study.

Module 5: Internals of RDBMS **[6L]**

Physical data structures, query optimization: join algorithm, statistics and cost based optimization. Transaction processing, concurrency control and recovery management: transaction model properties, state serializability, lock base protocols; two phase locking, deadlock handling.

Module 6: File Organization & Index Structures **[6L]**

File and record Concept, placing file records on disk, fixed and variable sized records, Ttypes of single-level index (primary, secondary, clustering). Multilevel indices, dynamic multilevel indices using B-tree and B+ tree.

Text/Reference Books:

1. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", Addison Wesley Publishing.
2. C.J. Date, "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. J.D. Ullman, "Principles of Database Systems", Galgottia Publication.
4. G. Jim and R. Address, "Transaction Processing : Concepts and Techniques", Morgan Kauff-man.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	-	1	-	-	2	-	2	1
CO2	3	3	3	1	-	2	-	-	2	-	1	2
CO3	3	3	3	1	-	1	-	-	2	-	2	1
CO4	3	3	3	1	2	2	-	-	2	-	1	2
CO5	3	2	2	2	-	1	-	-	2	-	2	1

Course Code	YCS4004			
Course Title	Formal Language and Automata Theory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Discrete Mathematics b) Programming and Data Structure			

Learning Objective:

In this course the students will learn the theory of computation, different formal language classes and their relationships, various techniques to prove or disprove theorems in automata theory using its properties, approaches to determine the decidability and intractability of computational problems. At the end of the course student will be able analyze complex problems and automaton to find solutions of such problems.

Course Outcome:

CO1: To explain the basic properties of formal languages and grammars

CO2: To understand the tools for recognizing different formal languages

CO3: To differentiate between regular, context-free and recursively enumerable languages

CO4: To apply the theory of computation and computational models including decidability and intractability

Course Content:

Module 1: Introduction to Finite Automata [10L]
Finite Automata, Alphabets, Strings, Languages, Regular Languages, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation, State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Myhill-Nerode Theorem, FA with output - Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

Module 2: Properties of Regular Expression [7L]
Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages, Application of Pumping Lemma, Closure and decision properties of Regular Languages.

Module 3: Language & Grammar Formalism [9L]
Grammars, Regular grammars-Right linear and left linear grammars, Equivalence between regular linear grammar and FA, Context Free Grammar, Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs - CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs-

Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

Module 4: Push Down Automata **[4L]**

PDA Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA, PDA to CFG, Two stack PDA.

Module 5: Turing Machines and Decidability **[6L]**

Basic model, Definition and representation, Instantaneous Description, Language acceptance by TM, Computable functions, Types of Turing machines, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs, Post correspondence problem (PCP), Modified PCP.

Text/Reference Books:

1. J. D. Ullman, J. Hopcroft and R. Motwani, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 2007
2. P. Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett Learning, 2012
3. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", Prentice Hall India, 2008
4. M. Sipser, "Introduction to Theory of Computation", Thomson Course Technology, 2006
5. J. C. Martin , "Introduction to Languages and Theory of Computations", McGraw Hill, 2011
6. E. A. Rich, Automata, "Computability and Complexity", Pearson Education, Inc., 2019
7. D. Kozen, "Automata and Computability", Spinger, 1997
8. H. R. Lewis and C. H. Papadimitriou, "Elements of the Theory of Computation", Prentice Hall of India Private Ltd.,1998
9. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory", Cambridge University Press, 2010
10. D. I. A. Cohen, "Introduction to computer theory", John Wiley & Sons, Inc., 1986

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	2	-	-	1	-	-	1
CO2	3	3	1	1	-	1	-	-	2	-	-	1
CO3	3	2	1	1	1	2	-	-	1	-	-	1
CO4	3	2	1	1	1	1	-	-	2	-	-	1

Course Code	YMG4001
Course Title	Economics for Engineers
Category	Humanities
LTP & Credits	L | T | P | Credits 2 | 0 | 0 | 2
Total Contact Hours	24
Pre-requisites	None

Learning Objective:

In this course the students will learn about the managerial economics, basics of accounting and financial management. At the end of the course, the students will be able to make different managerial decisions in terms of economics and also able to solve financial statement as well as they can make different financing decision for business and at personal level.

Course Outcome:

CO1: To apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio

CO2: To evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions

CO3: To compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and/or systems

CO4: To evaluate the profit of a firm, carry out the break-even analysis and employ this tool to make production decision

CO5: To discuss and solve advanced economic engineering analysis problems including taxation and inflation

Course Content:

Module 1: Introduction **[3L]**

Managerial Economics, Relationship with other disciplines, Firms: Types, Objectives and goals, Managerial Decisions-Decision Analysis.

Module 2: Demand and Supply Analysis **[5L]**

Demand: Types of demand, determinants of demand, Demand function, Demand Elasticity, Demand forecasting. Supply: Determinants of supply, Supply function, Supply Elasticity.

Module 3: Cost Analysis **[5L]**

Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – PV ratio.

Module 4: Elementary Economic Analysis **[4L]**

Inflation: Meaning of inflation, types, causes, measures to control inflation.
National Income: Definition, Concepts of national income, Method of measuring national income.

Module 5: Financial Accounting **[5L]**

Concepts and Definition of Accounting, Journal, Ledger, Trial Balance.
Trading A/C, Profit & Loss A/C and Balance Sheet.

Module 6: Investment Decision **[2L]**

Time value of money: Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Text/Reference Books:

1. B. Riggs and S.U. Randhwa, "Engineering Economics", McGraw Hill Education India.
2. D. Vengedasalam and K. Madhavan, "Principles of Economics", Oxford University Press.
3. W. G. Sullivan, E. M. Wicks and C. P. Koelling, "Engineering Economy", Pearson.
4. R. P. Seelvan, "Engineering Economics", Prentice-Hall of India.
5. H. L. Ahuja, "Principles of Micro Economics", S. Chand & Company Ltd.
6. S. P. Gupta, "Macro Economics", Tata McGraw Hill.
7. K. K. Dewett, "Modern Economic Theory", S. Chand & Company Ltd.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	2	-	-	-	-	2	1
CO2	-	-	-	3	-	2	-	-	-	-	-	1
CO3	-	1	-	-	-	2	-	-	-	-	3	1
CO4	-	-	-	-	-	2	-	-	3	-	-	1
CO5	-	1	-	-	-	2	-	-	-	-	1	1

Course Code	YCS4101			
Course Title	Computer Organization and Architecture Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a)Digital Circuits Laboratory			

Learning Objective:

In this laboratory course, the students will be conducting experiments using a MIPS instruction set simulator. They will also learn how to model various hardware blocks using the hardware description language Verilog. They shall be designing various functional units like adder, multiplier, processor, etc. using a Verilog.

Course Outcome:

CO1: To understand how to write assembly language programs in MIPS

CO2: To design various combinational and sequential circuits using

Verilog **CO3:** To design and analyze various CPU functional units using

Verilog **CO4:** To apply a pipelined processor using Verilog

Course Content:

1. Familiarization with MIPS assembly language programming using some instruction set simulator like QtSPIM.
   a. Reading and displaying an arbitrary string, and an integer.
   b. Store numbers sequentially in memory and find the minimum, maximum, and sum.
   c. Sort a set of numbers stored in memory. **[2 days]**

2. Familiarization of function calls with MIPS assembly language programming.
   a. Write a function to compute the factorial of a given number.
   b. Write a function to compute the GCD of two numbers.
   c. Write a function to compute the N-th Fibonacci number. **[2 days]**

3. Familiarization with a Verilog simulator like iVerilog, and write simple combinational and sequential modules using behavioral and structural modeling with Verilog.
   a. Write a module to implement an arbitrary Boolean function (e.g. F = A'BC + C'D).
   b. Write a module to implement a full adder, and hence a 4-bit ripple carry adder.
   c. Write a module to implement a D flip-flop, and hence a 4-bit shift register.
   d. Write a module to implement an 8-bit up-down counter with asynchronous clear. **[2 days]**

4. Write Verilog modules to implement functional blocks used in computer organization.
   a. Write a module to implement a 16-bit arithmetic and logic unit with 8 functions.
   b. Write a module to implement read/write operations in a 1024 x 16 memory system. **[2 days]**

5. Implement the MIPS 5-stage pipeline in Verilog, using a subset of 16 instructions. The design has to be tested by writing a test bench containing sample machine language programs stored in a memory module. **[4 days]**

Text/Reference Books:

1. qtSPIM simulator, http://spimsimulator.sourceforge.net/
2. MIPS overview, https://tams.informatik.uni-hamburg.de/applets/hades/webdemos/mips.html
3. M. M. Mano and M. D. Ciletti, “Digital Design: with an Introduction to Verilog HDL (5th Ed.)”, Pearson Education.
4. J. Bhasker, “Verilog HDL Synthesis: A Practical Primer”, B. S. Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	-	-	-	-	-	2	-	-	2
CO2	-	1	2	2	1	-	-	-	2	-	-	2
CO3	1	1	1	2	1	1	-	-	2	-	-	2
CO4	-	-	1	1	2	2	-	-	2	-	-	2

Course Code	YCS4102			
Course Title	Algorithms Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Programming Practices I			

Learning Objective:

The course aims to provide strategies (divide and conquer, dynamic, greedy) to solve problems in computer effectively. Using the many paradigms of solving problems, the innovative and effective approaches of solving a specific situation will be demonstrated. In each case, the focus is on the rigorous proof of the algorithm's validity.

Course Outcome:

CO1: To prove the correctness and analyze the running time of the basic algorithms

CO2: To design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy

CO3: To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem

CO4: To Identify and analyze criteria and specifications appropriate to new problems

Course Content:

1. Experiments on Divide and Conquer Approach. Binary Search (Recursive & Iterative).
Merge Sort, Heap Sort, Quick Sort.
Find Maximum and Minimum element from an array of integers. **[2 days]**

2. Experiments on Dynamic Programming.
Minimum number of scalar multiplications needed for chain of matrix. All pair of shortest paths for a graph.
Single-source shortest path for a graph (Dijkstra, Bellman Ford).
Longest common subsequence problem. **[2 days]**

3. Experiments on Backtracking. The n-Queens problem.
Graph Coloring problem. **[2 days]**

4. Experiments on Greedy Methods. Knapsack problem.
Job sequencing with deadlines.
Minimum cost spanning tree by Prim's and Kruskal's algorithm. **[2 days]**

5. Innovative Experiments
Take the university time table for all departments. Write a computer program to find all

conflicts within the time table using graph colouring approach. Provide a solution using Backtracking. Compute the distance and find the stoppages every classmate of yours cover to

reach the institute. Then assume their speeds based on their travelling modes. Compute each student's minimum time to reach the institute premises.

[2 days]

Text/Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", MIT Press.
2. E. Horowitz and S. Shani, "Fundamentals of Computer Algorithms", Universities Press.
3. K. Mehlhorn and P. Sanders, "Data Structures and Algorithms", Springer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	1	1	-	-	2	-	-	3
CO2	3	2	2	3	1	-	-	-	2	-	-	3
CO3	3	3	2	3	1	1	-	-	2	-	-	3
CO4	3	3	2	1	1	-	-	-	2	-	-	3

Course Code	YCS4103			
Course Title	Data Base Management System Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a)Digital Circuits Laboratory			

Learning Objective:

In this course, the students will able to learn the data models, conceptualize and depict a database system; learn the fundamental concepts of SQL queries; understand the concept of designing a database with the necessary attributes; know the methodology of Accessing, Modifying and Updating data & information from the relational databases; learn database design as well as to design user interface and how to connect with database.

Course Outcome:

CO1: To understand the basic concepts regarding database, SQL queries

CO2: To explain the concepts of PL/SQL

CO3: To differentiate between DBMS and advanced DBMS

CO4: To analyze database system concepts and apply normalization to the database

CO5: To apply and create different transaction processing and concurrency control applications

Course Content:

1. Experiments on fundamentals of database systems Creating a Database
   Creating a Table
   Specifying Relational Data Types
   Specifying Constraints
   Creating Indexes **[2 days]**

2. Experiments on database Tables and Record handling INSERT statement
   Use of SELECT and INSERT together
   DELETE, UPDATE, TRUNCATE statements
   DROP, ALTER statements **[2 days]**

3. Experiments on retrieving data from database The SELECT statement
   Use of the WHERE clause
   Use of the Logical Operators in the WHERE clause
   Use of IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
   Use of the Aggregate
   Functions Combining tables
   using JOINS
   Sub-queries **[3 days]**

4. Experiments on Miscellaneous Database
   Management Creating Views
   Creating Column Aliases
   Creating Database Users
   Use of GRANT and REVOKE **[1 day]**

5. Experiments on PL/SQL
   Use of decision making statement, different loop structures to solve simple programs (e.g., sum of few numbers, pattern prints, etc.).
   Inserting values into tables, reading data from a table.
   Basic working with CURSORS **[1 day]**

6. Innovative Experiments
   Case study of handling complex databases (e.g., College Management System, Hospital management System, Library management System, Payroll management System, etc.) **[3 days]**

Text/Reference Books:

1. H. F. Korth and A. Silberschatz, "Database System Concepts", McGraw Hill.
2. E. Ramez and S. Navathe, "Fundamentals of Database Systems", Benjamin Cummings Publishing Company.
3. C. J. Date, "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
4. G. Jim and R. Address, "Transaction Processing : Concepts and Techniques", Moragan Kauff-man.
5. J.D. Ullman, "Principles of Database Systems", Galgottia Publication.
6. I. Bayross , "SQL, PL/SQL the Programming Language of Oracle", BPB Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	1	-	-	1
CO2	3	2	2	1	2	-	-	-	1	-	-	1
CO3	1	2	3	-	-	-	-	-	1	-	-	2
CO4	3	1	2	2	1	-	-	-	1	-	1	2
CO5	2	2	3	1	-	-	-	-	1	-	1	2

Course Code	YCS4104
Course Title	Programming Practices II
Category	Professional Core
LTP & Credits	L T P Credits 0 0 3 1.5
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming b) Basic Problem Solving

Learning Objective:

In this practical course, the students will be learning Python programming basics and paradigm. python looping, control statements and string manipulations. Students will be made familiar with the concepts of various modules, packages and python libraries used for various applications (Machine learning, Deep learning etc.).

Course Outcome:

CO1: Understand and explain the basic principles of Python programming language and object oriented concept.

CO2: Define and demonstrate the use of built-in data structures along with the help of condition checking and looping structures.

CO3: Understand and apply various applications of different modules and packages in Python.

CO4: Learn to handle exceptions and files in Python.

Course Content:

1. History, Features, Setting up path, working with Python, Basic Syntax, Variable and Data Types, Operator. **[1 day]**

2. Conditional Statements: If, If- else, Nested if-else, Looping, For, While, Nested loops , Control Statements : Break, Continue, Pass. **[1 day]**

3. String Manipulation: Accessing Strings, Basic Operations, String slices, Function and Methods. Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods. **[2 days]**

4. Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods. Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties. **[2 days]**

5. Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables. **[1 day]**

6. Modules: Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file,

Reading and writing files, Functions. **[2 days]**

7. Exception and File Handling: Exception, Exception Handling, Except clause, Try & finally clause, User Defined Exceptions. **[1 day]**

8. A case study on using a computer game for teaching data structures on stacks and queues. The computer game is developed to help students visualize the data structures and data access operations on stacks and queues. This game-based learning is engaging, fun and, more importantly, abstract concepts in data structures can be visualized and learnt through game playing. **[2 days]**

Text/Reference Books:

1. T. R. Padmanabhan, "Programming with Python (1st Ed.)", Springer.
2. R. Thareja, "Python Programming: using Problem Solving Approach (1st Ed.)", Oxford University Press.
3. W. McKinney, "Python Data Analysis (2nd Ed.)", O.Reilly.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	2	1	-	1	-	-	-
CO2	3	1	1	-	1	2	1	-	-	-	-	2
CO3	3	3	1	1	1	2	1	-	1	-	-	2
CO4	3	2	2	1	1	2	1	-	-	-	-	2

Course Code	YCS4501			
Course Title	Constitution of India			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Upon completion of this lesson, students will be able to understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context. Understand and analyse the three organs of the state in the contemporary scenario. Understand and Evaluate the Indian Political scenario amidst the emerging challenges.

Course Outcome:

CO1: Develop human values , create awareness about law ratification and significance of Constitution

CO2: Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.

CO3: Create understanding of their Surroundings, Society, Social problems and their suitable solutions

CO4: Demonstrate with distribution of powers and functions of Local Self Government.

CO5: Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

Course Content:

1. Meaning of the constitution law and constitutionalism **[3L]**
2. Historical perspective of the Constitution of India **[2L]**
3. Salient features and characteristics of the Constitution of India **[1L]**
4. Scheme of the fundamental rights **[2L]**
5. The scheme of the Fundamental Duties and its legal status **[2L]**
6. The Directive Principles of State Policy – Its importance and implementation **[2L]**
7. Federal structure and distribution of legislative and financial powers between the Union and the States **[3L]**
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India **[2L]**
9. Amendment of the Constitutional Powers and Procedure **[2L]**
10. The historical perspectives of the constitutional amendments in India **[2L]**

11. Emergency Provisions: National Emergency, President Rule, Financial Emergency **[3L]**

12. Local Self Government – Constitutional Scheme in India **[3L]**
13. Scheme of the Fundamental Right to Equality **[3L]**
14. Scheme of the Fundamental Right to certain Freedom under Article 19 **[3L]**
15. Scope of the Right to Life and Personal Liberty under Article 21. **[3L]**

Text/Reference Books:

1. D.D. Basu, V.R. Manohar, B.P.Banerjee, S.A.Khan, , Introduction to the Constitution of India. Wadhwa, 2001.
2. P. M. Bakshi & S. C. Kashyap, he constitution of India. Universal Law Publishing, 1982.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	3	2	3	-	-	-	2
CO2	-	-	1	-	-	3	2	3	-	-	-	2
CO3	-	-	1	-	-	3	2	3	-	1	-	2
CO4	-	-	1	-	-	3	2	3	-	1	-	2
CO5	-	-	1	-	-	3	2	3	-	1	-	2

Semester 5 Curriculum and Syllabus

SEMESTER-5							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS5001	Operating Systems	3	0	0	3
2	PC	YCS5002	Embedded Systems	3	0	0	3
3	PC	YCS5003	Introduction to Data Science	3	0	0	3
4	PC	YCS5004	Advanced Computer Architecture	3	0	0	3
5	OE		Elective I	3	0	0	3
		YCS5005	Multimedia Technology				
		YCS5006	Operations Research				
		YCS5007	Communication Engineering				
PRACTICAL							
6	PC	YCS5101	Operating Systems Laboratory	0	0	3	1.5
7	PC	YCS5102	Embedded Systems Laboratory	0	0	3	1.5
8	PC	YCS5103	Data Science Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS5501	Environmental Science	3	0	0	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS5201	Innovative Project III	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**21**

Course Code	YCS5001
Course Title	Operating Systems
Category	Professional Core
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Data Structures and Algorithms b) Computer Organization and Architecture

Learning Objective:

In this course, the students will learn about the role of operating system as the interface between application programs and the computer hardware. The role of operating system in managing various computer resources shall be dealt with in detail.

The course will be very helpful for the students in strengthening their skills in handling large software projects.

Course Outcome:

CO1: To explain the role of operating system and how it acts as interface between hardware and software.

CO2: To contrast the concepts of processes and threads, and how they are scheduled.

CO3: To demonstrate the use of various synchronization tools in solving the critical section problem.

CO4: To explain and classify the various memory management techniques including virtual memory.

CO5: To apply the knowledge of data structures to explain how file systems can be implemented on secondary storage.

Course Content:

Module 1: Introduction to Operating Systems [4L]

Functionalities of operating system – hardware/software interface. Evolution of operating systems – batch, multi-programmed, time-sharing, real-time, distributed. Simultaneous Peripheral Operations On-Line (SPOOL).
Protection and Security – user/supervisory mode, privileged instructions, system calls (invoking OS services).

Module 2: Processes and Threads [7L]

Processes – basic concept, process control block (PCB), process state transition diagram.
Process scheduling – independent and co-operating processes, inter-process communication using shared memory and message passing. Case studies from Unix/Linux.

Threads – lightweight process concept, benefits of threads, user and kernel level threads, using thread library in Unix/Linux.
CPU Scheduling – scheduling criteria, preemptive and non-preemptive scheduling. Scheduling algorithms – FCFS, SJF, SRTF, RR, priority, multi-level feedback queue.

Module 3: Process Synchronization and Deadlocks **[7L]**

Classical problems of process synchronization – producer-consumer, reader-writer, dining philosopher, etc.
Critical section problem – illustration, software solutions, solution using synchronization hardware: test-and-set (TST) and SWAP instructions.
Semaphores – definition, binary and counting semaphores, implementation of semaphores, minimizing busy waiting. Case studies from Unix/Linux.
Deadlocks – deadlock characterization, methods of handling deadlock, deadlock prevention versus deadlock avoidance, Banker's algorithm.

Module 4: Memory Management **[8L]**

Logical versus physical address space, swapping, contiguous memory allocation, memory protection using fence registers.
Paging – basic concept, performance analysis, translation look-aside buffer (TLB). Segmentation.
Virtual memory – separation of logical and physical address space, demand paging, locality of reference.
Page replacement algorithms – FCFS, LRU, Optimal, Belady's anomaly. Thrashing, working set model.

Module 5: Device and File Management **[7L]**

Disk structure – cylinders, tracks and sectors.
Disk scheduling algorithms – FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.
File system – file concept, access methods, directory and file system structure, allocation methods (contiguous, linked, indexed), free space management. Case study for Unix/Linux.

Module 6: Miscellaneous Topics **[3L]**

Brief overview of real-time and distributed operating systems, mobile operating systems.

Text/Reference Books:

1. A. Silberschatz, P. B. Galvin and G. Gagne, "Operating System Concepts", Wiley Asia.
2. D. M. Dhamdhere, "Operating Systems: A Concept-Based Approach", Tata McGraw-Hill.
3. M. Bach, "Design of the Unix Operating System", Prentice-Hall of India.
4. W. Stallings, "Operating Systems: Internals and Design Principles", Prentice-Hall of India.
5. C. Crowley, "Operating System: A Design-Oriented Approach", Irwin Publishing.
6. G. J. Nutt, "Operating Systems: A Modern Perspective", Addison-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	-	-	-	2	2	-	-	-	1	2
CO2	-	2	3	-	2	-	2	-	-	-	1	2
CO3	-	2	3	2	2	1	2	-	-	-	1	2
CO4	1	2	2	-	2	-	2	-	1	-	1	2
CO5	2	2	3	1	2	1	2	-	1	-	1	2

Course Code	YCS5002
Course Title	Embedded Systems
Category	Professional Core
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Computer Organization and Architecture b) Digital Circuits and Logic Design

Learning Objective:

In this course, the students will learn about microprocessor and microcontroller architectures and their use to develop embedded systems. Various case studies with popular development boards shall be discussed.

The course will be very helpful for students who want to apply the knowledge to develop real-life applications that involve embedded systems.

Course Outcome:

CO1: To explain the architecture of 8085 microprocessor and examine various applications.

CO2: To summarize the basic design principles of embedded systems.

CO3: To explain and compare the various microcontroller architectures and development boards.

CO4: To explain and demonstrate how sensors and actuators work in the context of embedded systems.

CO5: To apply the knowledge to develop various real-life applications.

Course Content:

Module 1: Basic 8085 Architecture and Interfacing [12L]

Introduction to 8085 microprocessor architecture – instruction execution and timing, memory and I/O interfacing, interrupt structure and DMA operation.
8085 assembly language programming – instruction set, writing simple programs, generating time delays, stacks and subroutines.
Basic interfacing concepts – 8255 programmable peripheral interface, interfacing examples.

Module 2: Introduction to Embedded Systems [4L]

Definitions and constraints, hardware and processor requirements, application dependent requirements, hardware-software co-design approach, example system design.
Embedded system hardware – microprocessors and microcontrollers, Von Neumann and Harvard architecture, RISC and CISC.

Module 3: Microcontroller Architecture [10L]

ARM processor architecture – instruction execution, instruction pipeline, ARM instruction set and addressing modes. Case study with an ARM development board.

Other popular microcontroller families – ATmega328P microcontroller (Arduino Uno), PIC microcontroller family, 8051 microcontroller family.

Module 4: Miscellaneous Topics **[4L]**

Digital signal processor (DSP) architecture – case studies and applications.
Memory for embedded systems – embedded SRAM, embedded DRAM, flash memory. Bus structures and standards for embedded systems.
Internet-of-things (IoT) – basic architecture and applications.

Module 5: Sensors and Actuators **[6L]**

Sensors and Actuators – temperature sensor, light sensor, pressure sensor, motion sensor, humidity sensor, gas sensor, relays, LED & LCD display units, WiFi interface module, GPS/GPRS module.
Example interfacing using microcontroller boards, programming environments (e.g., embedded C), home automation.

Text/Reference Books:

1. R. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publisher.
2. W. Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufmann.
3. M. A. Mazidi, J. G. Mazidi et al., "The 8051 Microcontroller and Embedded Systems", Prentice-Hall of India.
4. M. Sloss, D. Symes, and C. Wright, "ARM System Developers Guide: Designing and Optimizing System Software", (Online Resource).
5. P. Marwedel, "Embedded System Design", Kluwer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	2	-	-	-	-	-	-	2
CO2	-	3	3	1	-	-	-	-	-	-	-	2
CO3	-	2	-	2	2	-	-	-	-	-	-	2
CO4	3	1	2	-	1	2	2	-	-	-	2	2
CO5	-	-	-	2	3	3	2	-	-	-	1	2

Course Code	YCS5003			
Course Title	Introduction to Data Science			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn about the fundamentals of data science. The course will also impart design thinking capability to build big-data. Also, developing design skills of models for big data problems shall be covered.

After the completion of this course, the students will be in a better position to learn and understand the basic programming tools for data sciences.

Course Outcome:

CO1: To understand and analyze data visualization in big-data analytics.

CO2: To explain and utilize Exploratory Data Analysis.

CO3: To explain and utilize matrix decomposition techniques to perform data analysis.

CO4: To explain and demonstrate data pre-processing techniques.

CO5: To apply basic machine learning algorithms in various applications.

Course Content:

Module 1: Introduction [4L]

Big Data and Data Science: Big Data Analytics, Business intelligence vs. Big data, big data frameworks, Current landscape of analytics, data visualization techniques, visualization software.

Module 2: Exploratory Data Analysis (EDA) [6L]

Exploratory Data Analysis (EDA), statistical measures, Basic tools (plots, graphs and summary statistics) of EDA, Data Analytics Lifecycle, Discovery.

Module 3: Basic Statistical Inference [5L]

Developing Initial Hypotheses, Identifying Potential Data Sources, EDA case study, testing hypotheses on means, proportions and variances.

Module 4: Regression models [5L]

Regression models: Simple linear regression, least-squares principle, MLR, logistic regression, Multiple correlation, Partial correlation.

Module 5: Linear Algebra Basics [4L]

Matrices to represent relations between data, Linear algebraic operations on matrices –Matrix decomposition: Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

Module 6: Data Pre-processing and Feature Selection **[6L]**

Data cleaning, Data integration, Data Reduction, Data Transformation and Data Discretization, Feature Generation and Feature Selection, Feature Selection algorithms: Filters, Wrappers, Decision Trees, Random Forests.

Module 7: Basic Machine Learning Algorithms **[6L]**

Classifiers: Decision tree, Naive Bayes classifier, k-Nearest Neighbors (k-NN), k-means, Support Vector Machine. Association Rule mining – Ensemble methods.

Text/Reference Books:

1. J. Leskovek, A. Rajaraman and J. Ullman, "Mining of Massive Datasets. v2.1", Cambridge University Press.
2. S. Acharya and S. Chellappan, "Big Data Analytics", Wiley.
3. J. Han, K. Kamber and J. Pei, "Data Mining: Concepts and Techniques", Morgan Kaufmann.
4. J. Liebowitz, "Big Data and Business Analytics", CRC Press.
5. C. Rajan, "Data mining methods, 2nd edition", Narosa.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	2	2	2	-	-	2	-	1	3
CO2	1	2	2	2	2	2	-	-	1	-	1	3
CO3	1	2	2	2	1	2	-	-	2	-	1	3
CO4	2	1	1	1	1	2	-	-	1	-	1	1
CO5	2	1	1	1	1	2	-	-	2	-	1	3

Course Code	YCS5004
Course Title	Advanced Computer Architecture
Category	Professional Core
LTP & Credits	L | T | P | Credits 3 | 0 | 0 | 3
Total Contact Hours	36
Pre-requisites	a) Computer Organization and Architecture

Learning Objective:

In this course, the students will learn about the advanced features of computer architecture. The concept of quantitative principles of design, pipeline, multiprocessor systems will be taught in this course.

After the completion of this course, the student will better understand the architecture of modern day processors.

Course Outcome:

CO1: To analyze and measure quantitative principles in computer science.

CO2: To design and analyze pipelining system.

CO3: To explain and analyze instruction level parallelism.

CO4: To analyze and design memory systems for higher bandwidth.

CO5: To categorize multiprocessor systems and analyze their performance.

Course Content:

Module 1: Performance Evaluation and Pipeline Concept [10L]

Review of basic computer architecture, Quantitative principles in computer design, Measuring performance, Amdahl's law, Examples.
Concept of pipeline, Instruction pipeline, Arithmetic pipeline. Pipeline performance and optimization techniques (reservation table, minimum average latency).
Hazards: Data hazard, Structural hazard, Control hazard.
Techniques for handling hazard: data forwarding, delay slots, branch prediction, compiler optimization techniques.

Module 2: Instruction Level Parallelism [5L]

Instruction Level Parallelism (ILP), Techniques to increase ILP, Superscalar Architecture, Very Long Instruction Word (VLIW) Architecture.

Module 3: Memory System [7L]

Memory hierarchy, Inclusion, Coherence and locality properties, Cache optimization Techniques, Virtual memory concept, Translation Lookaside Buffer (TLB), Paging and segmentation, Memory replacement policies.

Module 4: Multiprocessor Systems **[10L]**

Taxonomy for parallel architectures, Centralized Shared memory architecture: synchronization and memory coherency, cache coherency problem, interconnection networks. Distributed shared memory architecture: Loosely couped systems, Uniform Memory Access (UMA) and Non- Uniform Memory Access (NUMA).

Module 5: Non-Conventional Architectures **[4L]**

Data flow computers, Systolic architectures, Domain specific architectures, GPUs, etc.

Text/Reference Books:

1. D. A. Patterson, and J. L. Hennessy, “Computer Organization and Design-The Hardware/-Software Interface”, Morgan Kaufmann.

2. L. Hennessy and D. A. Patterson, “Computer Architecture: A Quantitative Approach”, Morgan Kaufmann.

3. M. J. Flynn, “Computer Architecture: Pipelined and Parallel Processor Design”, Narosa Publishing House.

4. K. Hwang, “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	1	-	-	2	-	-	-	-	2
CO2	2	2	3	-	1	-	1	-	-	-	-	2
CO3	2	1	2	2	-	-	1	-	-	-	-	2
CO4	2	-	2	2	2	-	1	-	-	-	2	2
CO5	2	-	1	2	1	1	2	-	-	-	2	2

Course Code	YCS5005
Course Title	Multimedia Technology
Category	Open Elective
LTP & Credits	L T P Credits: 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Design and Analysis of Algorithms

Learning Objective:

In this course, the students will learn to adopt factual knowledge and develop skills needed for independent development of multimedia systems and applications using available theory and different applications.

Course Outcome:

CO1: To explain the basic concept of multimedia and its applications.

CO2: To learn and analyze various multimedia Technologies.

CO3: To explain and analyze various multimedia creations.

CO4: To apply the basic understanding of concepts in real-world applications.

Course Content:

Module 1: Introduction to Multimedia [7L]

Introduction to multimedia: graphics, image and video representations, fundamental concepts of video, digital audio. Storage requirements of multimedia applications, need for compression, taxonomy of compression algorithms. Elements of information theory, error free compression, lossy compression.

Module 2: Text Compression [4L]

Huffman coding, adaptive Huffman coding, arithmetic coding, Shannon-Fano coding, Dictionary techniques – LZW family algorithms.

Module 3: Image Compression [6L]

Image Compression: Fundamentals, compression standards, JPEG Standard, sub-band coding, wavelet based compression.
Implementation using Filters – EZW, SPIHT coders, JPEG 2000 standard, JBIG and JBIG2 standards.

Module 4: Video Compression [6L]

Video compression techniques and standards – MPEG video coding: MPEG-1 and MPEG- 2 video coding, MPEG-3 and MPEG-4 motion estimation and compensation techniques, H.261 standard, DVI technology, DVI real time compression. Current trends in compression standards.

Module 5: Audio Compression [5L]

Audio compression Techniques, A-Law companding, frequency domain and filtering, basic sub-band coding, application o speech coding – G.722, MPEG audio, progressive encoding, silence compression, speech compression – Formant and CELP vocoders.

Module 6: Animation **[8L]**

Overview of Animation Techniques – Key framing. Computer animation: Motion capture and editing, forward/inverse kinematics, deformation models, facial animation. Raster methods, design of animation sequences, animation techniques, key-frame systems, motion specification – direct, dynamics, – rigid body animation, collision detection. Graphics file format – OpenGl animation procedures.

Text/Reference Books:

1. D. Hankerson, G. A. Harris and P. D. Johnson, "Introduction to Information Theory and Data Compression", CRC press.
2. D. Solomon, "Data Compression – The Complete Reference", Springer, New York.
3. M. S. Drew and Z. Li, "Fundamentals of Multimedia", Prentice-Hall of India.
4. P. Symes, "Digital Video Compression", McGraw Hill.
5. Y. Q. Shi and H. Sun, "Image and Video Compression for Multimedia Engineering: Algorithms and Fundamentals", CRC Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	2	2	-	2	-	-	3
CO2	1	2	2	-	2	-	1	-	2	-	-	3
CO3	3	1	2	-	2	-	1	-	2	-	-	3
CO4	1	2	3	2	1	-	2	-	2	-	-	3

Course Code	YCS5006
Course Title	Operations Research
Category	Open Elective
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Mathematics I & II b) Fundamentals of Programming

Learning Objective:

In this course the students will learn about the basic knowledge of LPP, duality, transportation problem, assignment problem, game theory, queueing and inventory models. At the end of the course, the students will get knowledge about various decision making through operations research models.

Course Outcome:

CO1: To explain linear programming problems and appreciate their limitations.

CO2: To analyze and solve linear programming problems using appropriate techniques and optimization solvers.

CO3: To conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship.

CO4: To develop mathematical skills to analyze and solve transportation, assignment problem and network models arising from a wide range of applications.

CO5: To share and communicate ideas, explain procedures and interpret results and solutions in written and electronic forms to different audiences.

Course Content:

Module 1: Linear Programming Problem [10L]

Linear Programming Problem(LPP): Basics of LPP and its applications. General mathematical formulation of LPP. Definitions: Convex set, Solution, Feasible Solution, Basic and Non-Basic Variables, Basic Feasible Solution, Degenerate and Non-Degenerate solution, Optimum/Optimal Solution; Solution of LPP by Graphical Analysis/Method, Simplex Method, Charnes' Big M-Method; Duality Theory.

Module 2: Transportation Problem and Assignment Problem [6L]

Transportation Problem, Assignment Problem – problem solving.

Module 3: Game Theory [5L]

Game Theory: Introduction; Two person Zero Sum game, Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

Module 4: Network Optimization Models **[5L]**

Network Optimization Models: CPM, PERT, Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and stack. Critical path, Probability of meeting scheduled date of completion of project. Calculation of CPM network. Various floats for activities.

Module 5: Sequencing **[2L]**

Sequencing: Johnson's Algorithm (1957) For n Jobs and two machines, n Jobs and three machines.

Module 6: Queuing Theory **[5L]**

Queuing Theory: introduction and basic structure; Birth-and-Death Model (Poisson / Exponential distribution); Poisson Queue Models: (M/M/1):(∞/FIFO) and (M/M/1):(N/FIFO) and Problems.

Module 7: Inventory **[3L]**

Introduction to EOQ Models of Deterministic and Probabilistic, Safety Stock, Buffer Stock.

Text/Reference Books:

1. K. Swaroop and P. K. Manmohan, "Operations Research", Sultan Chand and Sons.
2. J. G. Chakraborty and P. R. Ghosh, "Linear Programming and Game Theory", Central Book Agency.
3. P. M. Karak, "Linear Programming and Theory of Games", ABS Publishing House.
4. D. K. Jana and T. K. Roy, "Operations Research", Chhaya Prakashani Pvt. Ltd.
5. H. A. Taha, "Operations Research", Pearson.
6. J. K. Sharma, "Operations Research Theory and Applications", Macmillan India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	1	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	1	1
CO5	3	3	2	-	-	-	-	-	-	-	1	1

Course Code	YCS5007			
Course Title	Communication Engineering			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Basic Electronics			

Learning Objective:

In this course, the students will be taught about the fundamental concepts of modern communication systems. This will include various kinds of modulation techniques, information theory and coding techniques, and multiple access techniques.

The course will be very helpful for the students in understanding next level courses like Computer Networks.

Course Outcome:

CO1: To explain and compare the fundamental concepts of analog, pulse and digital modulation techniques.

CO2: To compare and contrast the essential concepts of information theory and coding techniques.

CO3: To explain and classify the various spread spectrum and multiple access techniques in data communication.

Course Content:

Module 1: Analog Modulation **[5L]**

Amplitude Modulation: AM, double sideband full carrier system (DSBSC), single sideband suppressed carrier system (SSBSC), Vestigial sideband system (VSB), power spectral density (PSD).

Modulators and demodulators, angle modulation, frequency and phase modulation. Superheterodyne receivers.

Module 2: Pulse Modulation **[7L]**

Low-pass sampling theorem, Quantization, pulse amplitude modulation (PAM).

Line coding: pulse code modulation (PCM), differential pulse code modulation (DPCM), delta modulation (DM), and adaptive differential pulse code modulation (ADPCM).

Time Division Multiplexing, Frequency Division Multiplexing.

Module 3: Digital Modulation and Transmission **[8L]**

Phase shift keying: binary phase shift keying (BPSK), differential phase shift keying (DPSK), quadrature phase shift keying (QPSK). Principles of M-ary signaling, M-ary PSK quadrature amplitude modulation (QAM). Pulse shaping, Duo binary encoding, Cosine filters, equalizers.

Module 4: Information Theory and Coding **[8L]**

Measure of information: entropy, source coding theorem, Shannon–Fano coding, Huffman coding, LZ coding. Channel capacity, Shannon-Hartley law, Shannon's limit.

Error control codes: cyclic codes, syndrome calculation, convolution coding, sequential and Viterbi decoding.

Module 5: Spread Spectrum and Multiple Access **[8L]**

Pseudo-Noise (PN) sequences: properties, m-sequence, direct sequence spread spectrum (DSSS). Processing gain, jamming, frequency hopping spread spectrum (FHSS). Synchronization and tracking, Multiple Access: frequency division multiple access (FDMA), time division multiple access (TDMA), code division multiple access (CDMA).

Text/Reference Books:

1. J. G. Proakis and M. Salehi, "Fundamentals of Communication Systems", Pearson Education.
2. S. Haykin, "Communication Systems", John Wiley and Sons.
3. B. Carlson, P. B. Crilly, and J. C. Ruteledge, "Communication Systems", McGraw-Hill.
4. R. E. Ziemer and W. H. Tranter, "Principle of Communication", John Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	2	2	-	-	-	1	-	3
CO2	1	1	2	1	2	2	-	-	-	2	-	3
CO3	1	1	1	1	2	2	-	-	-	1	-	3

Course Code	YCS5101				
Course Title	Operating Systems Laboratory				
Category	Professional Core				
LTP & Credits	L	T	P	Credits	
	0	0	3	1.5	
Total Contact Hours	36				
Pre-requisites	a) Data Structures and Algorithms b) Computer Organization and Architecture				

Learning Objective:

In this laboratory course, the students will be carrying out various software assignments on Unix/Linux shell programming and system calls. Also, assignments for simulating important OS modules like CPU scheduling, file system, etc. shall be carried out.

Course Outcome:

CO1: To learn how to write shell scripts.

CO2: To learn how to use Unix/Linux system calls and to design a shell program.

CO3: To analyze the performance of CPU scheduling algorithms through

simulation. **CO4:** To learn how to use multi-threaded programming.

CO5: To design and implement one OS module like memory management, file system, etc.

Suggestive List of Experiments:

1. Write shell scripts using "bash" shell scripting language for simple system administration tasks, text search and replacement, directory and file manipulation, simple numeric computations, etc. **[2 days]**

2. Write programs in C for familiarization with the Unix/Linux system calls fork, exec, wait, exit, dup, pipe, shared memory, etc. **[2 days]**

3. Write a command line interpreter (shell) program using the Unix/Linux system calls with the facilities for: (a) running executable programs, (b) running a program in the background, (c) input and output redirection, (d) command piping. **[2 days]**

4. Implementation of various CPU scheduling algorithms in C, and compare their performances. **[2 days]**

5. Write programs using "pthread" library with multiple threads, and use semaphores for mutual exclusion. **[1 day]**

6. Design and implement a Unix-like memory-resident file system using the concept of inodes.

OR

Implementation of memory management system supporting virtual memory, and analyze the performance. **[3 day(s)]**

Text/Reference Books:

1. A. Silberschatz, P. B. Galvin and G. Gagne, “Operating System Concepts”, Wiley Asia.
2. D. M. Dhamdhere, “Operating Systems: A Concept-Based Approach”, Tata McGraw-Hill.
3. M. Bach, “Design of the Unix Operating System”, Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	-	1	2	1	-	1	-	-	2
CO2	2	-	2	-	2	1	-	-	1	-	-	2
CO3	2	1	2	1	2	2	1	-	1	-	-	2
CO4	2	-	1	-	3	1	-	-	2	-	-	2
CO5	2	1	2	3	2	2	1	-	2	-	-	2

Course Code	YCS5102			
Course Title	Embedded Systems Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Computer Organization and Architecture b) Digital Circuits and Logic Design			

Learning Objective:

In this laboratory course, the students will be conducting hands-on sessions with various microprocessor and microcontroller development boards for a better understanding of the design of embedded systems. The sessions shall also involve interfacing of various sensors and actuators.

Course Outcome:

CO1: To learn programming on the 8085 development board, and interfacing simple peripherals.

CO2: To design programming and interfacing experiments on the Arduino UNO

board. **CO3:** To design programming and interfacing experiments on ARM

development board. **CO4:** To learn how to interface various sensors and actuators.

Suggestive List of Experiments:

1. Programming assignments based on 8085 microprocessor board – simple programs, looping, bit manipulation, subroutines. **[2 days]**
2. Interfacing switches, LEDs and 7-segment displays to the microprocessor kit, writing delay routines. **[2 days]**
3. Programming and interfacing experiments based on the Arduino UNO microcontroller board . **[3 days]**
4. Programming and interfacing experiments based on ARM development board. **[2 days]**
5. Design a home automation systems with multiple sensors and actuators, using some microcontroller board. **[3 days]**

Text/Reference Books:

1. R. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publisher.
2. W. Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufmann.
3. M. A. Mazidi, J. G. Mazidi et al., "The 8051 Microcontroller and Embedded Systems", Prentice-Hall of India.

4. M. Sloss, D. Symes, and C. Wright, “ARM System Developers Guide: Designing and Optimizing System Software”, (Online Resource).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	2	1	2	-	1	-	-	3
CO2	2	1	2	2	1	1	2	-	2	-	-	3
CO3	2	1	2	2	1	-	2	-	1	-	-	3
CO4	2	1	2	1	1	2	2	-	2	-	-	3

Course Code	YCS5103			
Course Title	Data Science Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Programming Practices II			

Learning Objective:

In this course, the students will learn to manipulate data objects, produce graphics, analyze data using common statistical methods and generate reproducible statistical reports with programming in Python and R.

After the completion of this course, the students will be in a better position to solve the analytical problems of data science using Python and R.

Course Outcome:

CO1: To be able to solve analytical problems using Python and R.

CO2: To develop competency in Python and Python libraries such as Pandas, Numpy, and Scipy.

CO3: To explain and analyze results effectively using visualizations in Python and R.

CO4: To demonstrate how to import, export and manipulate data and produce statistical summaries of continuous and categorical data in Python and R.

CO5: To be able to perform exploratory data analysis using Python and R.

Suggestive List of Experiments:

1. Experiments on basic Python programming.
   Expressions, operators, matrices, decision statements, control flow and functions.
   Classes, objects, packages and files.
   Tuples, lists, sequences, dictionaries, comprehensions. **[2 days]**

2. Experiments based on additional features of Python.
   Numpy arrays objects, creating arrays, basic operations, indexing, slicing and iterating, copying arrays, shape manipulation, identity array, eye function, universal function.
   Linear algebra with Numpy, eigenvalues and eigenvectors with Numpy. **[2 days]**

3. Experiments based on Aggregation, Joining and Pandas
   Object. Aggregation and joining.
   Pandas Object: concatenating and appending data frames, index objects.
   Handling time series data using Pandas, handling missing values using Pandas. **[3 days]**

4. Experiments based on advanced features and statistical
   techniques. Reading and writing the data including JSON data.
   Web scraping using python, combining and merging Datasets, Data transformations, Basic

matplotlib plots, common plots used in statistical analysis in python.
Common plots used in statistical analysis in python Data types in R. Sequence generation, Vector and subscript, Random number generation in R. Data frames and R functions, Data manipulation and Data Reshaping using plyr, dplyr, reshape. Parametric statistics and Non-parametric statistics. Continuous and Discrete Probability distribution using R.
Correlation and covariance, contingency tables, Overview of Sampling, different sampling techniques, R and data base connectivity.
Web application development with R using Shiny, Approaches to dealing with missing data in R, Exploratory data analysis with simple visualizations using R, Feature or Attribute selection using R, Dimensionality Reduction with R, Time series data analysis with R. **[5 days]**

Text/Reference Books:

1. J. Payne, "Beginning Python: Using Python 2.6 and Python 3.1", Wrox.
2. M. T. Goodrich, R. Tamassia and M. H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons.
3. I. Idris, "Python Data Analysis", Pact Publishing Limited.
4. C. Beeley, "Web Application Development with R Using Shiny", Pact Publishing.
5. M. J. Crawley, "The R Book", Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	-	2	-	1	-	-	3
CO2	2	1	3	2	3	1	2	-	2	-	-	3
CO3	1	1	1	1	1	-	2	-	1	-	-	3
CO4	2	1	2	2	3	-	2	-	2	-	-	3
CO5	1	2	1	1	1	-	2	-	1	-	-	3

Course Code	YCS5501			
Course Title	Environmental Science			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Students will be able to understand the natural environment and its relationships with human activities and able to apply the fundamental knowledge of science and engineering to assess environmental and health risk, to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues and to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome:

CO1: To understand the natural environment and its relationships with human activities.

CO2: To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

CO3: To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

CO4: Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course Content:

Module 1: General Natural Resources [11L]

Forest Resource, water resource, mineral resource, energy resources: alternative source of energy Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography Disaster Management: Types of disasters (Natural & Manmade), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control) Ecology & Ecosystem: Elements of ecology, definition of ecosystem-components types and function, Food chain & Food web, Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

Module 2: Air pollution and control Sources of Pollutants [10L]

Point sources, nonpoint sources and manmade sources primary & secondary pollutant Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog), Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion control of air pollution (ESP,

cyclone separator, bag house, catalytic converter, scrubber (ventury).

Module 3: Pollution **[9L]**

Water Pollution Classification of water (Ground & surface water) Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds. Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control) Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride Layout of waste water treatment plant (scheme only).

Module 4: Land Pollution types of Solid Waste **[3L]**

Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (biomedical), E-waste Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages). Waste management: waste classification, waste segregation, treatment & disposal

Module 5: Noise Pollution **[3L]**

Definition of noise, effect of noise pollution on human health, Average Noise level of some common noise sources Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18 hr Index) . Noise pollution control.

Text/Reference Books:

1. Shashi Chawla, "A Textbook of Environmental Studies", Tata McGraw Hill Education Private Ltd.
2. Dr. J P Sharma, "Environmental Studies", University Science Press.
3. J K Das Mohapatra, "Environmental Engineering", Vikas Publication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	1	2	2	2	-	-	-	2
CO2	3	2	2	-	-	2	2	2	-	-	-	3
CO3	2	2	2	-	1	2	-	2	-	-	-	2
CO4	2	2	2	-	-	-	2	2	-	-	-	2

Semester 6 Curriculum and Syllabus

SEMESTER-6							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS6001	Computer Networks	3	0	0	3
2	PC	YCS6002	Software Engineering	3	0	0	3
3	PC	YCS6003	Compiler Design	3	0	0	3
4	PC	YCS6004	Cryptography and Network Security	3	0	0	3
5	OE		Elective II	3	0	0	3
		YCS6005	Internet Technology				
		YCS6006	E-Commerce and ERP				
		YCS6007	Cloud Computing				
		YCS6008	Java Programming				
PRACTICAL							
6	PC	YCS6101	Computer Networks Laboratory	0	0	3	1.5
7	PC	YCS6102	Software Engineering Laboratory	0	0	3	1.5
BLENDED (MOOC + INTERNAL ASSESSMENT)							
8	OE	YCS6401	MOOCS Elective I	3	0	0	3
MANDATORY NON-CGPA COURSE							
9	MC	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS6201	Innovative Project IV	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**22.5**

Course Code	YCS6001
Course Title	Computer Networks
Category	Professional Core
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Computer Organization and Architecture b) Operating Systems

Learning Objective:

In this course, the students will learn about the fundamental concepts of computer networking, with detailed understanding about the TCP/IP protocol suite that drives the Internet. In addition, various important network applications shall be discussed.The course will be very helpful for the students in understanding how data flows through a real network and the various issues involved therein.

Course Outcome:

CO1: To explain the fundamental concepts of data communication

CO2: To illustrate how the various protocols at the data link layer level work

CO3: To explain the functionalities of the various protocols at the network and transport layer level

CO4: To demonstrate how various internetworking devices can be used to connect several different networks together

CO5: To learn about various network applications with particular emphasis on security

Course Content:

Module 1: Introduction to Data Communication Techniques [5L]

Data communication concepts, analog and digital signal transmission. Layered network architecture – the OSI model. Transmission media (guided and unguided) and data transmission techniques (analog and digital). Signal encoding techniques – NRZ, NRZI, AMI, Manchester, Differential Manchester, etc. Circuit switching and packet switching, virtual circuits and datagrams.

Module 2: Data Link Layer [7L]

Framing and flow-control techniques, stop-and wait and sliding-window protocols for frame transmission, performance analysis. Error control techniques – checksum and CRC, stop-and-wait ARQ, Go-back-N, selective reject protocols.

Multiple-access protocols: ALOHA, CSMA and CSMA/CD. IEEE 802.x Ethernet standards, switched Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LAN protocols and standards.

Module 3: Network Layer [8L]

TCP/IP protocol suite, internetworking concepts.

Internet Protocol (IP), IP addressing and routing, IP fragmentation and reassembly. IP subnets and masks – variable length subnet masks, classless inter-domain routing. Miscellaneous protocols – ARP and RARP, ICMP, BOOTP and DHCP. IPv6 – basic differences from IPv4.

Module 4: Transport Layer **[4L]**

Process-to-process delivery, TCP and UDP, TCP connection establishment and termination. Flow and congestion control in TCP – window advertisement, leaky-bucket and token-bucket algorithms.

Module 5: Internetworking Concepts **[6L]**

Internetworking devices – repeaters, hubs, bridges and routers.
Interconnecting LANs using bridges, frame forwarding and address learning.
Routing algorithms – shortest-path algorithm, distance vector algorithm, link state algorithm. RIP, OSPF and BGP algorithms.

Module 6: Network Applications **[6L]**

Client-server concept. Introduction to DNS, SMTP, SNMP, FTP, TELNET and HTTP.
Firewalls, Network Address Translator (NAT), Proxy Server, etc.
Basic concepts of cryptography – symmetric and asymmetric key cryptosystems, cryptographic hash functions. Digital signature, PGP, HTTPS.

Text/Reference Books:

1. W. Stallings, “Data and Computer Communication (5th Ed.)”, PHI / Pearson Education.
2. B. A. Forouzan, “Data Communication and Networking (3rd Ed.)”, Tata-McGraw Hill.
3. W. R. Stevens, “UNIX Network Programming (3rd Ed.), Prectice-Hall, Addision-Wesley.
4. A. Tanenbaum, “Computer Networks (4th Ed.), PHI / Pearson Education.
5. W. Stallings, “Cryptography and Network Security: Principles and Practice (4th Ed.)”, PHI / Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	2	-	2	-	-	2
CO2	2	2	1	1	-	-	2	-	2	-	-	2
CO3	-	2	1	1	2	-		-	2	-	-	2
CO4	2	-	2	2	-	3	-	2	2	-	-	2
CO5	2	-	1	2	-	3	-	2	2	-	-	2

Course Code	YCS6002			
Course Title	Software Engineering			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Object Oriented Programming			

Learning Objective:

In this course, the students will learn about concepts in software engineering and its applications. They will learn about the layered architecture and the process framework, and analyze software process models like waterfall, spiral, evolutionary models.
After completing the course the students will be able to design software requirements and specifications of documents, understand project planning, scheduling, cost estimation, risk management and also describe data models, object models, context models and behavioural models and about the quality checking mechanism for software process and product.

Course Outcome:

CO1: To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

CO2: To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns

CO3: To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice

CO4: To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning

Course Content:

Module 1: Introduction [6L]

Characteristics, Components, Application, Definitions, Software Process models, Waterfall Model, Prototype model, RAD, Evolutionary Models, Incremental, Spiral, Software Project Planning, Feasibility Analysis, Technical Feasibility.

Module 2: Software Engineering Models [8L]

System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, Data Dictionary, Data Modelling, Software Requirements Specification
Software Design Aspects: Objectives, Principles, Concepts, HLD and LLD, Top-Down and Bottom- Up design, Decision tree, decision table and structured English, Structure chart, Transform analysis Functional Vs. Object- Oriented approach.

Module 3: Methodologies [7L]

Introduction to Agile Methodology, Agile Testing, Quality in agile software development, Unified Modelling Language: Class diagram, interaction diagram, Collaboration diagram, sequence diagram, State chart diagram, activity diagram, Implementation diagram, Use-Case diagram.

Module 4: Project Documentation **[4L]**

Coding and Documentation: Structured Programming, Modular Programming, Module Relationship- Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation. Testing–Levels of Testing, Integration Testing, System Testing, Test Cases-White Box and Black Box testing, Software Quality, Quality Assurance, Software Maintenance

Software Quality, Quality Assurance, Software Maintenance

Software Configuration Management, Software Architecture, Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management, Reactive vs. Proactive Risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Project Monitoring.

Module 5: Software Quality Assurance **[6L]**

Refinements and minimization of Risk in Software Engineering, Cost-Benefit Analysis, Basics of estimation: COCOMO (Basic, intermediate, Complete) model, SEI –CMM, CMM Levels and Industry Standard, New Strategies in Industry Based software Engineering, Containerization.

Text/Reference Books:

1. R. S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
2. P. Jalote, "Software Engineering", Wiley India.
3. R. Mall, "Software Engineering", Prentice-Hall of India.
4. M. L. Shooman, "Software Engineering", Tata McGraw Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	-	2	3	2	-	2	-	-	3
CO2	2	3	2	3	-	1	2	-	2	-	-	3
CO3	3	2	1	2	2	1	2	-	2	-	-	3
CO4	2	1	3	-	1	1	2	-	2	-	-	3

Course Code	YCS6003			
Course Title	Compiler Design			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Formal Language and Automata Theory b) Computer Organization and Architecture c) Programming and Data Structure			

Learning Objective:

In this course the students will learn about the fundamental principles in compiler design, the algorithms and data structures involved in the construction of a compiler, automation tools like lex and yacc for translating high level language. At the end of the course student will be able to build different phases of compilers.

Course Outcome:

CO1: Understand the lexical, syntactic and semantic structures of a language.

CO2: Recall various techniques to modify grammar of a given language.

CO3: Understand intermediate representations including symbol table, parse/syntax tree and data structure required for such representations.

CO4: Understand different techniques for intermediate code and machine code optimization.

Course Content:

Module 1: Lexical Analysis **[8L]**

History of Compiler Design, Analysis of the Source Program, The Phases of a Compiler, Cousins of the Compiler, The Grouping of Phases, Compiler Construction Tools, Need and role of lexical analyzer, Lexical errors, Input Buffering, Specification of Tokens, Recognition of Tokens, Design of a Lexical Analyzer Generator, Use of Lex tool.

Module 2: Syntax Analysis **[9L]**

Need and role of the parser, Context Free Grammars, Top Down parsing, Recursive Descent Parser, Predictive Parser, LL (1) Parser, Shift Reduce Parser, LR Parser, LR (0) item, Construction of SLR Parsing table, Introduction to LALR Parser, Use of YACC/Bison tool, Design of a syntax analyzer for a sample language.

Module 3: Syntax Directed Translation **[7L]**

Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, Translation of assignment statements, Boolean expressions, Statements that alter the flow of control, postfix translation, Translation with a top down parser, Translation: Array references in arithmetic expressions, procedures call, declarations and case statements.

Module 4: Code Generation **[6L]**

Data structure for symbols tables, representing scope information, Three address code, quadruple & triples, Issues in the design of code generator, The target machine, Runtime Storage management, Basic Blocks and Flow Graphs, Next-use Information, A simple Code generator, DAG representation of Basic Blocks.

Module 5: Code Optimization **[6L]**

Sources of Optimization, Peephole Optimization, Optimization of basic Blocks, Introduction to Global Data Flow Analysis, Runtime Environments, Source Language issues, Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter Passing.

Text/Reference Books:

1. A. Aho, V. R. Sethi and D. J. Ullman, "Compilers Principles, Techniques and Tools", Pearson Education.
2. M. L. Scott, "Programming Language Pragmatics", Morgan Kaufmann Publishers.
3. C. N. Fischer, R. K. Cytron, and R. J. LeBlanc, "Crafting a Compiler", Addison-Wesley.
4. S. Chattopadhyay, "Compiler Design", Prentice-Hall of India.
5. A. W. Appel, "Modern Compiler Implementation in C", Cambridge University Press.
6. R. Mark, "Writing Compilers and Interpreters: A Modern Software Engineering Approach Using Java", Wiley Publishing.
7. K. D. Cooper and L. Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers.
8. A. I. Holub, "Compiler Design in C", Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	1	-	2	-	-	1
CO2	3	2	2	1	2	1	2	-	1	-	-	1
CO3	3	2	2	1	2	2	1	-	2	-	-	1
CO4	3	2	2	1	2	1	2	-	1	-	-	1

Course Code	YCS6004
Course Title	Cryptography and Network Security
Category	Professional Core
LTP & Credits	L | T | P | Credits 3 | 0 | 0 | 3
Total Contact Hours	36
Pre-requisites	a) Data Structures and Algorithms b) Operating Systems c) Discrete Structures

Learning Objective:

In this course, the students will learn about the various cryptographic techniques that are essential to understand how secure information systems can be built. In particular, various security applications shall be discussed as case studies.
The course will be very helpful for the students in strengthening their basic knowledge in cyber security.

Course Outcome:

CO1: To explain the basic concept of cryptography and its applications in network security

CO2: To learn and analyze various private-key cryptography algorithms

CO3: To learn and analyze various public-key cryptography algorithms

CO4: To explain various cryptographic hash functions and their applications in network security

CO5: To demonstrate how the basic concepts of cryptography can be used to develop practical security applications

Course Content:

Module 1: Introduction to Cryptography and Block Ciphers [4L]

Introduction to security attacks, services and mechanisms. Conventional encryption models – private-key and public-key cryptography. Classical encryption techniques –substitution and transposition ciphers.

Module 2: Private-key Cryptography [7L]

Block Cipher – Feistel structure, Shannon's theory of confusion and diffusion, DES, triple-DES, AES.
Linear and differential cryptanalysis – basic concepts. Key distribution problem.
Stream Cipher – basic concept, realization based on linear feedback shift register.

Module 3: Mathematical Background [8L]

Modular arithmetic, Fermat's and Euler's theorem, gcd, primality testing. Euclid's algorithm, Chinese remainder theorem.
Intractable problems – integer factorization problem, modular square root problem, discrete logarithm problem

Module 4: Public-key Cryptography **[6L]**

RSA algorithm, security of RSA, key management. Diffie-Hellman key exchange algorithm.
Elliptic curve cryptography – basic concepts.

Module 5: Cryptographic Hash Functions and Authentication **[5L]**

Properties of hash functions – MD5 message digest algorithm, secure hash algorithm (SHA-1).
Digital signatures – authentication protocols, various approaches, digital signature standard (DSS).

Module 6: Network Security **[8L]**

Authentication applications – Kerberos, X.509 directory authentication service.
Electronic mail security – pretty good privacy (PGP), S/MIME.
Certification – public-key infrastructure. Secure socket layer (SSL), transport layer security, secure HTTP (HTTPS), and other secure protocols on the Internet.
System security – viruses, worms and malware, firewall systems.

Text/Reference Books:

1. W. Stallings, "Cryptography and Network Security: Principles and Practices", Prentice-Hall of India.
2. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, "Handbook of Applied Cryptography", CRC Press.
3. D. Stinson, "Cryptography: Theory and Practice", CRC Press.
4. C. Kaufman, R. Perlman, and M. Speciner, "Network Security", Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	-	1	1	-	-	2	2
CO2	1	1	2	-	2	-	2	1	-	-	1	3
CO3	1	1	2	-	2	-	1	1	-	-	2	3
CO4	1	1	3	2	1	-	2	1	-	-	1	3
CO5	1	2	2	-	3	2	1	1	-	-	2	3

Course Code	YCS6005			
Course Title	Internet Technology			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Computer Networks			

Learning Objective:

In this course, the students will learn about the technology and protocols that drive the Internet. In addition, they will be taught about the various software technologies that are used in developing web pages and web-based applications. The course will be very helpful for the students as it will provide them with the background for developing web-enabled applications.

Course Outcome:

CO1: To explain the technology and protocols that drive the Internet

CO2: To appraise the software technologies required to develop web

pages **CO3:** To demonstrate how interactive web pages can be created

CO4: To explain the security technologies that are used to make Internet secure

Course Content:

Module 1: Introduction to Internet **[6L]**

Overview: Intranet, Extranet and Internet, world-wide web.
TCP/IP protocol suite. IP protocol – IP datagram format, IP addressing and routing, IP packet fragmentation, classful and classless addressing, IPv4 and IPv6. TCP and UDP protocols – header fields, TCP connection establishment, flow control and congestion control.
Routing algorithms – Intra- and inter-domain routing, RIP, OSPF and BGP protocols. Packet forwarding in routers with examples.

Module 2: Internet Applications **[6L]**

Client-server model, Berkeley socket interface.
Common protocols in TCP/IP suite – ARP and RARP, ICMP, BOOTP and DHCP, FTP, TELNET.
Domain Name System (DNS) – iterative versus recursive name resolution.
Simple Mail Transfer Protocol (SMTP) – command and response formats, POP3 and IMAP.
Hyper-Text Transport Protocol (HTTP) – request and response formats, HTTP server.

Module 3: Hyper-Text Markup Language (HTML) **[6L]**

HTML tags and attributes – Heading, Paragraph, Formatting, Ordered and Bulleted Lists, Hyperlinks, Table, Block, CSS. Advanced features – HTML forms, HTML frames, image maps.
Extensible Markup Language (XML) – Syntax, Tree, Elements, Attributes, Validation, Viewing. Introduction to XHTML.

Common Gateway Interface (CGI) Scripts – principle of operation, environment variables, GET and POST methods, server-side scripting.

Module 4: Internet Scripting Languages **[6L]**

PERL – variable, condition, loop, array. Implementing data structures – Hash, String, Regular Expression, File handling, I/O handling.

JavaScript – statements, variable, comparison, condition, switch, loop, break. Object -string, array, regular expressions.

Cookies – basic concept, creation and storing cookies with example.

Java Applets – container class, components, Applet life cycle, update method. Embedding Applets within HTML page, parameter passing.

Module 5: Security and Privacy **[6L]**

Network Security – fundamental concepts, symmetric-key and asymmetric-key algorithms, cryptographic hash functions.

Common Security Protocols – Digital Signature, Pretty Good Privacy (PGP), HTTPS.

Network Security – Common vulnerabilities, Proxy Server and Network Address Translation (NAT), Packet-level and application-level firewalls, Secure transactions in ecommerce applications.

Module 6: Miscellaneous Topics **[6L]**

Internet Telephony – principle of operation, voice over IP (VoiP).

Multimedia Applications – multimedia over IP, RSVP, RTP, RTCP and RTSP protocols. Streaming media, Codec and Plugins.

Search Engine and Web Crawler – principle of operation.

Introduction AJAX – AJAX Internals, XML HTTP request object, AJAX UI tags.

Text/Reference Books:

1. N. P. Gopalan and J. Akilandeswari, "Web Teclmology: A Developer's Perspective", PHI Learning.

2. R. Banerjee, "Intemetworking Technologies, An Engineering Perspective", PHI Learning.

3. S. Holzner, "HTML Black Book", Dremtech Press.

4. P. J. Deitel and H. M. Deitel, "Internet and World Wide Web: How to program?", Pearson Education.

5. B. A. Forouzan, "Data Communication and Networking (3rd Ed.)", Tata-McGraw Hill.

6. W. Stallings, "Cryptography and Network Security: Principles and Practice (4th Ed.)", PHI / Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	1	-	-	-	-	-	2
CO2	2	2	2	2	1	-	-	-	-	-	-	3
CO3	2	2	-	-	1	2	-	-	-	-	-	3
CO4	2	1	1		2	3	-	-	-	-	-	3

Course Code	YCS6006			
Course Title	E-Commerce and ERP			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Software Engineering b) Computer Organization and Architecture			

Learning Objective:

In this course, the students will learn about e-marketplaces, the major types of electronic markets, and also know about different types of intermediaries in e-commerce.
This subject also give the idea on electronic catalogs, shopping carts, search engines, and describe the various types of auctions and list their characteristics.

Course Outcome:

CO1: To explain the basic concept of E-Commerce and its applications

CO2: To learn and analyze various ERP Tools

CO3: To learn and analyze various E-Commerce concepts

CO4: To apply the basic understanding of ERP in business environment

Course Content:

Module 1: Introduction to E-Commerce [10L]

Introduction What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of E-Commerce, Inter Organizational E-Commerce Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework Network Infrastructure for E-Commerce Network Infrastructure for E-Commerce, Market forces behind I Way, Component of I way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

Module 2: Mobile Commerce and ERP [7L]

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices, Web Security Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, firewalls & Network Security.

Module 3: E-Commerce Payment and Gateways [8L]

Electronic Payments Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card I Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

Module 4: E-Commerce and EDA [5L]

Net Commerce EDA, EDI Application in Business, Legal requirement in E - Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

Module 5: Internet and E-Commerce **[6L]**

Internet and Electronic commerce, internet, extranet and enterprise solutions, information system for business operations, information system for managerial decision support, information system for strategic advantage.

Text/Reference Books:

1. T.P. Liang, "Electronic Commerce, A Managerial Perspective", Prentice Hall
2. R. Kalakota and A. Whinston, "Frontiers of Electronic Commerce", Addision Wesley.
3. D. Amor, "The E-Business Revolution", Addision Wesley.
4. M. Greenstein, "Electronic Commerce", McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	1	1	-	-	2	-	-	2
CO2	1	2	1	-	1	-	1	-	-	-	-	2
CO3	1	1	2	-	2	-	-	-	-	-	-	2
CO4	1	1	3	1	1	-	-	-	-	2	-	2

Course Code	YCS6007
Course Title	Cloud Computing
Category	Open Elective
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	a) Computer Networks b) Operating Systems

Learning Objective:

To provide students a sound foundation of the cloud computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios. To enable students exploring some important cloud computing driven commercial systems and applications.

Course Outcome:

CO1: To explain the Cloud architecture, different services and deployment models.

CO2: To learn the concepts of abstraction and different types of virtualization.

CO3: To identify and explain different cloud offerings with their usage namely Azure, Google Apps, Amazon web service

CO4: To explain the underlying concepts of cloud management and security and illustrate the use of Service Oriented Architecture (SOA)

Course Content:

Module 1: Definition of Cloud Computing and its Basics [10L]

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing. Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients. Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service(CaaS).

Module 2: Use of Platforms in Cloud Computing [9L]

Concepts of Abstraction and Virtualization Virtualization technologies:Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of

Open	Virtualization	Format

– OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance.

Module 3:Use of various Web Services **[5L]**

Concepts of Platform as a Service: Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks Use of Google Web Services: Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.Use of Amazon Web Services: Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service Use of Microsoft Cloud Services: Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 4: Cloud Infrastructure **[6L]**

Types of services required in implementation – Consulting, Configuration, Customization and Support, Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle), Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)

Module 5: Concepts of Services and Applications **[6L]**

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition

– Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.

Text/Reference Books:

1. B. Sosinsky, "Cloud Computing Bible (1st Ed.)", Wiley.
2. R. Buyya, C. Vecchiola, S. T. Selvi, "Mastering Cloud Computing (2nd Ed.)", McGraw Hill Education.
3. A. T. Velte, "Cloud computing: A practical approach (3rd Ed.)", Tata McGraw Hill.
4. C. Miller, "Cloud Computing (4th Ed.)", PHI / Pearson Education.
5. K. Saurabh, "Cloud Computing (2nd Ed.)", Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	1	-	-	-	-	-	-	2
CO2	2	2	2	-	1	-	-	1	1	-	-	2
CO3	3	1	2	-	1	2	-	-	2	-	-	1
CO4	3	3	3	-	1	2	-	1	1	-	-	2

Course Code	YCS6008			
Course Title	Java Programming			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Fundamentals of Programming b) Object Oriented Programming			

Learning Objective:

The course objective is to understand various properties of object oriented programming. The course focuses on basics of OOP such as: abstraction, encapsulation, polymorphism and inheritance. This course gives a detailed discourse on Java programming language. This course thereafter focuses on platform independence of Java, implementation of various OOP paradigm, special properties such as exception handling and GUI usage.

Course Outcome:

CO1: To explain the process of interaction between objects, classes & methods

CO2: To acquire a basic knowledge of Object Orientation with different properties

CO3: To analyze various different string handling functions with various I/O

operations **CO4:** To discuss basic code reusability feature w.r.t. Inheritance,

package and Interface.

CO5: To implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Content:

Module 1: JAVA Basics **[8L]**

Fundamentals of Java: JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes.

Module 2: Object Oriented Programming **[7L]**

Encapsulation, Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & initialization code block, Access Control, Modifiers, Nested methods, Inner & Anonymous Classes, Abstract Class & Interfaces Defining Methods, Argument Passing Mechanism , Method Overloading, Recursion.

Module 3: Inheritances and Polymorphism **[9L]**

Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword.
Packages and Interfaces: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces.
I/O Streams: Concepts of streams, Stream classes- Byte and Character stream, Reading

console Input and Writing Console output, File Handling.

Module 4: Exception Handling **[6L]**

Exception types, Usage of Try, Catch, Throw, Throws and Finally

Thread: Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads, Critical Factor in Thread, DeadLock.

Module 5: JAVA Applet **[6L]**

Applet vs. Application, Applet class, Advantages of Applet, Applet Lifecycle My First Applet, Applet tag, How to run applet?

GUI Programming: Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package).

Collection Framework Collections of Objects, Collection Types, Sets, Sequence, Map, Understanding Hashing, Use of ArrayList & Vector.

Text/Reference Books:

1. H. Schildt and C. Dann, “Java: the Complete Reference”, McGraw-Hill Education.
2. E. Balagurusamy, “Programming With Java: A Primer”, Tata McGraw-Hill.
3. B. Eckel, “Thinking in JAVA”, Prentice Hall.
4. G. Reese, “Database Programming with JDBC and JAVA”, O’Reilly Media, Inc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	1	-	-	2	-	2	-	-	3
CO4	-	-	2	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	-	2	2	2	3

Course Code	YCS6101			
Course Title	Computer Networks Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a. Operating Systems Laboratory b. Computer Organization and Architecture Laboratory			

Learning Objective:

In this laboratory course, the students will be learning network programming using the socket API system calls, and also analyze packets flowing over the network. Also, a number of algorithms at the datalink and network layers shall be simulated and the results analyzed.

Course Outcome:

CO1: To learn how to use socket API system calls for network programming

CO2: To learn how to capture network packets and analyze them

CO3: To analyze various algorithms at the datalink and network layers through simulation

Suggestive List of Experiments:

1. Familiarization with Berkeley socket interface system calls in C, and writing programs to communicate between two machines using both connection-oriented (TCP) and connection-less (UDP) protocols. **[3 days]**

2. Write programs in C to simulate the stop-and-wait and sliding-window protocols, and carry out performance analyses both in the absence of errors and also in presence of errors. **[2 days]**

3. Familiarization with a packet capturing and analysis tool (like Wireshark), and analyze packets as captured under various data transfer scenarios over the network. **[2 days]**

4. Write a program in C to simulate a router for filtering IP packets (make the specification of the problem as realistic as possible).. **[3 days]**

5. Write programs to implement the distance vector algorithm for building up the routing tables in a network of routers.. **[2 days]**

Text/Reference Books:

1. W. Stallings, "Data and Computer Communication (5th Ed.)", PHI / Pearson Education.

2. B. A. Forouzan, "Data Communication and Networking (3rd Ed.)", Tata-McGraw Hill.

3. W. R. Stevens, "UNIX Network Programming (3rd Ed.), Prectice-Hall, Addision-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	-	3	-	-	-	2	-	-	3
CO2	1	2	2	2	-	-	-	-	2	-	-	3
CO3	2	2	1	-	2	2	2	-	2	-	-	3

Course Code	YCS6102			
Course Title	Software Engineering Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Object Oriented Programming Laboratory			

Learning Objective:

In this course students can build a fully functional, interactive, layered, distributed, database-backed software system from the ground-up as part of a small, agile, development team in a laboratory setting, become acquainted with historical and modern software methodologies. I also help to understand the phases of software projects and practice the activities of each phase, Practice clean coding, taking part in project management and become adept at such skills as distributed version control, unit testing, integration testing, build management, and deployment.

Course Outcome:

CO1: To construct, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

CO2: To design applicable solutions in one or more application domains using software engineering approaches with case studies

CO3: To develop the test cases from the design and effectively apply relevant standards and perform testing, and quality management and practice

CO4: To construct modern engineering architecture for software project management, time management and software reuse, and an ability to engage in life-long learning

Suggestive List of Experiments:

1. Write down the problem statement for a suggested system of relevance. **[1 day]**
2. Do Feasibility study along with requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system. **[1 day]**
3. To perform the function oriented diagram: Data Flow Diagram (DFD) and Structured chart. **[1 day]**
4. To perform the user's view analysis for the suggested system: Use case diagram. **[1 day]**
5. To draw the structural view diagram for the system: Class diagram, object diagram. **[1 day]**
6. To draw the behavioral view diagram: State-chart diagram, Activity diagram. **[1 day]**
7. To perform the behavioral view diagram for the suggested system: Sequence diagram, Collaboration diagram, timing diagram, component diagram, State diagram. **[1 day]**
8. To perform the implementation view diagram: Component diagram for the system. **[1 day]**
9. To perform the environmental view diagram: Deployment diagram for the system. **[1 day]**

10. To perform various testing using the testing tool unit testing, integration testing for a sample code of the suggested system. **[1 day]**

11. Perform Estimation of effort using FP Estimation for chosen system with other matrices. **[1 day]**

12. To prepare time line chart/Gantt Chart/PERT Chart for selected software project. **[1 day]**

Software required: MS Project, MS Visio, Docker

Text/Reference Books:

1. R. S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
2. P. Jalote, "Software Engineering", Wiley India.
3. R. Mall, "Software Engineering", Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	2	3	2	-	1	-	-	2
CO2	2	1	2	1	-	1	1	-	2	-	-	2
CO3	3	2	1	2	1	1	2	-	1	-	-	2
CO4	2	1	3	-	1	1	1	-	2	-	-	2

Course Code	YCS6501			
Course Title	Technical Report Writing and Presentation Skills			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	0	0	3	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

This course introduces students to the discipline of technical communication. Preparation of visuals to supplement text, workplace communication, descriptions of mechanisms, explanations of processes, and writing reports are the major topics included. This course is designed for students enrolled in technical degree programs.

Course Outcome:

CO1: To explain and demonstrate how to typeset documents using LaTeX

CO2: To explain and demonstrate how to write technical reports and research papers

CO3: To explain and demonstrate how to prepare and deliver presentations, and participate in group discussions

Suggestive List of Experiments:

1. Document preparation and typesetting using LATEX. **[3 days]**
2. Writing technical reports, styles and guidelines, data collection. **[2 days]**
3. Writing research papers, structure and guidelines, styles and formatting. **[3 days]**
4. Speaking skills, delivering seminars, group discussions. **[2 days]**
5. Guidelines for presentations, preparing presentations using Powerpoint or any other similar software tools. **[2 days]**

Text/Reference Books:

1. L. Lamport, “LaTeX: A Document Preparation System”, Addison-Wesley.

2. S. Kumar and P. Lata,“Communication Skills”, Oxford University Press.

3. A.J. Rutherfoord, “Basic Communication Skills for Technology”, Pearson.

4. M.A. Rizvi, “Effective Technical Communication”, McGraw Hill.

5. A. Leigh and M. Maynard, “The Perfect Presentation”, Random House.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	2	1	1	2	-	2	-	1
CO2	1	3	3	-	1	1	2	2	2	-	-	1
CO3	1	2	2	-	3	1	1	2	-	-	-	1

Semester 7 Curriculum and Syllabus

SEMESTER-7							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG7001	Value and Ethics in Profession	2	0	0	2
2	PE		Elective III	3	0	0	3
		YCS7011	Artificial Intelligence				
		YCS7012	Machine Learning				
		YCS7013	Data Warehousing and Data Mining				
3	PE		Elective IV	3	0	0	3
		YCS7011	Artificial Intelligence				
		YCS7012	Machine Learning				
		YCS7013	Data Warehousing and Data Mining				
PRACTICAL							
4	PE	YCS7101	Stream Lab 1: Artificial Intelligence and Machine Learning	0	0	4	2
BLENDED(MOOC + INTERNAL ASSESSMENT)							
5	OE	YCS7401	MOOCS Elective II	3	0	0	3
SESSIONAL(ONLY INTERNAL EVALUATION)							
6	PROJ	YCS7204	Project I	0	0	6	3
MANDATORY NON-CGPA COURSE							
7	MC	YCS7501	Social Awareness	3	0	0	0
		YCS7502	History of Science and Technology				
		YCS7503	Indian Liberal Arts				
TOTAL				**14**	**0**	**10**	**16**

Course Code	YMG7001			
Course Title	Values and Ethics in Profession			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn to be awareness on professional ethics and human values.

Course Outcome:

CO1: To explain the core values that shape the ethical behavior of an engineer

CO2: To understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories

CO3: To analyze various social issues, industrial standards, code of ethics, and role of professional ethics in engineering field

CO4: To explain the responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer

CO5: To acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

Course Content:

Module 1: Introduction **[2L]**

Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

Module 2: Psycho-social theories of moral development **[4L]**

View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

Module 3: Ethical Concerns **[4L]**

Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society.

Nature of values: Value Spectrum of a good life.

Module 4: Ethics of Profession **[4L]**

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.

Social and ethical responsibilities of Technologists. Codes of professional ethics.

Whistle blowing and beyond, Case studies.

Module 5: Self Development **[4L]**

Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module 6: Effects of Technological Growth **[6L]**

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics.

Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text/Reference Books:

1. S. H. Unger, "Controlling Technology: Ethics and the Responsible Engineers", John Wiley & Sons.
2. D. Johnson, "Ethical Issues in Engineering", Prentice Hall.
3. A. N. Tripathi, "Human Values in the Engineering Profession", Monograph published by IIM, Calcutta, 1996.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	1	1	2	-	1
CO2	-	-	-	-	-	1	1	3	1	2	-	1
CO3	-	-	-	-	-	3	2	3		1	-	1
CO4	-	-	-	-	-	3	2	1	-	-	-	1
CO5	-	-	-	-	-	3	2	2		1	3	1

Course Code	YCS7011			
Course Title	Artificial Intelligence			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Design and Analysis of Algorithms			

Learning Objective:

In this course, the students will learn the basic concepts, theories and techniques of artificial intelligence and also help students to learn the application of machine learning / AI algorithms in different fields of Computer Engineering.

Course Outcome:

CO1: To explain the basic concept of Artificial Intelligence and its applications

CO2: To classify and analyze various AI tools and techniques

CO3: To learn and evaluate various AI algorithms

CO4: To apply the basic understanding of artificial intelligence in real world applications

Course Content:

Module 1: Introduction to Artificial Intelligence (AI) [7L]

Overview: foundations, scope, problems, and approaches of AI. Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents.

Module 2: AI Techniques [7L]

Artificial Intelligence programming techniques, Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A^*, AO^*, min-imax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

Module 3: Planning and Representation in AI [8L]

Planning: planning as search, partial order planning, construction and use of planning graphs, Representing and Reasoning with Uncertain Knowledge: probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

Module 4: Decision Making [8L]

Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

Module 5: Knowledge Acquisition [6L]

Machine Learning and Knowledge Acquisition: learning from memorization, examples, explanation, and exploration. Learning nearest neighbor, naive Bayes, and decision tree classifiers, Q-learning for learning action policies, applications.

Text/Reference Books:

1. S. Russell and P. Norvig, “Artificial intelligence: A Modern Approach”, Prentice Hall.
2. N. J. Nilsson, “Artificial Intelligence: A New Synthesis”, Morgan-Kaufmann, 1998.
3. J. Pearl, “Heuristics: Intelligent Search Strategies for Computer Problem Solving”, Addison-Wesley Publishing Company.
4. B. A. Heule, M. Van Maaren and H. Walsh, “T Handbook of Satisfiability”, IOS Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	1	1	2	-	-	-	-	2
CO2	1	1	2	-	1	-	2	-	-	-	-	2
CO3	2	2	1	-	2	-	2	-	-	-	-	2
CO4	1	2	3	2	1	-	2	-	-	-	-	3

Course Code	YCS7012			
Course Title	Machine Learning			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Probability and Statistics b) Design and Analysis of Algorithms			

Learning Objective:

It covers some of the important regression, classification, clustering, rule-based and probabilistic models and algorithms. The Themes included linear and logistic regression, regularization, decision trees, probabilistic, SVMs and neural networks, clustering and reduction in feature dimensionality.

Course Outcome:

CO1: To explain and formulate machine learning problems corresponding to different applications

CO2: To classify machine learning algorithms and analyze their strengths and weaknesses

CO3: To explain the basic theory underlying machine learning

CO4: To apply machine learning algorithms to solve problems of moderate complexity

Course Content:

Module 1: Introduction to Machine-based Learning [4L]

Applications and problems, learning scenarios, concepts of tasks (problems to be solved by machine learning), models (output of machine learning) and features (workhorses of machine learning), geometric models, probabilistic models, logical models.

Module 2: Binary and Multi-class Classification [5L]

Binary classification, assessing and visualizing performance of classification, scoring and ranking, turning rankers into classifiers, class probability estimation. Multiclass classification, multiclass scores and probabilities, regression, unsupervised and descriptive learning, predictive and descriptive clustering.

Module 3: Rule Learning and Decision Trees [7L]

Decision trees, ranking and probability estimation trees, tree learning as variance reduction, regression trees, learning ordered rule lists, learning unordered rule sets, descriptive rule learning, rule learning for subgroup discovery, association rule mining, first-order rule learning, Least squares method, multivariate linear regression, regular-ized regression.

Module 4: Linear Models for Classification and Clustering [8L]

Perceptron, support vector machine, soft margin SVM, probabilities from linear classifiers, beyond linearity with kernel methods, Nearest neighbor classification, distance[-based clustering, K-means algorithm, Hierarchical clustering, Normal distribution, probabilistic models for categorical data, na¨ıve Bayes model for classification, probabilistic models with hidden variables, Gaussian mixture model, compression-based model.

Module 5: Feature Processing **[6L]**

Types of features, calculation on features, categorical, ordinal and quantitative features, structured features, thresholding and discretization, normalization and calibration, incomplete features, feature selection - matrix transformations and decompositions.

Module 6: Other Machine Learning Topics of Interest **[6L]**

Bagging and random forests, boosted rule learning, mapping the ensemble landscape –bias, variance and margins, meta learning. What to measure, how to measure, how to interpret, interpretation of results over multiple data sets.

Text/Reference Books:

1. P. Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press.

2. M. Mohri, A. Rostamizadeh and A. Talwalkar, "Foundations of Machine Learning", MIT Press.

3. K. P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	2	-	-	-	-	2
CO2	3	3	3	-	-	2	2	-	-	-	-	2
CO3	3	3	2	-	2	1	2	-	-	-	-	2
CO4	3	3	3	3	3	2	2	-	-	-	-	3

Course Code	YCS7013
Course Title	Data Warehousing and Data Mining
Category	Professional Elective
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Data Structures and Algorithms b) Database Management System

Learning Objective:

In this course, the students will understand classical models and algorithms in data warehousing and data mining. It enables students to analyze the data, identify the problems, and choose the relevant models and algorithms to apply. This course assesses the strengths and weaknesses of various methods and algorithms and analyze their behavior.

Course Outcome:

CO1: Understand Data Mining Fundamentals and remember the various issues in Data mining

CO2: Understand the architecture of Data warehousing and its different tools

CO3: Apply and analyze the basic of Data mining techniques and its various functionalities

CO4: Understand various issues and challenges of data mining techniques along with various applications, trends in different areas

Course Content:

Module 1: Introduction to Data Warehouse and Multi-dimensional Data [6L]

Introduction to Data Warehousing, Data warehouse Architecture and Infrastructure, Data cube and lattice structure. Star, Snowflakes and Fact Constellation models, Components. Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture, Reporting and Query tools and Applications, Tool Categories.

Module 2: Online Analytical Processing (OLAP) tools [6L]

Online Analytical Processing (OLAP) vs OLTP, Need –Multidimensional Data Model – OLAP Guidelines - ROLAP vs MOLAP vs HOLAP - Multidimensional versus Multirelational OLAP - Categories of Tools – OLAP Tools and the Internet.

Module 3: Data Mining and Knowledge Discovery Process [6L]

Introduction to Data Mining, Types of data, AI vs ML vs DL - Data Mining Functionalities, Data Mining Systems and Task Primitives - Integration of a Data Mining System with a Data Warehouse - Data Preprocessing, Data Mining vs. Machine learning, Prediction with Regression - Mining Frequent Patterns, Associations and Correlations -Mining Methods (Apriori Algorithm) - Mining Methods-FP Growth Algorithm.

Module 4: Supervised and Unsupervised learning [13L]

Classification and Prediction - Basic Concepts - Decision Tree Induction - Bayesian Classification - Lazy Learners (KNN Classification) - Classification by Backpropagation
- Support Vector Machines - Clustering and Applications and Trends in Data Mining
- Categorization of Major Clustering Methods, Types of Data - Partitioning Methods
- K-Means Clustering - K-Medoids Clustering - Density-Based Methods-¿DBSCAN - Hierarchical Methods (Agglomerative approach) - Hierarchical Methods (Divisive approach) - Grid Based Methods - Model-Based Clustering Methods.

Module 5: Data mining and Its Applications [5L]

Clustering High Dimensional Data - Outlier Analysis - Data Warehousing Applications - Data Mining Applications - Machine Learning Applications Towards Research.

Text/Reference Books:

1. J. Han and M. Kamber, "Data Mining Concepts and Techniques (2nd Ed.)", Elsevier.
2. P. Tan, M. Steinbach and V. Kumar, "Introduction To Data Mining (3rd Ed.)", PHI / Person Education.
3. D. T. Larose, "Data Mining Methods and Models (1st Ed.)", Wiley.
4. M. H. Dunham, "Data Mining: Introductory and Advanced Topics (1st Ed.)", Prentice Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		2	1	1	2	-	-	-	1	-
CO2	2	2	1	2	1	2	1	-	-	-	2	1
CO3	3	3	3	3	3	1	2	-	-	-	1	2
CO4	3	3	2	3	2	2	1	-	-	-	2	3

Course Code	YCS7101			
Course Title	Stream Laboratory 1 (Artificial Intelligence and Machine Learning)			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	0	0	4	2
Total Contact Hours	48			
Pre-requisites	a) Data Structures and Algorithms b) Database Management System c) Programming Practices II			

Learning Objective:

In this course, the students will learn about the basic principles, techniques, and applications of Artificial Intelligence and Machine Learning towards problem solving, inference, perception, knowledge representation, and puzzles design.

Course Outcome:

CO1: To explain the working principles of PROLOG/ LISP and apply LIST structure of PROLOG

CO2: To apply the principles of reasoning and inference to real world problems and design programs to solve various puzzles

CO3: To design simple algorithms for data classification in Python/R and test them with benchmark data sets

CO4: To design simple algorithms for data clustering in Python/R and test them with benchmark data sets

CO5: To analyze and evaluate algorithms for estimation/prediction using regression

Suggestive List of Experiments:

In this laboratory, the students will be familiarized with PROLOG/ LISP language. A tentative outline of the experiments is presented below, structured into four modules.

1. Introduction to PROLOG facts & rules with the help of a simple family tree; how the goals are given in PROLOG; some simple queries on the family tree.

   Formation of recursive definition; how PROLOG executes the goals; simple assignments.

   How PROLOG deals with problems with numbers – integers, real; with some examples.

   Implementation of Graph Search algorithms like DFS, BFS; Some application of DFS & BFS.

   Implementation of some well-known puzzles, like 8-queens problem, Towers-of-Hanoi problem, etc. **[4 days]**

2. Implementation of Classifiers – K-NN; Na¨ıve Bayes Classifier; Decision Tree, SVM, Perceptron; Multi-Layer Perceptron, Random Forest etc, on Python/R platform and test them on benchmark datasets (Kaggle/UCI Machine Learning).

   Familiarization with a few ML Tools: Excel; WEKA; R; Python in terms of classification. **[4 days]**

3. Implementation of data clustering algorithms – K-Means; DBSCAN, Hierarchical (AGNES/-DIVISIVE) etc, on Python/R platform and test them on benchmark datasets (Kaggle/UCI Machine Learning).

   Familiarization with a few ML Tools: Excel; WEKA; R; Python in terms of clustering. **[3 days]**

4. Implementation of Regression (single and Multiple Variables) linear and non-liner, Logistic regression for prediction tasks. **[1 day]**

Text/Reference Books:

1. I. Bratko, "Prolog programming for artificial intelligence", Pearson education.
2. S. Kaushi, "Logic and Prolog Programminge", New Age International Publishers.
3. B. Lantz, "Machine learning with R", PACKT Publishin.
4. C. M.Andreas and S. Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Media.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	2	-	1	-	2	-	-	-
CO2	3	3	3	-	2	-	2	-	1	-	-	1
CO3	3	3	2	-	3	2	1	1	2	-	-	1
CO4	3	3	2	-	3	2	2	1	1	-	-	1
CO5	3	3	2	-	3	2	1	1	2	-	-	1

Course Code	YCS7501			
Course Title	Social Awareness			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn about the fundamental concepts of Social Awareness, with detailed understanding about the Human Rights. In addition, major social issues, religion-problems of the minorities, role of youth as a social agent shall be discussed. The course will be very helpful for the students in understand the society in different angles and form a holistic view.

Course Outcome:

CO1: To understand the agents of social change

CO2: To identify the tools to analyse the divided society scientifically through right-based approach

CO3: To identify and discuss the issues and problems prevalent in the society

Course Content:

Module 1: Basic concept and elements of Social Awareness [6L]

Understanding the Concept, need, basic guidelines for Social Awareness, The basic elements of Social Awareness: Respectfulness, Cleanliness, Thriftiness, Reason for the Weakening Social Responsibility, Education as the Core Method to Strengthen Stu-dent's Social Responsibility, Indianness Indian social ethos: Indian society, characteristics of Indian society, The concept of social problems, characteristics of social problem, types of social problem, social problem and social change in India.

Module 2: World trends & contemporary India [6L]

World trends today: Some basic data-Globalization- World Social Forum vs. World Economic Forum-the North South divide, Emerging challenges in contemporary India-(social, political, economic and cultural issues).

Module 3: Contemporary India: Social perspective [6L]

India: A land of cultural and religious diversity - secularism-communalism-fundamentalism, Indian politics and religion-problems of the minority and women empowerment.

Module 4: Major social problems and Mind set in India [6L]

Indian resources and Poverty; Manifestation and Measurement; Incidence and Magnitude; Causes, problems of poor and pains of poverty, Ignorance in Governance and corruption- The Concept; Causes and Impact of Corruption; Combating Corruption-Right to information act, Indian education system and illiteracy Illiteracy-Magnitude, Causes and Consequences -Functional illiteracy, Caste Discrimination – caste discrimination and process of exclusion, untouchability, caste and politics, Reservation policy, Child abuse, child labour -Child Population and the Working Children; Effects of Abuse on Children; Violence against woman- Women's Harassment; Nature, Extent and Char-

acteristics of Violence Against Women; Trans Gender issue.

Module 5: Role of the youth in social agent **[6L]**

Concept of Youth Unrest; Youth Protests, Agitations and Movements; Important Youth Agitations in India; Youth Leadership, Social Demands and Terrorism- The Concept; Characteristics, Causes and Consequences, Alcoholism, Drug Abuse, Drug Addiction and other social deviations- Aberrant Behaviour; Basic Concepts; Nature and Impact of Abusable Drugs; Extent and Nature of Drug Abuse; Role of Family & Peer Group in Drug in Abuse; Control over Drug Abuse, Youth and politics effective intervention by youth, Effective intervention by youth.

Module 6: Emerging alternatives **[6L]**

Participation in governance and Social Activism - Discovering social roles of individuals and groups, Human rights: Know your rights: Human rights (Universal Declaration of Human Rights- Concepts in human rights- Human rights violations.)and Economic, Social, Cultural rights, Educating the community - Influencing key decision makers, Changing local and national politics - Making our world a better place.

Text/Reference Books/Journals:

1. J. Berry, J. Trimble and E. Olmedo, "Assessment of acculturation: Field methods in cross-cultural research (pp. 291–324) (W. J. Lonner & J. W. Berry (Eds.))", Sage Publications, Inc.

2. C. Bichta, "Corporate Social Responsibility A Role in Government Policy and Regulation", CRI Publisher.

3. D. Jamali and R. Mirshak, "Corporate Social Responsibility (CSR): Theory and Practice in a Developing Country Context", Journal of Business Ethics, Vol-72, pp. 243-262, 2007

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	3	2	-	2	-	2
CO2	-	-	-	-	-	3	2	2	-	1	-	2
CO3	-	-	-	-	-	2	2	3	-	2	-	1

Course Code	YCS7502
Course Title	History of Science and Technology
Category	Mandatory Non-CGPA Course
LTP & Credits	L: 3, T: 0, P: 0, Credits: 0
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

Ancient Indian science and technology have contributed significantly to the foundations and growth of modern sciences. Yet there is little genuine material accessible to younger generations to help them understand and appreciate the extent of these contributions. Furthermore, History of Science and Technology acts as a natural bridge between humanities and sciences. This course will provide an overview of some of the chief landmarks in the development of science in India especially in the fields of mathematics, physics, astronomy, chemistry, medicine, etc. The modules will include not only specific advances or breakthroughs, but also discuss the epistemological and cultural contexts behind them. The course promises to be an eye-opener to students from a variety of disciplines.

Course Outcome:

CO1: To understand the evolution of science and technology in India.

CO2: To explain the origin of astronomy and mathematics in ancient India.

CO3: To assess the developments in various branches of science and technology.

Course Content:

Module 1: Understanding Science from the Ancient Indian Perspective [4L]

Ontology.
Epistemology.
Methodology.

Module 2: Developments in Science and Technology [6L]

Science and scientists: chronological development and evolution.
Development of science and technology in specific areas: space technology, nuclear technology, bio-technology renewable energy, etc.

Module 3: Astronomy [5L]

Ritual origins of classical Indian Astronomy.
Knowledge revealed in the *Samhitas*, *Brahmanas*, and *Sutras*.
Pre-*Siddhantic* and *Siddhantic* developments.

Module 4: Mathematics [6L]

Knowledge revealed in Vedic and Post-Vedic texts.

Contributions by eminent mathematicians: Aryabhata, Brahmagupta, Bhaskaracharya. The Kerala School of Mathematics.
Traditions of Computational Techniques.

Module 5: Medicine and Health Sciences **[5L]**

Ayurveda.
Yoga.
Contributions by Charaka and Sushruta.

Module 6: Allied Sciences and Technology **[10L]**

Contributions in the field of Architecture.
Developments and practices in Civil Engineering.
Advances in Metallurgy.
Findings and applications of Chemistry.

Text/Reference Books:

1. D.M. Bose, S.N. Sen and B.V. Subbarayappa, "A Concise History of Science in India", 1989.
2. H. Selin and R. Narasimha (eds.), "Encyclopaedia of Classical Indian Sciences", 2007.
3. A. Ghosh, "History of Science in India – Astronomy", 2014.
4. D.P. Chattopadhyaya, "History of Science and Technology in Ancient India", 1986.
5. S. Balachandra Rao, "Indian Astronomy – A Primer", 2008.
6. B.S. Yadav et al. (eds.), "Ancient Indian Leaps into Mathematics", 2011.
7. T. Padmanabhan (ed.), "Astronomy in India: A Historical Perspective", 2010.
8. B.V. Subbarayappa (ed.), "Chemistry and Chemical Techniques in India", 1999.
9. T.R.N. Rao and S. Kak (eds.), "Computing Science in Ancient India", 2000.
10. G. Ifrah, "The Universal History of Numbers: From Prehistory to the Invention of the Computer, 2005.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	1	3	-	2	-	3
CO2	-	-	-	-	-	1	3	2	-	2	-	2
CO3	-	-	-	-	-	1	2	3	-	1	-	2

Course Code	YCS7503			
Course Title	Indian Liberal Arts			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn about the fundamental concepts of Indian Liberal Arts. Liberal Arts courses are rather new in India. They fulfill an important gap in the Indian education system. The course will be very helpful for the students to enhance their understanding of liberal arts.

Course Outcome:

CO1: To learn about the liberal Arts and how they are changing India

CO2: To remember and make the students aware of Indian constitution

CO3: To explain Globalization and the impact of Globalization India

CO4: To learn about Indian Economy and various concepts related to

that **CO5:** To illustrate various aspects of Culture Studies

CO5: To demonstrate Public Speaking and Dramatization as Performing Arts

Course Content:

Module 1: Principles of Liberal Arts **[7L]**

Definitions of Liberal Arts Greek centers of learning like Athens, Sparta and Gurukul in Ancient India. Changing Profiles of Liberal Arts education. Benefits of Liberal Arts education. Future trends and challenges of Liberal Arts. The via media between science, technology and culture. Fostering human values in the age of science and technology.

Module 2: Introduction to the Constitution of India **[5L]**

The Constituent Assembly and the Indian Constitution. Preamble to the Constitution of India. Rights and Fundamental Duties, Directive Principles. Concept of Welfare State and its different Constitutional Safeguards.

Module 3: Globalization, Sociology and Psychology of Social Change **[6L]**

Globalization- Nature and Concept. Impact of Globalization in general and in India. Dynamics of Globalization and Economic growth. Cultural dynamics of globalization. Implication of globalization on media, environment and folk arts.

Module 4: Indian Economics **[5L]**

Per Capita Income, National Income and its composition. Poverty, Inequality and Unemployment. Human Development Index. Foreign Direct Investment in India.

Module 5: Culture and Literary Studies **[8L]**

Concept of Culture: Meaning and Definition. Introduction to Cultural Studies: definition, aim, scope, methodology. Popular Culture: Meaning, Nature and definition. Rise of popular culture. Mass culture, popular culture and high culture. Popular culture in India. Reading Culture: Interdisciplinary perspectives. Digital culture and ethics,

Module 6: Dramatics Performing Arts and Public Speaking **[5L]**

Concept of performing arts. Definition, nature, scope and significance of dramatics. Role of director in the development of play. Acting as an art and science. Relationship between Indian theatre and new electronic media such as radio, TV and Cinema. Changing nature of Indian Dramatics and its presentation techniques. Public speaking as an art and its preparation.

Text/Reference Books/Journals:

1. "The Philosophy Book: Big Ideas Simply Explained", D. K. Publishers.
2. D. Pattanaik, "Indian Culture, Art and Heritage", Pearson Education India.
3. S. Nitin, "Art and Culture", McGraw-Hill Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	1	-	2	-	-
CO2	-	-	-	-	-	-	2	1	-	2	-	-
CO3	-	-	-	-	-	-	1	2	-	2	-	-
CO4	-	-	-	-	-	-	1	1	-	1	-	-
CO5	-	-	-	-	-	-	1	2	-	1	-	-

Semester 8 Curriculum and Syllabus

SEMESTER-8							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG8001	Principles of Management	2	0	0	2
2	PE		Elective V	3	0	0	3
		YCS8011	Data Analytics				
		YCS8012	Natural Language Processing				
		YCS8013	Deep Learning				
3	PE		Elective VI	3	0	0	3
		YCS8011	Data Analytics				
		YCS8012	Natural Language Processing				
		YCS8013	Deep Learning				
PRACTICAL							
4	PE	YCS8101	Stream Lab 2: Artificial Intelligence and Machine Learning	0	0	4	2
SESSIONAL(ONLY INTERNAL EVALUATION)							
5	PROJ	YCS7204	Project II	0	0	6	3
MANDATORY NON-CGPA COURSE							
6	MC	YCS8501	Indian Culture and Tradition	3	0	0	0
TOTAL				**11**	**0**	**10**	**13**

Course Code	YMG8001			
Course Title	Principles of Management			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the fundamental principles of management used in the industry and the different organizations. They will learn of the various field of study of management and the theories related to them and will be able to practically apply these theories in their management skills as well. At the end of the course, the students will be able to understand and interpret the proper knowledge and skills necessary to work as a proper manager in the field.

Course Outcome:

CO1: To familiarize the students with the origins of management principles and compare them with the modern trends in management theories

CO2: To understand the essential functions of management along with the theories framed by management experts in the business field

CO3: To explain the managerial process and the functions related to them which help them bring about change

CO4: To understand the proper relationship between the various levels of management in a business Organisation and the process by which to achieve the objectives

CO5: To explain the importance of feedback controlling of the management process along with the relevant theories, and to properly understand the process by which to apply proper management principles in modern day practices in the business Organisation and solve problems based on them

Course Content:

Module 1: Management [4L]

Management (Definition, Nature, Importance, Evolution), Contribution of Fayol, Taylor, Hawthorne, Maslow, Management- Art or Science?, Functions of Manager (Duties and responsibilities), Ethics in Management, Functions of Management

Module 2: Planning and Control [4L]

Planning (Steps, types and barriers), Mckinsey Approach, SWOT, Operational and Strategic Planning, Controlling (Concept, Relationship with Planning, Process, Dimensions), MBO

Module 3: Decision Making and Organizing [4L]

Decision Making Process, Certainty and Uncertainty of Decisions, Brainstorming, Process of Organizing, Authority and Responsibility, Delegation and Empowerment, Centralization and Decentralization, Departmentation

Module 4: Staffing **[4L]**

Manpower Planning, Job Design, Selection and Recruitment, Training and Development, Performance Appraisal

Module 5: Leadership and Communication **[3L]**

Role of leadership, theories of leadership, qualities of a good leader, Development of leadership, Communication process and types, Electronic Media

Module 6: Group Dynamics **[2L]**

Group- Concept, Stages of Group formation, types of groups

Module 7: Recent Trends in Management **[3L]**

Social Responsibility in management, Changes in management, TQM, Stress Management, International and Global Management, Crisis Management

Text/Reference Books:

1. H. Cortes, D. S. Bright and E. Hartman, "Principles of Management".
2. R. B. Rudani, "Principles of Management".
3. M. Gupta, "Principles of Management".
4. L. M. Prasad, "Principles and Practice of Management".

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	1	2	1	1	-	3	-	3
CO2	2	3	1	-	2	1	1	-	2	3	2	2
CO3	1	-	1	1	2	1	-	1	1	1	3	2
CO4	3	1	2	1	-	1	-	-	-		1	1
CO5	2	1	1	3	-	-	1	1	-	1	3	2

Course Code	YCS8011
Course Title	Data Analytics
Category	Professional Elective
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Probability and Statistics

Learning Objective:

In this course, the students will be taught about the methods for data preparation and data understanding. Also, the essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods shall be covered. After the completion of this course, the students will be in a better position to learn and understand use of predictive analytics, data science and data visualization.

Course Outcome:

CO1: To explain missing data and handle missing data in the real world data sets by choosing appropriate methods

CO2: To classify the summarization technique of data using basic statistics and visualization of the data using basic graphs and plots

CO3: To identify the outliers if any in the data set

CO4: To choose appropriate feature selection and dimensionality reduction technique

CO5: To explain multi-dimensional data handling techniques

Course Content:

Module 1: Introduction to Data Analytics **[3L]**

Introduction to data analytics (DA), Data Analytics lifecycle, Exploratory Data Analysis (EDA) – Definition, Motivation, Steps in data exploration.

Module 2: Preprocessing Techniques **[4L]**

Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, improving the accuracy of analysis.

Module 3: Preprocessing Bayesian Estimation **[4L]**

Introduction to Bayesian Estimation, Multiple Imputation-Imputation Phase, Analysis and Pooling Phase, Practical Issues in Multiple Imputation, Models for Missing Notation Random Data.

Module 4: Data Summarization & Visualization **[4L]**

Statistical data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, ND Statistical data analysis.

Module 5: Outlier Analysis **[3L]**

Introduction, Extreme Value Analysis, Clustering based, Distance Based and Density Based outlier analysis, Outlier Detection in Categorical Data.

Module 6: Feature Subset Selection **[4L]**

Feature selection algorithms: filter methods, wrapper methods and embedded methods, Forward selection backward elimination, Relief, greedy selection, genetic algorithms for features election.

Module 7: Dimensionality Reduction and Case Studies **[8L]**

Introduction, Principal Component Analysis (PCA), Kernel PCA, Canonical Correlation Analysis, Factor Analysis, Multi-dimensional scaling, Correspondence Analysis.

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Text/Reference Books:

1. C. C. Aggarwal ,"Data Mining The Text book", Springer.
2. C. K. Enders, "Applied Missing Data Analysis", The Guilford Press.
3. I. Koch, "Analysis of Multivariate and High dimensional data", Cambridge University Press.
4. M. Jambu, "Exploratory and Multivariate Data Analysis", Academic Press.
5. C. C. Aggarwal, "Data Classification Algorithms and Applications", CRC press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	-	1	-	-	-	-	2
CO2	3	1	1	1	1	-	2	-	-	-	-	2
CO3	1	3	2	2	2	-	1	-	-	-	-	3
CO4	-	1	1	2	2	3	2	-	-	-	-	2
CO5	1	3	2	1	1	3	1	-	-	-	-	3

Course Code	YCS8012
Course Title	Natural Language Processing
Category	Professional Elective
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	a) Design and Analysis of Algorithms b) Compiler Design

Learning Objective:

In this course, the students will learn about the various Natural Language techniques that are essential to understand how to build Language Processing systems. In particular, various security applications shall be discussed as case studies. The course will be very helpful for the students in strengthening their basic knowledge in Language Processing.

Course Outcome:

CO1: To explain the basic concept of NLP and its applications

CO2: To learn and analyze various NLP Tools

CO3: To learn and analyze various NLP Concepts

CO4: To apply the basic understanding of NLP in real language processing environment

Course Content:

Module 1: Introduction to NLP [7L]

Introduction: Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications. Text representation in computers, encoding schemes. Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML.

Module 2: Management of Linguistic Data [7L]

Management of linguistic data with the help of GATE, NLTK. Regular expressions, Finite State Automata, word recognition, lexicon. Morphology, acquisition models, Finite State Transducer. N-grams, smoothing, entropy, HMM, ME, SVM, CRF.

Module 3: Speech Tagging and Applications [8L]

Part of Speech tagging: Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions. A survey on natural language grammars, lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, Context Free Grammar, spoken language syntax.

Module 4: Parsing [8L]

Parsing: Unification, probabilistic parsing, TreeBank. Semantics: Meaning representation, semantic analysis, lexical semantics, WordNet Word Sense Disambiguation-Selection restriction, machine learning approaches, dictionary based approaches.

Module 5: Discourse and applications of NLP **[6L]**

Discourse: Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure. Applications of NLP: Spell-checking, Summarization Information Retrieval- Vector space model, term weighting, homonymy, polysemy, synonymy, improving user queries. Machine Translation– Overview.

Text/Reference Books:

1. D. Jurafsky and J. H. Martin. "Speech and Language Processing", Pearson Education.
2. A. James,"Natural Language Understanding", Pearson Education.
3. A. Bharati, R. Sangal andV. Chaitanya,"Natural Language Processing: a Paninian Perspective", Prentice-Hall of India.
4. T. Siddiqui andU. S. Tiwary,"Natural language processing and Information Retrieval", OUP.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	1	1	1	-	-	-	-	2
CO2	2	2	1	-	1	2	2	-	-	-	-	3
CO3	1	1	1	-	2	2	1	-	-	-	-	2
CO4	1	1	3	2	1	2	2	-	-	-	-	3

Course Code	YCS8013
Course Title	Deep Learning
Category	Professional Elective
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Machine Learning

Learning Objective:

In this course, students will learn the fundamentals of deep learning, and they will improve their understanding of the on-going research in computer vision and multimedia field. The students will be introduced to major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Course Outcome:

CO1: To explain theoretical aspects of deep learning models

CO2: To identify the deep learning algorithms that are more appropriate for various types of learning tasks in various domains

CO3: To analyze deep learning algorithms and solve real-world problems

CO4: To understand deep learning concepts with convolutional neural network case studies

Course Content:

Module 1: Introduction **[8L]**

Introduction to deep learning, Neural Network Basics, Backpropagation, Feed forward Neural Network, Logistic Regression.

Module 2: Key Concepts **[6L]**

Key concepts on Deep Neural Networks, Shallow Neural Network, Planar data classification with a hidden layer, Building your Deep Neural Network: step by step.

Module 3: Optimization **[8L]**

Hyperparameter Tuning, Batch Normalization, Regularization, Gradient Checking. Generative Adversarial Networks: Practical aspects of deep learning, Generative Adversarial Networks (GAN), Conditional GAN, Super Resolution GAN, Cycle GAN.

Module 4: Deep Reinforcement Learning **[8L]**

Deep Reinforcement Learning, Hyperparameter Tuning, Batch Normalization.

Module 5: Convolutional Neural Network **[6L]**

Foundations of Convolutional Neural Network, Deep Convolutional Models.

Text/Reference Books:

1. I. Goodfellow, Y. Bengio and A. Courville, “Deep Learning”, MIT Press.
2. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	1	2	3
CO2	3	3	3	3	3	1	-	-	-	-	2	3
CO3	3	2	2	3	3	2	2	-	2	2	3	3
CO4	3	3	3	3	3	-	-	-	-	-	2	3

Course Code	YCS8101
Course Title	Stream Laboratory 2 (Artificial Intelligence and Machine Learning)
Category	Professional Elective
LTP & Credits	L: 0, T: 0, P: 4, Credits: 2
Total Contact Hours	48
Pre-requisites	a) Probability and Statistics b) Programming Practices II

Learning Objective:

In this course, the students will learn about the basic principles, techniques, and applications of Artificial Intelligence and Machine Learning towards problem solving, inference, perception, knowledge representation, and puzzles design.In this course, the students will learn about the working principle of different Deep Learning models and their significance in real time environment, by looking into various facets of Python libraries specifically meant for such.

Course Outcome:

CO1: To categorize different facets of Python DL libraries

CO2: To classify a problem statement into supervised or unsupervised

CO3: To generate solutions of real life problems using different DL models

CO4: To design simple algorithms for data clustering in Python/R and test them with benchmark data sets

Suggestive List of Experiments:

The list of experiments has been provided in several modules. Module 1 will provide foundation knowledge on Python Libraries on different Deep Learning models, familiarization with PyTorch, TensorFlow, and Keras. Experiments 2, 3, 4 and 5 will focus on different DL models and their applications.

1. Usage of numpy: array operations, Fourier transform, random numbers Usage of scipy: linear algebra, statistics, optimization, sparse matrices. Usage of MatPlotLib: Scatterplot, histogram, Image Plot.
   Python-based DL libraries: Torch, Tensor Flow, and Keras. **[4 days]**
2. Usage of different loss functions in multilayer perceptrons. Classification of MNIST dataset using Convolutional Neural Networks.
   Generation of feature maps from different layers of Convolutional Neural Networks using Python. **[3 days]**
3. Classification of MNIST dataset using Residual Neural Network. **[1 day]**
4. Implementation of semantic segmentation using fully convolutional network. **[1 day]**
5. Implementation of Autoencoders using Python.

Implementation of Deep-Belief Network using
Python.

Image Noise removal using Autoencoder and Deep-Belief network **[3 days]**

Text/Reference Books:

1. R. Johansson, "Numerical Python: Scientific Computing and Data Science Applications with Numpy." SciPy and Matplotlib, Apress.
2. Y. Goodfellow, A. Bengio, Courville and Y. Bengio. "Deep learning". (Vol. 1. No. 2). Cambridge: MIT press.
3. https://towardsdatascience.com/
4. https://openai.com/blog/
5. https://deepmind.com/

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	3	-	2	-	-	-	-	2
CO2	3	3	3	3	-	-	1	-	-	-	-	2
CO3	3	3	3	3	2	2	2	1	-	-	-	2
CO4	3	3	3	3	-	2	1	1	-	-	-	2

Course Code	YCS8501
Course Title	Indian Culture and Tradition
Category	Mandatory Non-CGPA Course
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 0
Total Contact Hours	36
Pre-requisites	

Learning Objective:

India has a diverse and distinct culture that has been developing for thousands of years and varies from region to region.

The main objectives of this course are to familiarize students with various aspects of the culture and heritage of India, to develop among students a feeling of love and a sense of belonging towards the nation, to promote an integral and holistic growth of young minds, to develop the expressive and communicative power of logical reasoning, and to develop student sensibility with regard to issues of gender in contemporary India.

Course Outcome:

CO1: To understand the main features of Indian culture, civilization and Heritage.

CO2: To connect up and explain basics of Indian Traditional knowledge.

CO3: To explain the important issues related to gender in contemporary India.

CO4: To describe the socio-cultural insecurities caused by globalization.

CO5: To appreciate the ancient aesthetics and knowledge of construction, and also stimulate interest to know the subject in detail.

Course Content:

Module 1: Culture - An Introduction **[6L]**

Traditional and Modern concepts of Culture.
Notions of Culture in textual tradition, anthropological, archaeological and sociological understanding of the term culture.
Elements of Culture, concept of Indian culture and value system. Relation between culture and civilization.

Module 2: Indian Religion, Philosophy, and Practices **[6L]**

Pre-Vedic and Vedic Religion.
Buddhism, Jainism, Six System Indian Philosophy.
Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement.
Socio religious reform movement of 19th century, Modern religious practices.

Module 3: Indian Culture Studies **[8L]**

Indian Society and Culture in historical and contemporary perspectives.
Moments and Milestones in the history of India’s freedom Movement, Historiography.
Multiculturalism, Ethnicity, New Social Thoughts and movements (including environmental movement), Diaspora.

Indian Polity, Impact of Globalization on Indian society, Post Modernism, World Politics and terrorism.
Feminism (including eco-feminism), Women's Empowerment, Gender discrimination &
Gender Violence.

Module 4: Cultural Heritage and Performing Arts **[6L]**
Cultural Heritage: its significance and its constituents.
Importance of Built Heritage at the level of Locality, Region, Nation and World.
Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals.
Current developments in Arts and Cultural.
Indian's Cultural Contribution to the World.

Module 5: Socio-Cultural Issues in Contemporary India **[5L]**
Caste System
Issues related to woman: Gender Discrimination, Dowry System
Communalism
Issues related to the Elderly
Issues of poverty and
Unemployment Problems of
Children

Module 6: Student Activism and Youth Culture **[5L]**
History of Youth Movement in India.
Nature of Students Activism in India.
Indian students' Unrest in Global Perspective.
Causes of student Activism.
Youth Culture and Future Development

Text/Reference Books:

1. N. Singhania, Indian Art and Culture, McGraw-Hill.
2. Y. Singh, Modernization of Indian Tradition, Publisher-Rawat.
3. V. Pandey, Indian Society And Culture, Publisher - Rawat.
4. N. Hasnain, Indian Society And Social Issues, McGraw-Hill.
5. D. Pattanaik, Indian Culture, Art and Heritage, Pearson Education India.
6. Dr. P. K. Agrawal, Indian Culture, Art and Heritage, Prabhat Prakashan.
7. Dr. S. S. Mathur, A Sociological Approach to Indian Education, Vinod Pustak Mandir Agra.
8. K. A. Jacobsen, Modern Indian Culture and Society, Routledge (1st edition).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	1	-	-	-	1
CO2	-	-	-	-	-	-	1	2	-	-	-	1
CO3	-	-	-	-	-	-	2	1	-	-	-	1
CO4	-	-	-	-	-	-	1	2	-	-	-	1
CO5	-	-	-	-	-	-	2	1	-	-	-	1

R21 Curriculum

B.Tech. in Computer Science and Engineering with specialization in "Cyber Security"

JIS University
Agarpara, Kolkata

SEMESTER-1							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT1001	Mathematics I	3	1	0	4
2	BS	YPH1001	Physics	3	1	0	4
3	ES	YCS1001	Basic Electronics	3	0	0	3
4	ES	YCS1002	Engineering Mechanics	3	0	0	3
5	ES	YCS1003	Basic Problem Solving	2	1	0	3
6	HS	YED1001	English for Communication	2	0	0	2
PRACTICAL							
7	BS	YPH1101	Physics Laboratory	0	0	3	1.5
8	ES	YCS1101	Basic Electronics Laboratory	0	0	3	1.5
9	ES	YCS1102	Engineering Drawing and Graphics	0	0	3	1.5
10	HS	YED1101	Language Laboratory	0	0	2	1
TOTAL				**16**	**3**	**11**	**24.5**

SEMESTER-2							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT2001	Mathematics II	3	1	0	4
2	BS	YCH2001	Chemistry	3	0	0	3
3	ES	YCS2001	Basic Electrical Engineering	3	0	0	3
4	ES	YCS2002	Fundamentals of Programming	2	1	0	3
PRACTICAL							
5	BS	YCH2101	Chemistry Laboratory	0	0	3	1.5
6	ES	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	1.5
7	ES	YCS2102	Programming Practices I	0	0	3	1.5
EMBEDDED(THEORY + PRACTICAL)							
8	ES	YCS2301	Workshop Practice	1	0	3	2
MANDATORY NON-CGPA COURSE							
9	MC	YCS2501	Universal Human Values and Professional Ethics	3	0	0	0
10	MC	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	0
TOTAL				**15**	**2**	**15**	**19.5**

SEMESTER-3							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT3001	Discrete Structures	3	0	0	3
2	BS	YMT3002	Probability and Statistics	3	0	0	3
3	PC	YCS3001	Digital Circuits and Logic Design	3	1	0	4
4	PC	YCS3002	Data Structures and Algorithms	3	1	0	4
5	OE	YCS3003	Object Oriented Programming	3	0	0	3
PRACTICAL							
6	PC	YCS3101	Digital Circuits Laboratory	0	0	3	1.5
7	PC	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	1.5
8	OE	YCS3103	Object Oriented Programming Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS3501	Behavioral and Interpersonal Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS3201	Innovative Project I	0	0	3	1.5
TOTAL				**15**	**2**	**15**	**23**

SEMESTER-4							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS4001	Computer Organization and Architecture	3	0	0	3
2	PC	YCS4002	Design and Analysis of Algorithms	3	1	0	4
3	PC	YCS4003	Data Base Management System	3	0	0	3
4	PC	YCS4004	Formal Language and Automata	3	0	0	3
5	HS	YMG4001	Economics for Engineers	2	0	0	2
PRACTICAL							
6	PC	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	1.5
7	PC	YCS4102	Algorithms Laboratory	0	0	3	1.5
8	PC	YCS4103	Data Base Management System Laboratory	0	0	3	1.5
9	PC	YCS4104	Programming Practices II	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
10	MC	YCS4501	Constitution of India	3	0	0	0
SESSIONAL (ONLY INTERNAL EVALUATION)							
11	PROJ	YCS4201	Innovative Project II	0	0	3	1.5
TOTAL				**17**	**1**	**15**	**22.5**

SEMESTER-5							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS5001	Operating Systems	3	0	0	3
2	PC	YCS5002	Embedded Systems	3	0	0	3
3	PC	YCS5003	Introduction to Data Science	3	0	0	3
4	PC	YCS5004	Advanced Computer Architecture	3	0	0	3
5	OE		Elective I	3	0	0	3
		YCS5005	Multimedia Technology				
		YCS5006	Operations Research				
		YCS5007	Communication Engineering				
PRACTICAL							
6	PC	YCS5101	Operating Systems Laboratory	0	0	3	1.5
7	PC	YCS5102	Embedded Systems Laboratory	0	0	3	1.5
8	PC	YCS5103	Data Science Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS5501	Environmental Science	3	0	0	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS5201	Innovative Project III	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**21**

SEMESTER-6							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS6001	Computer Networks	3	0	0	3
2	PC	YCS6002	Software Engineering	3	0	0	3
3	PC	YCS6003	Compiler Design	3	0	0	3
4	PC	YCS6004	Cryptography and Network Security	3	0	0	3
5	OE		Elective II	3	0	0	3
		YCS6005	Internet Technology				
		YCS6006	E-Commerce and ERP				
		YCS6007	Cloud Computing				
		YCS6008	Java Programming				
PRACTICAL							
6	PC	YCS6101	Computer Networks Laboratory	0	0	3	1.5
7	PC	YCS6102	Software Engineering Laboratory	0	0	3	1.5
BLENDED (MOOC + INTERNAL ASSESSMENT)							
8	OE	YCS6401	MOOCS Elective I	3	0	0	3
MANDATORY NON-CGPA COURSE							
9	MC	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS6201	Innovative Project IV	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**22.5**

SEMESTER-7							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG7001	Value and Ethics in Profession	2	0	0	2
2	PE		Elective III	3	0	0	3
		YCS7031	Fundamentals of Cyber Security				
		YCS7032	Design of Secured Systems	3			
3	PE		Elective IV	3	0	0	3
		YCS7031	Fundamentals of Cyber Security				
		YCS7032	Design of Secured Systems	3			
PRACTICAL							
4	PE	YCS7103	Stream Lab 1: Cyber Security	0	0	4	2
BLENDED(MOOC + INTERNAL ASSESSMENT)							
5	OE	YCS7401	MOOCS Elective II	3	0	0	3
SESSIONAL(ONLY INTERNAL EVALUATION)							
6	PROJ	YCS7204	Project I	0	0	6	3
MANDATORY NON-CGPA COURSE							
7	MC	YCS7501	Social Awareness	3	0	0	0
		YCS7502	History of Science and Technology				
		YCS7503	Indian Liberal Arts				
TOTAL				**14**	**0**	**10**	**16**

SEMESTER-8							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG8001	Principles of Management	2	0	0	2
2	PE		Elective V	3	0	0	3
		YCS8031	Cyber Law and Security Policy				
		YCS8032	Quantum Computing		0		
3	PE		Elective VI	3	0	0	3
		YCS8031	Cyber Law and Security Policy				
		YCS8032	Quantum Computing				
PRACTICAL							
4	PE	YCS8103	Stream Lab 2: Cyber Security	0	0	4	2
SESSIONAL(ONLY INTERNAL EVALUATION)							
5	PROJ	YCS7204	Project II	0	0	6	3
MANDATORY NON-CGPA COURSE							
6	MC	YCS8501	Indian Culture and Tradition	3	0	0	0
TOTAL				**11**	**0**	**10**	**13**

Credit Distribution Ratio:

Category	Credit Allocation As per Autonomy	Credit Allocation As per AICTE
Humanities, Social Sciences & Management Courses	9	12*
Basic Sciences Courses	24	25*
Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc	23	24*
Professional Core Courses	61.5	48*
Professional Elective Courses relevant to chosen	16	18*
Open Elective Courses-Electives from other technical and /or emerging subjects	16.5	18*
Project work, seminar and internship in industry or elsewhere	12	15*
Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracurricular activities		
Total	162	160*

Credit Distribution in details:

A. Humanities, Social Sciences & Management Courses (HS)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YED1001	English for Communication	2	0	0	2	2
2	YED1101	Language Laboratory	0	0	2	2	1
3	YMG4001	Economics for Engineers	2	0	0	2	2
4	YMG7001	Value and Ethics in Profession	2	0	0	2	2
5	YMG8001	Principles of Management	2	0	0	2	2
		Total Credit:					**9**

B. Basic Sciences Courses (BS)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YMT1001	Mathematics I	3	1	0	4	4
2	YPH1001	Physics	3	1	0	4	4
3	YPH1101	Physics Laboratory	0	0	3	3	1.5
4	YMT2001	Mathematics II	3	1	0	4	4
5	YCH2001	Chemistry	3	0	0	3	3
6	YCH2101	Chemistry Laboratory	0	0	3	3	1.5
7	YMT3001	Discrete Structures	3	0	0	3	3
8	YMT3002	Probability and Statistics	3	0	0	3	3
		Total Credit:					**24**

C. Engineering Sciences Courses including Workshop, Drawing, Basics of Elec-trical/Mechanical/Computer etc. (ES)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS1001	Basic Electronics	3	0	0	3	3
2	YCS1101	Basic Electronics Laboratory	0	0	3	3	1.5
3	YCS1002	Engineering Mechanics	3	0	0	3	3
4	YCS1102	Engineering Drawing and Graphics	0	0	3	3	1.5
5	YCS1003	Basic Problem Solving	2	1	0	3	3
6	YCS2001	Basic Electrical Engineering	3	0	0	3	3
7	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	3	1.5
8	YCS2002	Fundamentals of Program-ming	2	1	0	3	3
9	YCS2102	Programming Practices I	0	0	3	3	1.5
10	YCS2301	Workshop Practice	1	0	3	4	2
		Total Credit:					**23**

D. Professional Core Courses (PC)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	YCS3001	Digital Circuits and Logic Design	3	1	0	4	4
2	YCS3101	Digital Circuits Laboratory	0	0	3	3	1.5
3	YCS3002	Data Structures and Algorithms	3	1	0	4	4
4	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	3	1.5
5	YCS4001	Computer Organization and Architecture	3	0	0	3	3
6	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	3	1.5
7	YCS4002	Design and Analysis of Algorithms	3	1	0	4	4
8	YCS4102	Algorithms Laboratory	0	0	3	3	1.5
9	YCS4003	Data Base Management System	3	0	0	3	3
10	YCS4103	Data Base Management System Laboratory	0	0	3	3	1.5
11	YCS4004	Formal Language and Automata	3	0	0	3	3
12	YCS4104	Programming Practices II	0	0	3	3	1.5
13	YCS5001	Operating Systems	3	0	0	3	3
14	YCS5101	Operating Systems Laboratory	0	0	3	3	1.5
15	YCS5002	Embedded Systems	3	0	0	3	3
16	YCS5102	Embedded Systems Laboratory	0	0	3	3	1.5
17	YCS5003	Introduction to Data Science	3	0	0	3	3
18	YCS5103	Data Science Laboratory	0	0	3	3	1.5
19	YCS5004	Advanced Computer Architecture	3	0	0	3	3
20	YCS6001	Computer Networks	3	0	0	3	3
21	YCS6101	Computer Networks Laboratory	0	0	3	3	1.5
22	YCS6002	Software Engineering	3	0	0	3	3
23	YCS6102	Software Engineering Laboratory	0	0	3	3	1.5
24	YCS6003	Compiler Design	3	0	0	3	3
25	YCS6004	Cryptography and Network Security	3	0	0	3	3
		Total Credit:					**61.5**

E. Professional Elective Courses relevant to chosen specialization/Branch (PE)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS7031	Fundamentals of Cyber Security	3	0	0	3	3
	YCS7032	Design of Secured Systems					
2	YCS7031	Fundamentals of Cyber Security	3	0	0	3	3
	YCS7032	Design of Secured Systems					
3	YCS7103	Stream Lab 1: Cyber Security	0	0	4	4	2
4	YCS8031	Cyber Law and Security Policy	3	0	0	3	3
	YCS8032	Quantum Computing					
5	YCS8031	Cyber Law and Security Policy	3	0	0	3	3
	YCS8032	Quantum Computing					
6	YCS8103	Stream Lab 2: Cyber Security	0	0	4	4	2
		Total Credit:					**16**

F. Open Elective Courses-Electives from other technical and / or emerging subjects (OE)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS3003	Object Oriented Programming	3	0	0	3	3
2	YCS3103	Object Oriented Programming Laboratory	0	0	3	3	1.5
2	YCS5005	Multimedia Technology	3	0	0	3	3
	YCS5006	Operations Research					
	YCS5007	Communication Engineering					
4	YCS6005	Internet Technology	3	0	0	3	3
	YCS6006	E-Commerce and ERP					
	YCS6007	Cloud Computing					
	YCS6008	Java Programming					
5	YCS6401	MOOCS Elective I	3	0	0	3	3
6	YCS7401	MOOCS Elective II	3	0	0	3	3
		Total Credit:					**16.5**

G. Project work, seminar and internship in industry or elsewhere (PW)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	YCS3201	Innovative Project I	0	0	3	3	1.5
2	YCS4201	Innovative Project II	0	0	3	3	1.5
3	YCS5201	Innovative Project III	0	0	3	3	1.5
4	YCS6201	Innovative Project IV	0	0	3	3	1.5
5	YCS7204	Project I	0	0	6	6	3
6	YCS8201	Project II	0	0	6	6	3
		Total Credit:					**12**

H. Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracur- ricular activities] (MC)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	YCS2501	Universal Human Values and Professional Ethics	3	0	0	3	0
2	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	3	0
3	YCS3501	Behavioral and Interpersonal Skills	0	0	3	3	0
4	YCS4501	Constitution of India	0	0	3	3	0
5	YCS5501	Environmental Science	0	0	3	3	0
6	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	3	0
7	YCS7501	Social Awareness	0	0	3	3	0
	YCS7502	History of Science and Tech- nology					
	YCS7503	Indian Liberal Arts					
8	YCS8501	Indian Culture and Tradition	0	0	0	3	0
		Total Credit:					**0**

Semester 1 Curriculum and Syllabus

SEMESTER-1							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT1001	Mathematics I	3	1	0	4
2	BS	YPH1001	Physics	3	1	0	4
3	ES	YCS1001	Basic Electronics	3	0	0	3
4	ES	YCS1002	Engineering Mechanics	3	0	0	3
5	ES	YCS1003	Basic Problem Solving	2	1	0	3
6	HS	YED1001	English for Communication	2	0	0	2
PRACTICAL							
7	BS	YPH1101	Physics Laboratory	0	0	3	1.5
8	ES	YCS1101	Basic Electronics Laboratory	0	0	3	1.5
9	ES	YCS1102	Engineering Drawing and Graphics	0	0	3	1.5
10	HS	YED1101	Language Laboratory	0	0	2	1
TOTAL				**16**	**3**	**11**	**24.5**

Course Code	YMT1001
Course Title	Mathematics I
Category	Basic Science
LTP & Credits	L T P Credits 3 1 0 4
Total Contact Hours	48
Pre-requisites	None

Learning Objective:

In this course the students will learn about the basic knowledge of matrix algebra, function of several variables and Improper integral. At the end of the course, the students will be able to solve engineering problems.

Course Outcome:

CO1: To understand and remember the distinctive characteristics of matrix algebra and calculus

CO2: To understand the theoretical concept of vector space and apply the concepts to solve problems

CO3: To understand and remember definite and improper integrals and apply the concept to solve problems

CO4: To understand the concept of functions of several variables and apply the concept to solve problems

Course Content:

Module 1: Matrix Algebra **[11L]**

Matrix Algebra: Inverse and rank of a matrix; Orthogonal matrix and its properties, trace of a matrix, Consistency and inconsistency of linear systems of equations, Solution of linear system of equation by Gauss elimination, matrix inverse method. Eigenvalues and eigenvectors; Cayley-Hamilton Theorem, Diagonalization of a matrix.

Module 2: Vector Spaces **[15L]**

Vector Spaces: Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map. Inner product spaces, Gram-Schmidt orthogonalization.

Module 3: Definite and Improper integral **[6L]**

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties.

Module 4 : Calculus **[6L]**

Calculus: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 5 : Function of Several variables **[10L]**

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian, Maxima and minima

of functions of two variables, Method of Lagrange multipliers.

Text/Reference Books:

1. E. Kreyszig, "Advanced Engineering Mathematics (9th Edition)", John Wiley & Sons.
2. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
3. T. Veerarajan, "Engineering Mathematics for First Year", Tata McGraw-Hill.
4. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers.
5. N.P. Bali and M.Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	2	-	-	-	-	-	1
CO2	3	2	-	3	-	3	-	-	-	-	-	1
CO3	3	2	2	1	-	1	-	-	-	-	-	1
CO4	2	3	1	3	-	1	-	-	-	-	-	1

Course Code	YPH1001			
Course Title	Physics			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None			

Learning Objective:

The aim of the course is to provide the students with adequate exposure about the basic principles of physics along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome:

CO1: To understand and remember the basic principle of Classical mechanics, Relativistic Mechanics, Quantum Mechanics and statistical mechanics and microscopic phenomena

CO2: To analyse and differentiate interference and diffraction ,

CO3: To understand the working principle of laser, optical fiber and holography amplifier and analyze its various applications enhance the knowledge in modern optics

CO4: To To understand and apply the knowledge in modern physics

Course Content:

Module 1: Mechanics [10L]

Representation of vector, scalar and vector fields, partial derivative of vector, gradient of scalar field, divergence and curl of vector field.

Friction, conservation laws, rigid body, moment of inertia, acceleration of rigid body, Mass energy Equivalence, Concept of photon.

Module 2: Quantum Theory [6L]

Black body Radiation spectrum, Wein's law , Rayleigh – Jeans law, Quantum theory of radiation, Wave mechanics, wave particle duality, De Broglie waves, Bohr's quantization rules, Phase and group velocities, Davission-Germer Experiment, Heisenberg Uncertainty Principle, Wave function and its significance, Schrodinger's wave equation.

Module 3: Laser, Fibre Optics and Holography [5L]

Laser: Spontaneous and stimulated emission of radiation, Population inversion, Einstein's coefficients, Concept of three and four level laser, Construction and working of Ruby laser, He-Ne lasers, Laser Applications.

Module 4 : Statistical Mechanics and Applications [5L]

Introduction to Statistical mechanics, Concept of energy levels and energy states. Classical limits of quantum statistics, Concept of Fermi level. Fermi level in metals,

Fermi level for intrinsic and extrinsic semiconductors (pictorial representations on temperature dependence and doping concentration viz. p type, n-type).

Module 5 : Electromagnetic Induction **[4L]**

Magnetic flux, Faraday's law of electromagnetic induction, electromotive force, Ampere's circuital law, Maxwell's equation.

Module 6 : Dielectrics **[4L]**

Types of dielectric, relation between dielectric constant and electric susceptibility, po-larizability, Clausius- Mossotti Equation, application of dielectric materials

Module 7 : Magnetic properties of materials **[2L]**

Magnetic flux density, magnetic permeability, magnetic susceptibility, classification of magnetic materials, diamagnetic materials, paramagnetic materials, Curie law.

Text/Reference Books:

1. A. Beiser, "Concepts of Modern Physics", McGraw Hill India.
2. D. K. Bhattacharya and P. Tandon, "Engineering Physics", Oxford India.
3. B. Lal and N. Subramanyam, "A Text Book Of Optics", S. Chand & Co.
4. I. Dominic and A Nahari, "A Text Book of Engineering Physics", Owl Book Publishers.
5. E. Hecht, "Optics", Pearson Education.
6. N. Mehta, "Applied Physics for Engineers", PHI Ltd.
7. J. C Palais, "Fiber Optic Communications", Pearson Education.
8. B. K. Pandey and S. Chathurvedi , "Engineering Physics", Cengage Learning.
9. J. Philip , "A text book of Engineering Physics", Educational Publishers.
10. B. Premlet , "Engineering Physics, McGraw Hill India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	3	2	-	-	3	-	-	3
CO2	2	2	1	1	1	1	-	-	-	-	-	3
CO3	1	3	1	2	2	1	-	-	1	-	-	3
CO4	2	2	2	1	1	1	-	-	1	-	-	3

Course Code	YCS1001			
Course Title	Basic Electronics			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the fundamental behavior and principle of operations of various electronic devices and circuits. At the end of the course, the students will be able to design useful electronic subsystems like rectifier, amplifier, oscillator, etc.

Course Outcome:

CO1: To understand and remember the principle of operation of semiconductor devices

CO2: To understand and analyze the operations of P-N junction diode, bipolar and field-effect transistors and solve design problems

CO3: To understand and remember the principle of working of operational amplifier and demonstrate its various applications

Course Content:

Module 1: Fundamentals of semiconductor **[6L]**

Conductors, Insulators, and Semiconductors: crystal structure, Fermi Dirac function, Fermi level, Energy band diagrams, valence band, conduction band, and band gap. Intrinsic and extrinsic (p-type and n-type) semiconductors, drift and diffusion current
— expression only (no derivation), mass action law, charge neutrality in semiconductor,
Einstein relationship in semiconductor, Numerical problems.

Module 2: P-N Junction Diode and its Applications **[8L]**

p-n junction diode, characteristics and parameters, diode approximations, static and dynamic resistance of diode, V-I characteristics and current expression of diode, temperature dependencies of V-I characteristics. p-n junction breakdown: conditions, avalanche and Zener breakdown, Concept of Junction capacitance, Zener diode and characteristics.
Diode half wave and full wave rectifiers (centre tapped and bridge) circuits and operation, ripple factor without filter, efficiency, reduction of ac ripples using filter circuit (Qualitative analysis). Design of diode clipper and clamper circuit: explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module 3: Bipolar Junction Transistor **[6L]**

BJT operation: PNP and NPN transistors, transfer characteristics, current conduction mechanism. Common Emitter, Common Base, Common Collector configurations and static characteristics, junction biasing condition for active, saturation and cut-off modes, DC load line and quiescent point, base bias, voltage divider bias, numerical problems.

BJT-based oscillator – design issues, numerical problems.

Module 4: Field Effect Transistor **[6L]**

Classification of field-effect transistors: JFET, MOSFET, operating principle of JFET. Drain and transfer characteristics of JFET (n-channel and p-channel), CS, CG, CD configurations, Relation between JFET parameters.

FET as an amplifier and as a switch: graphical analysis. E-MOSFET (n- channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems.

Module 5 : Feedback and Operational Amplifier **[8L]**

Concept of feedback: positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation.

Operational amplifier: electrical equivalent circuit, ideal characteristics, non-ideal characteristics of op-amp – offset voltages, bias current, offset current, slew rate; common-mode rejection ratio and bandwidth. Inverting and non-inverting amplifier: closed loop voltage gain, concept of virtual ground. Applications op-amp: adder, differentiator and integrator. Numerical problems.

Module 6 : Electronic Instruments and Measurements **[2L]**

Basics of measurement, cathode-ray and digital-storage oscilloscopes, measurement of voltage, frequency and phase; signal generators and analytical instruments.

Text/Reference Books:

1. J. Millman.,C. Halkias and C. D. Parikh, "Integrated Electronics", McGraw-Hill Education.
2. D. A. Bell, "Electronic Devices and Circuits" Oxford University Press.
3. D. P. Kothari and I. J. Nagrath, "Basic Electronics" McGraw-Hill Education.
4. J. D. Ryder, "Electronic Fundamentals and Applications" Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	3	-	2	-	-	2
CO2	1	2	2	1	2	2	3	-	3	-	-	2
CO3	1	1	3	2	2	2	3	-	3	-	-	2

Course Code	YCS1002			
Course Title	Engineering Mechanics			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course the students will learn how to apply Newtonian physics to relatively simple real-life applications. Specifically, topics on statics, dynamics and elementary strength of materials will be covered.

Course Outcome:

CO1: To understand and remember the representation of force, moments and analyze friction-based systems in static condition

CO2: To determine the centroid of an area and calculate moment of intertia of a section

CO3: To apply conservation of momentum and energy principle for particle dynamics and rigid body kinematics

CO4: To explain and analyze the concept of virtual work, rigid body dynamics and systems under vibration

Course Content:

Module 1: Introduction to Engineering Mechanics [6L]

Force systems: basic concepts, particle equilibrium in 2-D and 3-D, rigid body equilibrium, system of forces, coplanar concurrent forces.
Components in space: resultant, moment of forces and its application, couples and resultant of force system, equilibrium of system of forces, free body diagrams, equations of equilibrium of coplanar and spatial Systems.

Module 2: Friction and Basic Structural Analysis [5L]

Types of friction, limiting friction, laws of friction, static and dynamic Friction.
Motion of bodies, wedge friction, screw jack and differential screw jack.
Equilibrium in three dimensions, method of sections, method of joints, determine if a member is in tension or compression, simple trusses, zero force members, beams, frames and machines.

Module 3: Centroid and Centre of Gravity [5L]

Centroid of simple figures from first principles, centroid of composite sections.
Centre of gravity and its implications, area moment of inertia, moment of inertia of plane sections from first principles, theorems of moment of inertia, moment of inertia of standard and composite sections; Mass moment inertia of circular plate, cylinder, cone, sphere, hook.

Module 4: Virtual Work and Energy Method **[5L]**

Virtual displacements, virtual work for particle and ideal system of rigid bodies, degrees of freedom.

Active force diagram, systems with friction, mechanical efficiency.

Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium, applications of energy method for equilibrium, stability of equilibrium.

Module 5 : Fundamentals of Particle Dynamics [10L]

Rectilinear motion, plane curvilinear motion (rectangular, path, and polar coordinates), 3-D curvilinear motion, relative and constrained motion. Newton's second law (rectangular, path, and polar coordinates).

Work: kinetic energy, power, potential energy. Impulse: momentum (linear, angular), impact (Direct and oblique).

General principles in dynamics: types of motion, instantaneous centre of rotation in plane motion, D'Alembert's principle and its applications in plane motion and connected bodies, work energy principle and its application in plane motion of connected bodies, kinetics of rigid body rotation.

Module 6 : Mechanical Vibrations **[5L]**

Basic terminology, free and forced vibrations, resonance and its effects, degree of freedom. Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

Text/Reference Books:

1. H. Shames, "Engineering Mechanics", Prentice-Hall.
2. R. C. Hibbler, "Engineering Mechanics: Principles of Statics and Dynamics" Pearson Press.
3. F. P. Beer and E. R. Johnston, "Vector Mechanics for Engineers (Vol. I – Statics, Vol. II - Dynamics)" Tata McGraw-Hill.
4. Ruina and R. Pratap, "Introduction to Statics and Dynamics" Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	3	-	-	1	-	-	-
CO2	3	2	2	1	1	1	-	-	1	-	-	-
CO3	2	2	3	2	1	1	-	-	1	-	-	-
CO4	2	2	2	2	1	1	-	-	1	-	-	-

Course Code	YCS1003			
Course Title	Basic Problem Solving			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	2	1	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Algorithmic skill is a fundamental skill in modern times, and this course provides the students with the foundations of computational problem solving. The course emphasizes on principles and methods rather than on systems and tools.

Course Outcome:

CO1: Understand the basic model of computation

CO2: Apply algorithmic thinking to understand, define and solve problems

CO3: Design and implement algorithms for a given problem

Course Content:

Module 1: Introduction to Computation [8L]
Model of computation, stored-program concept, hardware and software. Number representation: basic concepts, decimal and binary.

Module 2: Problem Solving and Algorithmic Thinking [8L]
Overview – problem definition, logical reasoning. Flowcharts – symbols used, examples. Algorithm – definition, practical examples, properties, representation, algorithms vs programs. Elementary concepts about time complexity.

Module 3: Algorithmic Thinking [8L]
Constituents of algorithms – Sequence, Selection and Repetition, input-output. Computation – expressions, logic. Problem Understanding and Analysis – problem definition, input-output, variables, name binding. Data organization: lists, arrays, etc., algorithms to programs.

Module 4: Problem Solving with Algorithms [12L]
Examples and case studies, sorting and searching, statistical calculations. Numerical methods – solution of equations, root finding, solution of differential equations, integration.

Text/Reference Books:

1. D.D. Riley and K. A. Hunt, "Computational Thinking for the Modern Problem Solver", CRC Press.
2. P. F. Luccio, "Computational Thinking: First Algorithms, then Code" Springer.
3. S. S. Sastry, "Introductory Methods of Numerical Analysis" Prentice-Hall of India.
4. R. G. Dromey, "How to Solve it by Computer" Prentice-Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	-	-	2	-	-	3
CO2	1	1	2	1	2	2	-	-	2	-	-	3
CO3	1	2	2	1	1	1	-	-	2	-	-	3

Course Code	YED1001
Course Title	English for Communication
Category	Humanities
LTP & Credits	L T P Credits 2 0 0 2
Total Contact Hours	24
Pre-requisites	None

Learning Objective:

In this course, the students will develop communicative competence in English so as to make them industry-ready, with special emphasis on knowledge in grammar and English writing.

Course Outcome:

CO1: To learn how to employ communication skills in the workplace

CO2: To understand and learn about the use of the different elements of English

CO3: To develop requisite skills for effective reading and comprehension of texts

CO4: To learn how to compose formal, written communication

Course Content:

Module 1: Communication in a Globalized World **[4L]**

Communication skills: definition and practical dimension. Use of technology in contemporary communication, communication in workplaces. Dimensions of workplace communication: ethics, cross-cultural contexts and virtual contexts.

Module 2: Functional Grammar **[8L]**

Articles and prepositions. Direct and indirect verbs, subject-verb agreement. Tense and voice, phrases and clauses, direct and indirect speech.

Module 3: Reading Comprehension **[6L]**

Reading purposes and skills: skimming, scanning and intensive reading. Reading comprehension: fictional and non-fictional prose. One-word substitution and sentence meeting.

Module 4: Writing Skills **[6L]**

Business emails: enquiry, order, complaint, job application and formal invitations. Minutes of meeting, proposals, notices. Importance of punctuation in writing.

Text/Reference Books:

1. Wren and Martin (Revised by N. D. V. Prasada Rao), "High School English Grammar and Composition", S. Chand Publishing.

2. S. A. Beebe and T. P. Mottet, "Business and Professional Communication – Principles and Skills and Leadership" Pearson Education.

3. Sethi and B. Adhikari, "Business Communication" Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	-	1	1	1	1	2	-	2	2
CO2	1	2	1	-	-	1	1	1	-	3	-	-
CO3	1	-	3	-	2	1	1	2	1	1	2	1
CO4	1	3	2	-	2	1	1	3	-	-	1	1

Course Code	YPH1101			
Course Title	Physics Laboratory			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The objective of this course is to revise the basic concepts of physics through standard set of experiments to correlate them with the corresponding theory.

Course Outcome:

CO1: To discover an idea of different measurements and errors

CO2: To understand and apply basic laws of physics and experiments

CO3: To practice and generate experimental skills in different areas of physics and applications

Suggestive List of Experiments:

1. General idea about Measurements and Errors i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment. ii) Proportional error calculation using Carrey Foster Bridge. **[2 days]**
2. Determination of wavelength of light by Newton's ring method. **[1 day]**
3. Determination of wavelength of light by Laser diffraction method. **[1 day]**
4. Determination of Planck's constant using photoelectric cell. **[1 day]**
5. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment. **[2 days]**
6. Determination of Stefan's constant. **[1 day]**
7. Determination of band gap of a semiconductor. **[1 day]**
8. Study of dispersive power of material of a prism. **[1 day]**
9. Measurement of nodal and antinodal points along transmission wire and measurement of wave length. **[1 day]**
10. Determination of wave length of light by Fresnel's bi-prism method. . **[1 day]**

Text/Reference Books:

1. B. L. Flint and H. T. Worsnop, "Advanced Practical Physics for Students", Asia Publishing House.
2. M. Nelson and J. M. Ogborn, "Advanced Level Physics Practicals", Heinemann Educational Publishers.

3. S. Panigrahi and B. Mallick, “Engineering Practical Physics”, Cengage Learning.

4. I. Prakash and Ramakrishna, "A Text Book of Practical Physics", Kitab Mahal.
5. D. P. Khandelwal, "A Laboratory Manual of Physics for Undergraduate Classes", Vani Publication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	1	-	1	-	-	1
CO2	3	1	2	1	1	1	-	-	2	-	-	1
CO3	1	2	2	2	2	1	-	-	1	-	-	1

Course Code	YCS1101			
Course Title	Basic Electronics Laboratory			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this laboratory course, the students will learn to analyze and evaluate the functionality of various electronic components and their use in designing rectifiers, amplifiers and oscillators.

Course Outcome:

CO1: To study and evaluate the characteristics of basic electronic components (diode, transistor, FET)

CO2: To design and evaluate circuits like rectifier, amplifier and oscillator

CO3: To study and differentiate the functionality of operational amplifier and design adder, differentiator and integrator circuits

Suggestive List of Experiments:

1. Familiarization with testing and measuring instruments like oscilloscope, power supply, signal generator. **[1 day]**
2. Study the I-V characteristics of junction diode / zener diode. **[1 day]**
3. Design of half-wave and full-wave rectifier circuits and analyze their functionality.. **[2 days]**
4. Study the transfer characteristics of bipolar transistor. **[1 day]**
5. Design amplifier circuits using bipolar transistors and verify their operation. **[1 day]**
6. Design oscillator circuits using bipolar transistors and verify their operation. **[1 day]**
7. Study an operational amplifier chip and analyze its functionality. **[1 day]**
8. Design of non-inverting and inverting amplifiers using operational amplifiers. **[1 day]**
9. Design of adders, integrators and differentiators using operational amplifiers. Design an operation amplifier circuit to solve a given differential equation. **[2 days]**

Text/Reference Books:

1. J. Millman, C. Halkias and C. D. Parikh, “Integrated Electronics”, McGraw-Hill Education.
2. D. A. Bell, “Electronic Devices and Circuits”, Oxford University Press.
3. D. P. Kothari and I. J. Nagrath, “Basic Electronics”, McGraw-Hill Education.
4. J. D. Ryder, “Electronic Fundamentals and Applications”, Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	2	1	-	2	-	-	1
CO2	1	2	2	1	2	2	-	-	1	-	-	1
CO3	2	2	2	1	2	1	-	-	2	-	-	1

Course Code	YCS1102			
Course Title	Engineering Drawing and Graphics			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn how to draw and model a system, component, or process that meets desired needs within realistic constraints. It will help students to use the techniques, skills, and modern engineering tools and communicate effectively.

Course Outcome:

CO1: To explain basic concepts of Engineering Graphics and visual aspects of design

CO2: To understand and apply common drafting tools with the knowledge of drafting standards

CO3: To apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints

CO4: To produce part models, carry out assembly operation and show working procedure of a designed project work using animation

Suggestive List of Experiments:

1. Introduction to Engineering Drawing: Lines, Lettering's, Dimensioning and Scales **[1 day]**
2. Geometrical Constructions and Curves. **[1 day]**
3. Projection of Pints ,Lines, and Lamina. **[1 day]**
4. Projection of Solids. **[1 day]**
5. Section of Solids. **[1 day]**
6. Development of Surfaces. **[1 day]**
7. Orographic Projections **[2 days]**
8. Isometric projections. **[2 days]**
9. Overview of Computer Graphics. **[2 days]**

Text/Reference Books:

1. N.D. Bhatt, V.M. Panchal and P.R. Ingle, "Engineering Drawing", Charotar Publishing House.
2. M.B. Shah and B. C. Rana, "Engineering Drawing and Computer Graphics", Pearson Education

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	-	-	-	-	1	2	1	-	-
CO2	2	1	2	-	1	1	-	2	1	2	1	1
CO3	2	1	3	2	3	-	-	2	2	2	1	1
CO4	2	1	3	3	3	1	1	2	2	2	2	2

Course Code	YED1101			
Course Title	Language Laboratory			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	0	0	2	1
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this laboratory course, the students will be exposed to the need of English in workplace, and to equip them with good language skills, communication skills and soft skills.

Course Outcome:

CO1: To apply different skills of technical communication in English

CO2: To use correct pronunciation when speaking English

CO3: To use appropriate techniques for effective and active listening

CO4: To learn to tell clearly and coherently in the professional arena

Suggestive List of Experiments:

1. Learn about phonetics and pronunciation guide (Introduction of phonetics and phonetic table, tongue and lip movements for vowels and consonants, monophthongs/diphthongs, voiced/un-voiced, aspirated/unaspirated, minimal pairs, syllables, stress and intonation). **[4 days]**
2. Training on listening and comprehension (Active listening and its techniques, academic listening versus business listening, listening activities: answering questions, form filling, summarizing news bulletin, presentation, video clip, lecture, story). **[6 days]**
3. Training on speaking skills (Basic parameters of speaking, fluency-focused activities: JAM, conversational role plays, speaking using picture, group discussions and personal interviews). **[6 days]**
4. Laboratory project work (Making 5-minute animation video with voiceover, OR making a 10-minute documentary film). **[8 days]**

Text/Reference Books:

1. P. Ladefoged, "A Course in Phonetics", Harcourt Brace Jovanovich College Publishers.
2. J. Sullivan, "Simply Said: Communicating Better at Work and Beyond", Wiley.
3. N. Leonardo, "Active Listening Techniques: 30 Practical Tooms to Hone your Communication Skills", Rockridge Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	3	-	2	-	1	-	2	2	2	3
CO2	-	3	-	-	-	-	1	2	-	2	1	-
CO3	-	3	3	-	2	-	1	1	-	2	2	1
CO4	-	3	3	-	2	-	1	1	-	2	1	1

Semester 2 Curriculum and Syllabus

SEMESTER-2							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT2001	Mathematics II	3	1	0	4
2	BS	YCH2001	Chemistry	3	0	0	3
3	ES	YCS2001	Basic Electrical Engineering	3	0	0	3
4	ES	YCS2002	Fundamentals of Programming	2	1	0	3
PRACTICAL							
5	BS	YCH2101	Chemistry Laboratory	0	0	3	1.5
6	ES	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	1.5
7	ES	YCS2102	Programming Practices I	0	0	3	1.5
EMBEDDED(THEORY + PRACTICAL)							
8	ES	YCS2301	Workshop Practice	1	0	3	2
MANDATORY NON-CGPA COURSE							
9	MC	YCS2501	Universal Human Values and Professional Ethics	3	0	0	0
10	MC	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	0
TOTAL				**15**	**2**	**15**	**19.5**

Course Code	YMT2001
Course Title	Mathematics II
Category	Basic Science
LTP & Credits	L / T / P / Credits: 3 / 1 / 0 / 4
Total Contact Hours	48
Pre-requisites	None

Learning Objective:

In this course, the students will learn about the basic knowledge of double and triple integration, ordinary differential equation and laplace transform. At the end of the course, the students will be able to solve engineering problems.

Course Outcome:

CO1: To use mathematical tools to evaluate multiple integrals and vector integrals.

CO2: To apply mathematical tools for solving ordinary differential equations.

CO3: To understand the properties of Laplace Transform to evaluate multiple integrals.

CO4: To apply the concept of Laplace transform to solve ordinary differential equations.

Course Content:

Module 1: Multivariable Calculus (Integration) [12L]

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Module 2: First Order Ordinary Differential Equations [10L]

Solution of first order and first-degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for, solvable for solvable for and Clairaut's equation.

Module 3: Second Order Ordinary Differential Equations [12L]

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2nd order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

Module 4: Laplace Transform [14L]

Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $t\,f(t)$, LT of $f(t)$, LT of derivatives of f (t), LT of $\int f(t)dt$, Evaluation of improper integrals using L^{t} LT of periodic and step T, functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Text/Reference Books:

1. E. Kreyszig, “Advanced Engineering Mathematics (9th Ed.)”, John Wiley & Sons.
2. B. V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill.
3. T. Veerarajan, “Engineering Mathematics for First Year”, Tata McGraw Hill.
4. B. S. Grewal, “Higher Engineering Mathematics (20th Ed.)”, Khanna Publishers.
5. N. P. Bali and M. Goyal, “A Text Book of Engineering Mathematics”, Laxmi Publications.
6. G. B. Thomas and R. L. Finney, “Calculus and Analytic Geometry (9th Ed.)”, Pearson.
7. W. E. Boyce and R. C. DiPrima, “Elementary Differential Equations and Boundary Value Problems”, Wiley India.
8. S. L. Ross, “Differential Equations (16th Ed.)”, Wiley India.
9. N. Piskunov, “Differential and Integral Calculus”, Vol.I & Vol.II Mir Publishers.
10. E. A. Coddington, “An Introduction to Ordinary Differential Equations”, Prentice Hall, India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	3	-	-	-	-	-	1
CO2	3	2	2	2	3	3	-	-	-	-	-	1
CO3	2	2	-	2	3	3	-	-	-	-	-	1
CO4	3	3	2	2	3	3	-	-	-	-	-	1

Course Code	YCH2001
Course Title	Chemistry
Category	Basic Science
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

The concepts developed in this course will allow the students to quantify several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Course Outcome:

CO1: To describe the fundamental properties of atoms & molecules, atomic structure and periodic properties and acid-bases concepts.

CO2: To apply fundamental concepts of thermodynamics, electrochemistry in different engineering applications.

CO3: To develop the knowledge of modern organic chemistry in different engineering applications.

CO4: To apply the knowledge of water quality parameters, corrosion control & polymers to different industries and Design economically and new methods of synthesis nano materials.

CO5: To determine the structure of organic molecules using different spectroscopic techniques.

Course Content:

Module 1: Inorganic Chemistry [9L]

Atomic structure: Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Pauli's exclusion principle, Hund's rule, Aufbau principle and its limitation, Definition – Isotopes and Isobars. Periodic properties: Group trends and periodic trends in physical properties: electron affinity, electronegativity, polariz-ability, oxidation states, effective nuclear charges. Acids and Bases: Theories of Acids and Bases – Arrhenius Theory – Lowry – Bronsted Theory – Lewis Theory – Advantages of Lewis Theory – pH and pOH – Definition – Numerical problems – Indicator
–Buffer solution.

Module 2: Physical Chemistry [8L]

Thermodynamics and electrochemistry: Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications. Solution and colloids: Solutions: Definition, Methods of expressing concentration of a solution – Molarity, Molality, Normality, Mole fraction and Percentage Mass – Simple problems.

Module 3: Organic Chemistry [6L]

Fundamental organic chemistry: Concepts of inductive effect, resonance, hyperconjuga-tion, introduction to reactions involving substitution, addition, elimination, oxidation reduction. Stereochemistry: Chirality, optical activity, structural isomerism, enan-tiomers, diastereomers, configurations (D,L & cis trans), R/S-nomenclature, racemiza-tion.

Module 4: Industrial Chemistry [10L]

Water: Hardness, alkalinity, numerical. Corrosion: Definition – Types of Corrosion –Theories of corrosion, preventive measures. Polymers: Classification of polymers, conducting polymers, biodegradable polymers. Green Chemistry: Definition, Principle of green chemistry. Nano-Particles: Definition – Importance of Nano-particles. Synthesis of a commonly used drug molecule: Paracetamol, Aspirin.

Module 5: Spectroscopic techniques in Chemistry [3L]

Basic principle of infrared spectroscopy, UV-VIS spectroscopy, 1H Nuclear magnetic resonance spectroscopy and their application.

Text/Reference Books:

1. A. Bahl & A. Bahl, "A Text Book of Organic Chemistry (21st Ed.)", S. Chand & Company.
2. N. Krishna Murthy, N. Y. S. Murthy and V. Anuradha, "A Text Book of Engineering Chem-istry", Maruthi Publications.
3. S. Sengupta, "Organic Chemistry (11th Ed.)", Oxford University Press.
4. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", Tata-McGraw Hill.
5. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publisher.
6. R. B. Seymour, C. E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	-	2	3	-	-	-	-	1
CO2	2	2	1	1	-	1	-	-	-	1	-	1
CO3	3	3	3	-	-	-	-	-	3	3	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	3	3	3	3	1	1	1	1	-	-	2	2

Course Code	YCS2001				
Course Title	Basic Electrical Engineering				
Category	Engineering Science				
LTP & Credits	L	T	P	Credits	
	3	0	0	3	
Total Contact Hours	36				
Pre-requisites	None				

Learning Objective:

In this course the students will learn about the fundamentals of electrical circuits, in particular DC and AC circuits, transformers and rotating machines.

Course Outcome:

CO1: To understand and remember the working of basic electrical circuits, power distribution and safety measures.

CO2: To understand and analyze the functioning of DC and AC circuits.

CO3: To understand and remember the basic principles of transformers and rotating machines.

Course Content:

Module 1: DC Circuits Fundamentals [9L]

Electric circuits: linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, dependent source, node, branch, active and passive elements, Kirchhoff's laws, source equivalence and conversion. Network Theorems: superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Star-Delta conversions.

Module 2: AC Circuits Fundamentals [9L]

Sinusoidal quantities: average and RMS values, peak factor, form factor, phase and phase difference, concept of phasor diagram, V-I relationship in R, L, C circuits, R-L-C circuits in series and parallel with phasor diagrams, impedance and admittance, impedance triangle and power triangle, power factor, concept of resonance, simple problems (series and parallel circuit only), three-phase balanced circuits, concept of three-phase power measurement.

Module 3: Single-Phase Transformer [5L]

Single-phase transformer: brief idea on constructional parts, classifications, working principle. Problems on EMF equation, phasor diagram, equivalent circuit.

Module 4: Electrical Rotating Machines [8L]

DC Machines: constructional features, classifications, working principle of motor and generator. Simple problems on voltage equation. Three-phase Induction Motor: basic concept of three phase circuit and production of rotating magnetic field, working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problems.

Module 5: Electrical Installations [5L]

Power generation to distribution through overhead lines and underground cables with single line diagram.Earthing of electrical equipment, basic accessories: MCB, MCCB,

ELCB, SFU, Megger.

Text/Reference Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata-McGraw Hill.
2. V. Mittle and A. Mittal, “Basic Electrical Engineering”, Tata-McGraw Hill.
3. E. Hughes, “Electrical and Electronics Technology”, PHI/Pearson Education.
4. C. L. Wadhwa, “Basic Electrical Engineering”, Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	-	1	-	-	1
CO2	1	2	2	1	1	1	-	-	1	-	-	1
CO3	1	2	2	1	1	1	-	-	2	-	-	1

Course Code	YCS2002			
Course Title	Fundamentals of Programming			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	2	1	0	3
Total Contact Hours	36			
Pre-requisites	Basic Problem Solving			

Learning Objective:

The course is oriented to those who want to advance structured and procedural programming understating and to improve C programming skills. The major objective is to provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

Course Outcome:

CO1: Understand the basics of computer generations and system architecture.

CO2: Learn the way of design, execution and debug programs in C language.

CO3: Understand and learn the data types, loops, functions and apply to solve different problems.

CO4: Apply to the dynamic behavior of memory by the use of pointers through Functions.

CO5: Design and analyze modular programs using control structure, selection Union and understand the file handling.

Course Content:

Module 1: Fundamentals of Computer System [6L]

History of Computer - Generation of Computer - Classification of Computers - Basic structure of Computer System - Primary & Secondary Memory, Processing Unit, Input & Output devices Overview of Procedural vs Structural language, compiler and assembler.

Module 2: Introduction to C Programming [5L]

Modular Programming, Structure vs Object oriented programming, C Fundamentals - Variable and Data Types: The C character set identifiers and keywords, data type & sizes - variable names, declaration, statements - Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion - C expressions, precedence and associativity, Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields.

Module 3: Branching, Decision making and Looping [9L]

Statement and blocks, if - else, switch case - goto and labels, Loops - while, for, do while - break and continue - One-dimensional arrays, Two-dimensional arrays - Multidimensional arrays. Passing an array to a function Character array and string - array of strings, Passing a string to a function - String related functions.

Module 4: Functions and Pointers in C [10L]

Function types, function prototypes, functions returning values - functions not returning values, scope rules - function recursion - auto, external, static and register variables Functions - C preprocessor and macro - Pointers, Pointer and Array, Pointer and String
- Pointer and functions - Dynamic memory allocation.

Module 5: Structures and File handling in C [6L]

Basic of structures, arrays of structures - structures and pointers, structures and functions - formatted and unformatted files - fopen, fclose, fgetc, fputc, fprintf, fscanf function - Command line arguments.

Text/Reference Books:

1. B. W. Kerninghan & D. M. Ritchie, "The C Programming Language (16*th* Ed.)", PHI/ Pearson Education.
2. Y. Kanetkar, "Let us C (15*th* Ed.)", BPB Publication.
3. E. Balagurusamy, "Programming in ANSI C (15*th* Ed.)", Tata-McGraw Hill.
4. K. R. Venugopal & S. R. Prasad, "Mastering C (7*th* Ed.)", Tata-McGraw Hill.
5. R. Thareja, "Introduction to C Programming (4*th* Ed.)", Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	1	1	-	-	2	-	1	1
CO2	2	1	2	-	1	1	-	-	2	-	1	2
CO3	2	2	-	-	1	1	-	-	2	-	1	2
CO4	2	2	1	-	1	1	-	-	2	-	1	2
CO5	2	3	2	-	1	1	-	-	2	-	1	2

Course Code	YCH2101			
Course Title	Chemistry Laboratory			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To impart the students with scientific approach and to familiarize them with experiments in chemistry required to solve engineering problems and practical implementation of fundamental concepts.

Course Outcome:

CO1: To utilize the fundamental laboratory techniques for analyses such as titrations, separation/purification and spectroscopy.

CO2: To learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.

CO3: To be able estimate the ions/metal ions present in domestic/industry waste water.

CO4: To be able to analyze and gain experimental skill.

CO5: To design innovative experiments applying the fundamentals of chemistry.

Suggestive List of Experiments:

1. Determination of alkalinity in the given water sample. **[1 day]**
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution. **[2 days]**
3. Determination of available chlorine in bleaching powder. **[1 day]**
4. Determination of chloride content in water sample. **[1 day]**
5. Determination of iron content in the given water sample by Mohr's method. **[1 day]**
6. pH- metric titration. **[1 day]**
7. Viscosity of an addition polymer like polyester by viscometer. **[1 day]**
8. Thin layer chromatography. **[1 day]**
9. Element detection and functional group identification in organic compounds. **[1 day]**
10. Preparation of Bakelite and Urea formaldehyde resin. **[1 day]**
11. Innovative experiments (any one) **[1 day]**
    a. Synthesis of Nano particles
    b. Green synthesis

Text/Reference Books:

1. G. Svehla and B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", PHI/ Pearson Education.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning.
3. M. Arif, "Engineering Chemistry Lab Manual", Owl publishers.
4. J. Ahad, "Engineering Chemistry Lab Manual", Jai Publications.
5. R. K. Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers.
6. S. C. George and R. L. Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	-	-	-	-	-	-	-	1
CO2	3	3	3	3	-	1	-	-	-	1	-	1
CO3	3	3	3	-	-	-	-	-	-	-	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	3	3	3	3	1	1	1	1	-	-	2	2

Course Code	YCS2101			
Course Title	Basic Electrical Engineering Laboratory			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the basic electrical components, machineries, instruments and safety measures.

Course Outcome:

CO1: To identify and apply common electrical equipment and instruments.

CO2: To develop electric networks using various components and analyze the circuit behavior.

CO3: To apply and analyze the basic characteristics of transformers and electrical machines.

Suggestive List of Experiments:

1. Familiarization with basic safety precautions (earthing), measuring instruments (voltmeter, ammeter, wattmeter), resistor, capacitor, inductor. **[1 day]**
2. Verification of Thevenin's and Norton's theorem. **[1 day]**
3. Verification of superposition and maximum power transfer theorem. **[1 day]**
4. Characteristics of fluorescent, tungsten and carbon filament lamps. **[1 day]**
5. Electrical analysis of R-L-C series circuit. **[1 day]**
6. Three-phase power measurement using two wattmeter method. **[1 day]**
7. Demonstration of cut-out sections of machines: DC machine (commutator-brush arrangement), Induction machine (squirrel-cage rotor). **[1 day]**
8. Measurement of primary and secondary voltage and current of single-phase transformer: short-circuit and open-circuit tests. **[1 day]**
9. Torque-speed characteristics of DC machine and three-phase induction motor. **[2 days]**
10. Characteristics of single-phase energy meter. **[1 day]**
11. Starting, reversing and speed control of DC shunt motor. **[1 day]**

Text/Reference Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata-McGraw Hill.
2. V. Mittle and A. Mittal, "Basic Electrical Engineering", Tata-McGraw Hill.

3. E. Hughes, “Electrical and Electronics Technology”, Pearson.
4. C. L. Wadhwa, “Basic Electrical Engineering”, Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	1	-	-	1	-	-	1
CO2	2	2	2	1	-	1	-	-	1	-	-	1
CO3	1	2	2	2	1	1	-	-	1	-	-	1

Course Code	YCS2102			
Course Title	Programming Practices I			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	Basic Problem Solving			

Learning Objective:

The course is oriented to those who want to advance structured and procedural programming understating and to improve C programming skills. The major objective is to provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

Course Outcome:

CO1: Learn and understand the DOS system commands and familiarize with C programming environment.

CO2: Learn and translate the algorithms into simple programs and understand the flowchart design and test.

CO3: Understand and implement conditional branching, iteration and recursion.

CO4: Apply and analyze various C programs with Arrays, Pointers, Structures, Union along with functions.

CO5: Apply programming to solve matrix addition and multiplication problems and understand the file handling.

Suggestive List of Experiments:

1. Familiarization with basic DOS commands and programming design with the help of Flowcharts using Raptor. **[1 day]**
2. Familiarization with C programming environment, Variable types and type Conversions, Simple computational problems using arithmetic expressions. **[1 day]**
3. Branching and logical expressions, Problems involving if-then-else structures. **[1 day]**
4. Loops, while and for loops, Iterative problems e.g., sum of series, patterns print. **[2 days]**
5. 1D Arrays: searching, sorting, 1D Array manipulation, 2D arrays and Strings, Matrix problems, String operations. **[2 days]**
6. Functions, call by value, Simple functions implementations, function recursion. **[2 days]**
7. Pointers, structures and dynamic memory allocation, Union. **[2 days]**
8. File handling, file reading, writing, copying etc. **[1 day]**

Text/Reference Books:

1. B. W. Kerninghan & D. M. Ritchie, “The C Programming Language (16th Ed.)”, PHI/ Pearson Education.
2. Y. Kanetkar, “Let us C (15th Ed.)”, BPB Publication.
3. E. Balagurusamy, “Programming in ANSI C (15th Ed.)”, Tata-McGraw Hill.
4. K. R. Venugopal & S. R. Prasad, “Mastering C (7th Ed.)”, Tata-McGraw Hill.
5. R. Thareja, “Introduction to C Programming (4th Ed.)”, Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	-	2	1	-	1	-	1	-
CO2	2	2	2	1	1	2	2	-	1	-	1	2
CO3	3	2	-	1	1	2	1	-	2	-	1	2
CO4	3	2	1	1	1	2	2	-	1	-	1	2
CO5	3	3	2	1	1	2	1	-	2	-	1	2

Course Code	YCS2301
Course Title	Workshop Practice
Category	Engineering Science
LTP & Credits	L T P Credits
	1 0 3 2
Total Contact Hours	48
Pre-requisites	None

Learning Objective:

To understand the basic knowledge of workshop practice and safety. To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking, Cutting etc. To expose students to different types of manufacturing/ fabrication processes.

Course Outcome:

CO1: To learn and design components with their own hands.

CO2: To illustrate practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

CO3: To produce and design small devices of their interest for project or research purpose

Suggestive List of Experiments:

1. Introduction to Workshop Practice & Theoretical Discussions **[1 day]**
2. Machine Shop. **[2 days]**
3. Fitting Shop. **[2 days]**
4. Carpentry Shop. **[2 days]**
5. Welding Shops. **[2 days]**
6. Electrical Electronics House Wiring & Soldering. **[2 days]**
7. Smithy Shop. **[2 days]**
8. Casting Shop. **[1 day]**
9. Plastic Moulding & Glass Cutting. **[2 days]**

Text/Reference Books:

1. S. K. Hajra Choudhury, A. K. Hajra Choudhury, and N. Roy, “Elements of WorkshopTech-nology”, Media promoters and Publishers.
2. P. N. Rao, “Manufacturing Technology”, Tata-McGraw Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	1	-	1	-	2	1	-	2
CO2	3	3	2	2	1	-	1	-	2	1	-	2
CO3	3	2	2	2	1	1	1	1	2	2	3	2

Course Code	YCS2501			
Course Title	Universal Human Values and Professional Ethics			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	Universal Human Values and Professional Ethics			

Learning Objective:

The course shall help the students appreciate the essential complementarily between "VAL-UES" and "SKILLS" to ensure sustained happiness and prosperity, which are the core aspirations of all human beings. It shall facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. It shall help the student to have Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcome:

CO1: Understand the importance of human values and ethics in the study and application of acquired knowledge in multiple domains for the wellbeing of the planet.

CO2: Understand the importance and role of natural acceptance and experiential validation in the daily practices and living in harmony with the society as a whole.

CO3: Understand and distinguish between the ego and the self, the importance of present moment and awareness, with a realization that desires arise out of the ego.

CO4: Understand the importance of creativity, participation, interconnectedness in the nature, sustainable solutions to the existing problems, and grasp the right utilization of their knowledge in their own discipline of study.

Course Content:

Module 1: Course Introduction Need, Basic Guidelines, Content and Process for Value Education [6L]

Understanding the need, basic guidelines, content and process for Value Education, Self Exploration–what is it? - its content and process; 'Natural Acceptance' and experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself [6L]

Understanding human being as a co-existence of the sentient 'I' and the material

‘Body’, Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha, Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer), Understanding the

characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Swasthya, Practice Exercises and Case Studies will be taken up in Practice Session.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human - Human Relationship [9L]

Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family, Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence [4L]

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence, Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics [11L]

Natural acceptance of human values ,Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations.

Text/Reference Books:

1. R.R Gaur, R. Sangal, G. P. Bagaria, "A foundation course in Human Values and professional

Ethics", Excel books.

2. R.R. Gaur, R. Sangal, G. P. Bagaria, "A foundation course in Human Values and professional Ethics – Teachers Manual", Excel books.
3. B. L. Bajpai, "Indian Ethos and Modern Management", New Royal Book Company.
4. P.L. Dhar, R.R. Gaur, "Science and Humanism", Commonwealth Publishers.
5. S. George, "How the Other Half Dies", Penguin Press.

6. I. Illich, “Energy & Equity”, The Trinity Press.
7. D. H. Meadows, D. L. Meadows, J. Randers, W. W. Behrens, “limits to Growth”, Universe Books.
8. S. Palekar, “How to practice Natural Farming”, Pracheen(Vaidik) Krishi Tantra Shodh.
9. A Nagraj, “Jeevan Vidya ek Parichay”, Divya Path Sansthan.
10. E.F. Schumacher, “Small is Beautiful: a study of economics as if people mattered”, Blond & Briggs.
11. A.N. Tripathy, “Human Values”, New Age International Publishers.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	2	2	2	-	1	-	2
CO2	2	2	2	-	-	2	-	2	-	1	-	2
CO3	2	2	2	-	-	-	2	2	-	1	-	2
CO4	3	2	2	2	-	3	3	3	-	1	-	3

Course Code	YCS2502			
Course Title	National Service Scheme (NSS)			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	0	0	3	0
Total Contact Hours	36			
Pre-requisites	a) Knowledge on Data Analysis, b) Aims to do Social Service			

Learning Objective:

This course will give a better understanding about the community in which student volunteers want to work and their relation along with identify the needs and problems of the community and involve them in problem-solving. They will develop capacity to meet emergencies and natural disasters, practice national integration and social harmony and utilize their knowledge in finding practical solutions to individual and community problems.

Course Outcome:

CO1: To develop knowledge about disadvantages of society and the process to be required to overcome it.

CO2: To propagate national integration among society.

CO3: To organize social campaign in society to aware people on their legal rights, health rights, cultural rights, environmental rights etc.

CO4: This subject makes students disciplined and helps the students to become a social campaigner.

Course Content:

Module 1: National Service Scheme **[10L]**

History and its Objectives, Organizational structure of N.S.S. at National, State, University and College Levels, Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation.

Module 2: National Integration **[6L]**

Need of National integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems.

Module 3: Special Programme **[6L]**

Legal awareness, Health awareness, First-aid Career guidance, Leadership training - cum - Cultural Programme, Globalization and its Economic Social Political and Cultural impacts.

Module 4: Special Camping programme **[7L]**

Nature and its objectives, Selection of camp site and physical arrangement Organization
of N.S.S. camp through various committees and discipline in the camp, Activities to be undertaken during the N.S.S. camp. Use of the mass media in the N.S.S. activities.

Module 5: N.S.S. Regular Activities **[7L]**

Traffic regulation, working with Police Commissioner's Office, Working with Health De-

partment, Blind assistance, Garments collection, Non-formal education 'Environmental Education, Awareness and Training (EEAT)', Blood donation.

Text/Reference Books:

1. H.Y.Siddiqui, “Social Work and Human Relations”, Rawat Publications.
2. R.R.Shastri, “Social Work tradition in India”, Welfare Research Organization.
3. S. Singh and S.P. Srivastava , “Social Work Education in India, Challenge and opportunities”, New Royal Book Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	-	3	1	3	1	1	1	-
CO2	1	-	-	1	-	3	1	2	1	1	1	-
CO3	-	1	1	1	1	3	1	2	1	1	1	-
CO4	1	-	-	-	1	3	1	3	-	1	1	-

Semester 3 Curriculum and Syllabus

SEMESTER-3							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT3001	Discrete Structures	3	0	0	3
2	BS	YMT3002	Probability and Statistics	3	0	0	3
3	PC	YCS3001	Digital Circuits and Logic Design	3	1	0	4
4	PC	YCS3002	Data Structures and Algorithms	3	1	0	4
5	OE	YCS3003	Object Oriented Programming	3	0	0	3
PRACTICAL							
6	PC	YCS3101	Digital Circuits Laboratory	0	0	3	1.5
7	PC	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	1.5
8	OE	YCS3103	Object Oriented Programming Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS3501	Behavioral and Interpersonal Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS3201	Innovative Project I	0	0	3	1.5
TOTAL				**15**	**2**	**15**	**23**

Course Code	YMT3001
Course Title	Discrete Structures
Category	Basic Science
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course, the students will learn about the mathematical foundations of computer science. The specific topics that would be covered include propositional calculus and proof techniques, set theory and other derived algebraic structures, recurrence relations, and the theory of graphs. The course will be very helpful for the students as it acts as prerequisite for various next level courses like algorithms, automata theory, artificial intelligence, etc.

Course Outcome:

CO1: To explain the distinctive characteristics of propositional logic and its applications.

CO2: To demonstrate the applications of various proof techniques.

CO3: To explain the basic concepts of sets, relations, functions and various algebraic structures.

CO4: To understand the concept of recurrence relations and methods of solution.

CO5: To explain and analyze the concept of graphs and various graph algorithms.

Course Content:

Module 1: Propositional Logic **[6L]**

Introduction to Propositional Calculus: Propositions, Logical Connectives, Conjunction, Disjunction, Negation. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Bi-conditional statements, Logical Equivalence, Tautology. Conjunc-tive and disjunctive normal forms.

Module 2: Proof Techniques **[6L]**

Forward proof, proof by contradiction, contrapositive proofs, proof by mathematical induction, proof of necessity and sufficiency.

Module 3: Sets, Relations and Functions **[8L]**

Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations. Finite and infinite seta, countable and uncountable sets. Algebraic structures with one binary operation: semigroups, monoids and groups. Algebraic structures with two binary operations: rings and fields.

Module 4: Recurrence Relations **[6L]**

Recurrence relations: Formulation of different counting problems in terms of recurrence relations. Solution of recurrence relations with constant coefficients by (i) iterative method, (ii) characteristic roots method, (iii) generating functions method.

Module 5: Introduction to Graphs **[10L]**

Graphs and their basic properties: digraphs, weighted graph, connected and disconnected graph, bipartite graph, complement of a graph, regular graph, complete graph, walk, path, circuit, Euler graph, cut set, cut vertices, adjacency and incidence matrices of a graph, isomorphism. Graph coloring problem, planar graphs, trees.

Text/Reference Books:

1. C. L. Liu, “Elements of Discrete Mathematics”, Tata McGraw-Hill.
2. J-P. Tremblay and R. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, McGraw-Hill Education.
3. S. K. Chakraborty and B. K. Sarkar, “Discrete Mathematics”, Oxford University Press.
4. R. Graham, D.E. Knuth and O. Patashnik, “Concrete Mathematics: A Foundation for Computer Science”, Addison-Wesley.
5. N. Deo, “Graph Theory with Applications to Engineering and Computer Science”, Prentice-Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	1	1
CO2	2	1	2	-	2	1	-	-	-	-	-	1
CO3	2	3	2	2	-	-	-	-	-	-	1	1
CO4	-	2	3	2	1	-	-	-	-	-	-	1
CO5	1	-	2	1	1	2	-	-	-	-	1	1

Course Code	YMT3002			
Course Title	Probability and Statistics			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the basic knowledge of probability and statistics. At the end of the course, the students will be able to solve different real life problems in the field of artificial intelligence, data science etc.

Course Outcome:

CO1: To explain and demonstrate the distinctive characteristics of probability distribution.

CO2: To analyze the probability of real world uncertain phenomena by identifying probability distribution that fits the phenomena.

CO3: To explain and demonstrate the distinctive characteristics of statistics.

CO4: To apply and analyze the uses and limitations of statistical analysis.

Course Content:

Module 1: Basic Probability [3L]

Sample space and events, probability, axioms of probability, some elementary theorems, conditional probability, Baye's Theorem.

Module 2: Random Variable and Distribution [12L]

Discrete and continuous random variable, Probability density function and probability mass function for single variable only, Distribution function and its properties, Definitions of Expectation and Variance, properties and examples, Some important discrete distribution: Binomial and Poisson distribution and related problems. Some important continuous distribution: Normal, uniform and Exponential distributions and related problems.

Module 3: Basic Statistics [9L]

Measures of central tendency, Measure of dispersion, Measure of skewness and kurtosis, Correlation, regression and rank correlation.

Module 4: Applied Statistics [12L]

Curve fitting by the method of least squares: fitting of straight lines, second-degree parabolas and more general curves. Sampling, Testing of hypothesis: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Small samples Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text/Reference Books:

1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers.
3. N. G. Das, "Statistical Methods (Combined Volume)", Tata-McGraw Hill.
4. R. Garg and C. Prasad, "Advanced Engineering Mathematics", Khanna Publishers.
5. S. Ross, "A First Course in Probability", Pearson Education India.
6. W. Feller, "An Introduction to Probability Theory and its Applications, Vol. 1", Wiley.
7. J. E. Freund and R. E. Walpole, "Mathematical Statistics", Prentice Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	-	-	2	1
CO2	3	2	1	1	-	-	-	-	-	-	1	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	3	2	2	1	-	-	-	-	-	-	1	1

Course Code	YCS3001			
Course Title	Digital Circuits and Logic Design			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None			

Learning Objective:

In this course, the students will be taught about the representation of numbers in a computer system, and how digital circuits can be designed using logic gates and flip-flops. Also, the process of digital-to-analog and analog-to-digital conversion shall be covered. After the completion of this course, the students will be in a better position to learn and understand the basic operation of a computer system and how the various functional blocks can be implemented.

Course Outcome:

CO1: To explain the binary number system, and its importance in digital circuit design.

CO2: To classify and analyze various ways of minimizing switching functions.

CO3: To understand the process of designing combinational logic circuits.

CO4: To understand the process of designing sequential logic circuit modules.

CO5: To understand and remember the process of analog-to digital and digital-to-analog conversion.

Course Content:

Module 1: Number Systems and Binary Codes **[7L]**

Introduction to number systems: decimal, binary, octal, hexadecimal. Conversion from one number system to another.
Signed number representation: sign-magnitude, 1's complement and 2's complement.
Addition and subtraction of numbers.
Binary codes: BCD, excess-3 code, Gray code.

Module 2: Logic Families and Minimization of Switching Functions **[10L]**

Logic gates and their functionalities.
Logic families: TTL, nMOS, CMOS, pass transistor logic. Realization of gates.
Boolean algebra, truth tables and switching functions. Minimization of completely and incompletely specified switching functions: Karnaugh Map and Quine-McCluskey methods.

Module 3: Combinational Logic Circuits **[9L]**

Realization of Boolean functions using NAND/NOR gates. Half-adder, full-adder and ripple-carry adder/subtractor.
Decoders, Encoders and Multiplexers: applications in logic design.

Module 4: Sequential Logic Circuits **[9L]**

Clocks, flip-flops and latches.

Types of flip-flops: SR, D, JK, T; Edge-triggered and master-slave flip-flops.
State table and state diagram, state minimization, synthesis of finite state machines (FSMs).

Module 5: Counters and Registers **[6L]**

Synchronous and asynchronous counters, up/down counters. Applications of counters. Registers: parallel-in parallel-out and shift registers, linear feedback shift register (LFSR).
Applications of registers in data paths.

Module 6: D/A and A/D Conversion Techniques **[7L]**

Boolean algebra, truth tables and switching functions. Minimization of completely and incompletely specified switching functions: Karnaugh Map and Quine-McCluskey methods.
Digital-to-analog converters: principle of operation, weighted resistor and resistive ladder D/A converters.
Analog-to-digital converters: resolution and accuracy. Types of A/D converters: flash type, counter type, successive-approximation type.

Text/Reference Books:

1. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory (3rd Ed.)", Cambridge University Press.
2. M. Morris Mano, "Digital Design (3rd Ed.)", Pearson.
3. G. De Micheli, "Synthesis and Optimization of Digital Circuits", Tata-McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	2	-	-	2	-	1	2
CO2	1	3	3	-	-	2	-	-	2	-	1	1
CO3	2	2	2	1	2	2	-	-	2	-	1	2
CO4	2	2	2	1	2	2	-	-	2	-	1	1
CO5	2	2	2	-	1	2	-	-	2	-	1	2

Course Code	YCS3002			
Course Title	Data Structures and Algorithms			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Fundamentals of Programming			

Learning Objective:

In this course, the students will be taught about the significance of non-linear data structures with respect to the access and organization of data, various algorithmic approaches to write programs to solve problems in different engineering domains by using different data structures, merits and demerits of altered algorithms in terms of time-complexity.

Course Outcome:

CO1: To differentiate how the choices of data structure and algorithm methods impact the performance of program.

CO2: To solve problems based upon different data structure and also write programs.

CO3: To identify appropriate data structure and algorithmic methods in solving problem.

CO4: To discuss the computational efficiency of the principal algorithms for sorting, search-

ing, and hashing.

CO5: To compare and contrast the benefits of dynamic and static data structures implementations.

Course Content:

Module 1: Introduction of Data Structure **[11L]**

Concepts of data structures, Abstract Data Type.
Algorithms and programs, basic idea of pseudo-code, Properties of an algorithm.
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.
Array: Different representations – row major, column major.
Sparse matrix – its implementation and usage, Array representation of polynomials. Linked List: Singly linked list – operations, Doubly linked list – operations.
Circular linked list – operations, Linked list representation of polynomial and applications.
Binary codes: BCD, excess-3 code, Gray code.

Module 2: Linear Data Structure **[10L]**

Stack and its implementations (using array and linked list).
Applications (Infix, Prefix, and Postfix with their conversions, Postfix Evaluation). Queue, circular queue, de-queue.
Implementation of queue- linear and circular (using array and linked list).

Recursion:Principles of recursion - use of stack, tail recursion.
Applications - The Tower of Hanoi, Eight-queen problem.

Module 3: Nonlinear Data Structure **[18L]**

Trees: Basic terminologies, forest, tree representation (using array and linked list).
Binary trees - binary tree traversal (pre-, in-, post- order).
Threaded binary tree – operations.
Binary search tree- operations (creation, insertion, deletion, searching). Concept of Max-Heap and Min-Heap (creation, deletion).
Height balanced binary tree – AVL tree (insertion, deletion with examples only).
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS)
– concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge). Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods).

Module 4: Searching and Sorting **[9L]**

Sorting Algorithms: Bubble sort, Insertion sort, Selection sort – with notion of complexity.
Quick sort, Merge sort – with complexity, Radix sort – with complexity.
Searching: Sequential search, Binary search, Interpolation Search– with complexity.
Hashing: Hashing functions, Collision resolution techniques.

Text/Reference Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed, "Fundamentals of Data Structures of C", Universities Press.
2. S. Lipschutz, "Data Structures", Tata McGraw Hill Education (India) Private Limited.
3. A. M. Tanenbaum, "Data Structures in C", Pearson.
4. R. Thareja, "Data Structures Using C", Oxford.
5. A.K. Rath, A. K. Jagadev, "Data Structure Using C", Scitech Publications.
6. T. H. Coreman, "Introduction to Algorithms", MIT Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	-	-	-	-	3	-	2
CO2	2	2	1	2	1	2	3	2	2	-	-	2
CO3	2	2	1	2	1	2		-	2	3	-	2
CO4	2	1	2	2	1	2	-	-	-	-	-	2
CO5	3	2	2	2	1	3	-	-	-	-	-	2

Course Code	YCS3003			
Course Title	Object Oriented Programming			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	Fundamentals of Programming			

Learning Objective:

This course introduces the student to the concepts of C++ in computer science. The course will allow the students to acquire knowledge to make functions, files with emphasis on different object oriented paradigm used in C++.

Course Outcome:

CO1: To study the process of interaction between objects, classes and functions.

CO2: To acquire basic knowledge of Object Orientation with different

properties. **CO3:** To analyze various string handling functions with various

I/O operations. **CO4:** To remember basic code reusability feature with respect to

Inheritance.

Course Content:

Module 1: C++ Introduction **[8L]**

Introduction to C++ and object-oriented concepts, C++ Standard Library, Basics of a Typical C++ Environment, Pre-processors Directives, illustrative C++ programs. Header Files and Namespaces, library files. Introduction to objects and object-oriented programming, Encapsulation (Information Hiding), Access Modifiers: Controlling access to a class, method, or variable (public, protected, private, package), Other Modifiers, Polymorphism: Overloading, Inheritance, Overriding Methods, Abstract Classes, Reusability, Class' behaviors.

Module 2: Classes and Data Abstraction **[7L]**

Introduction, Structure Definitions, Accessing Members of Structures, Class Scope and accessing Class Members, Separating Interface from Implementation, Controlling Access Function And Utility Functions, Initializing Class Objects: Constructors, Using Default Arguments With Constructors, Using Destructors, Classes : Const(Constant) Object And Const Member Functions, Object as Member of Classes, Friend Function and Friend Classes, Using This Pointer, Dynamic Memory Allocation with New and Delete, Static Class Members, Container Classes And Integrators, Proxy Classes, Function overloading.

Module 3: Inheritance and Polymorphism **[9L]**

Operator Overloading, Inheritance, and Virtual Functions and Polymorphism: Fundamentals of Operator Overloading, Restrictions On Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading, ¡¡, ¿¿ Overloading Unary Operators, Overloading Binary Operators.

Introduction to Inheritance,

Base Classes And Derived Classes, Protected Members, Casting Base-Class Pointers to Derived-Class Pointers, Using Member Functions, Overriding Base–Class Members

in a Derived Class, Public, Protected and Private Inheritance, Using Constructors and Destructors in derived Classes, Implicit Derived–Class Object To Base- Class Object Conversion, Composition Vs. Inheritance. Introduction to Virtual Functions, Abstract Base Classes and Concrete Classes, Polymorphism, New Classes and Dynamic Binding, Virtual Destructors, Polymorphism, Dynamic Binding.

Module 4: Files and I/O Streams and Templates **[6L]**

Files and Streams, Creating a Sequential Access File, Reading Data From A Sequential Access File, Updating Sequential Access Files, Random Access Files, Creating A Random Access File, Writing Data Randomly To a Random Access File, Reading Data Sequentially from a Random Access File. Stream Input/Output Classes and Objects, Stream Output, Stream Input, Unformatted I/O (with read and write), Stream Manipulators, Stream Format States, Stream Error States. Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters, Templates and Inheritance, Templates and Friends, Templates and Static Members.

Module 5: Exception Handling **[6L]**

Introduction, Basics of C++ Exception Handling: Try Throw, Catch, Throwing an Exception, Catching an Exception, Rethrowing an Exception, Exception specifications, Processing Unexpected Exceptions, Stack Unwinding, Constructors, Destructors and Exception Handling, Exceptions and Inheritance.

Text/Reference Books:

1. H. M. Deitel, “Instructor’s Manual: C++ how to Program”, Prentice Hall.
2. S. Lipschutz, “Data Structures”, Tata McGraw Hill Education (India) Private Limited.
3. E. Balagurusamy, “Object-Oriented Programming with C++”, Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	2	3	-	3
CO2	3	2	-	-	2	2	-	-	2		-	3
CO3	3	3	3	1	2	2	2	-	2	-	-	3
CO4	2	2	2	3	2	2	-	-	1	-	-	3

Course Code	YCS3101
Course Title	Digital Circuits Laboratory
Category	Professional Core
LTP & Credits	L / T / P / Credits: 0 / 0 / 3 / 1.5
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this laboratory course, the students will be conducting hands-on sessions for the design and implementation of combinational and sequential digital circuit modules, and also interfacing LED and 7-segment display units.

Course Outcome:

CO1: To understand and test the functionalities of basic gates.

CO2: To understand Boolean functions using various combinational circuit modules (like gates, multiplexer, decoder, etc.)

CO3: To understand and verify the functions of flip-flops and other sequential circuit elements (like counter, register, etc.)

CO4: To understand and analyze complex digital systems and verify the functionality.

Course Content:

1. Design a basic inverter using transistors, obtain the transfer characteristics, and measure the propagation delay. Repeat the experiment using an inverter chip. **[1 day]**

2. Given a Boolean function, minimize it and realize the function using NAND gates. Using 555 timer, design a rectangular waveform generator of a given frequency. **[1 day]**

3. Design full-adder using basic gates. Cascade two such full-adders to realize a 2-bit adder. Connect LEDs to observe the outputs, and verify the functionality. **[1 day]**

4. Verify the functionality of multiplexer and decoder chips. Implement a 4-variable Boolean function using 8-to-1 multiplexer. **[1 day]**

5. Implement RS and JK master-slave flip-flops using NAND gates and verify their functionalities. Verify the functionality of J-K flip-flop chip. **[1 day]**

6. Using JK or D flip-flops, design a 4-bit shift register and verify the functionality. Modify the designs to make it into (a) ring counter, (b) Johnson counter and verify the functionality. **[1**

day]

7. Design a 3-bit synchronous counter that counts in some arbitrary count sequence. Apply a square wave at the clock input, and analyze the waveforms observed. **[1 day]**

8. Design a 2-digit BCD counter, and display the count value on 7-segment display units. **[1 day]**

9. Design an 8-bit modulo-N counter for some arbitrary value of N. Connect a D/A converter at the output of the counter and observe the output waveform. Analyze the operation for various values of N. Use the circuit to display the transfer characteristic of a NOT gate on the oscilloscope. **[1 day]**

10. Design a data path consisting of an ALU, registers and multiplexers. Hence design the control path to compute the GCD of two numbers. **[1 day]**

Text/Reference Books:

1. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory (3rd Ed.)", Cambridge University Press

2. M. Morris Mano, "Digital Design (3rd Ed.).

3. G. De Micheli, "Synthesis and Optimization of Digital Circuits", Tata-McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	2	3	2	-	-	2	-	2	3
CO2	1	2	2	1	-	2	-	-	2	-	2	3
CO3	1	2	2	1	1	2	-	-	2	-	2	3
CO4	2	2	2	2	1	2	-	-	2	-	2	3

Course Code	YCS3102			
Course Title	Data Structures and Algorithms Laboratory			
Category	Programme Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Fundamentals of Programming			

Learning Objective:

In this course, the students will learn about C program based implementation ofdifferent algorithmic approaches by using non-linear and linear data structures to solve problems in different engineering domains.

Course Outcome:

CO1: To choose appropriate data structure as applied to specified problem definition.

CO2: To compare operations like searching, insertion, deletion, traversing mechanism on various data structures.

CO3: To explain various practical applications of data structures.

CO4: To analyze how to store, manipulate and arrange data in an efficient manner.

CO5: To demonstrate how to implement various data structures using arrays and linked list.

Suggestive List of Experiments:

1. Experiments on arrays **[1 day]**
Addition and Multiplication of Arrays
Implementation of Sparse Matrices

2. Experiments on Abstract Data Types **[2 days]**
Implementation of stack using Array
Applications of stack –infix to postfix conversion, expression evaluation

3. Experiments on Linked List **[2 days]**
Implementation of linked lists and its operations– insertion, deletion and reverse
Implementation of stacks and queues using linked list.
Polynomial addition and polynomial multiplication.

4. Experiments on Searching and Sorting **[2 days]**
Searching: Linear Search, Binary Search
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort

5. Experiments on Non-linear Data Structures **[2 days]**
Traversals of binary tree, Binary Search Tree (BST), Threaded binary tree
Height balanced binary tree – AVL tree (insertion, deletion)
B- Trees – insertion, deletion

6. Experiments on Hashing **[1 day]**
   Implementation of Hash tables and its operations – searching, inserting, and deleting, handling collisions.

7. Innovative Experiments **[2 days]**
   Case study of solving complex problems from various engineering domains using suitable data structures (e.g., mesh analysis in electrical circuits, event-driven simulation, etc.).

Text/Reference Books:

1. C. E. Balagurusamy, “Data Structures using C”, McGraw Hill.
2. E. Horowitz, S. Sahni and S. Anderson-freed, “Fundamentals of Data Structures of C”, Universities Press.
3. A. K. Sharma, “Data Structures using C”, Pearson.
4. 4. R. Thareja, “Data Structures using C”, Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	-	-	2	1	-	-
CO2	-	2	2	-	2	2	-	-	2	1	-	2
CO3	2	1	1	-	-	2	-	-	2	-	-	-
CO4	3	2	-	2	-	2	-	-	2	-	1	-
CO5	-	-	2	1	2	2	-	-	2	-	1	2

Course Code	YCS3103
Course Title	Object Oriented Programming Laboratory
Category	Open Elective
LTP & Credits	L T P Credits / 0 0 3 1.5
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming

Learning Objective:

The main objectives of this course is to understand the fundamental principles and approaches of object oriented programming using C++.

Course Outcome:

CO1: To understand and remember object-oriented programming concepts using the C++ language.

CO2: To understand and analyze the principles of data abstraction, inheritance and polymorphism.

CO3: To understand and remember the concepts of virtual functions.

CO4: To understand formatted and unformatted I/O operations.

CO5: To apply exception handling.

Course Content:

1. Programming using basic features of C++.
Executing programs in UNIX environment. Understand pre-processors directives, header Files and namespaces, library files, variables, data types, operators, control, basic loop control, through simple C++ programs. **[3 days]**

2. Functions and String Manipulation
Writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures and unions.
Longest common subsequence problem. **[2 days]**

3. Object Oriented Programming
Programs to demonstrate fundamentals of classes, abstract class, virtual class, overriding, template class, constructors-destructors and deal with member functions, operator overloading and polymorphism (both static and dynamic), inheritance, derived class handling. **[2 days]**

4. Exception handling, Input/output and Dynamic Memory Management
Write simple programs to demonstrate exception handling, I/O management, creation of linked list using dynamic memory management. **[3 days]**

5. Innovative Experiments
   Demonstrate read write operations from USB flash drive. Generate command line-based tic-tac-toe game. institute premises.

[2 days]

Text/Reference Books:

1. H. M. Deitel, "Instructor's Manual: C++ how to Program", Prentice Hall.
2. E. Balagurusamy, "Object-Oriented Programming with C++", Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	-	-	1	-	-	1
CO2	3	2	2	-	1	2	-	-	1	-	-	2
CO3	2	3	2	3	1	2	-	-	2	-	-	1
CO4	1	-	-	-	1	2	-	-	1	2	-	2
CO5	2	1	1	-	1	2	1	-	2	-	-	2

Course Code	YCS3501
Course Title	Behavioral and Interpersonal Skills
Category	Mandatory Non-CGPA Course
LTP & Credits	L | T | P | Credits 0 | 0 | 3 | 0
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course, the students will be taught about how to represent himself as a good human being and also able to learn to deal with different people with his/her interpersonal skillsets and behaviour. After the completion of this course, the students will be in a better position to learn and understand the basic interpersonal skills.

Course Outcome:

CO1: To understand how to handle workplace interpersonal communication in an effective manner.

CO2: To enhance the students skills with strong oral and written interpersonal communication.

CO3: To prepare students to critically analyze workplace situations and take appropriate decisions.

CO4: To prepare students campus ready through proper behavioral and interpersonal grooming.

CO5: To enhance skill set to design and frame team based Project Report and Presentation.

Course Content:

Module 1: Interpersonal Communication [9L]

The skills of Interpersonal Communication, Gender/Culture Neutrality, Rate of Speech, Pausing, Pitch Variation and Tone, Corporate Communication, Branding and Identity.

Module 2: Interpersonal Communication Vs Workspace Communication [9L]

Workplace Communication, Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.), Communication with Clients, Customers, Suppliers etc., Organizing/Participating in Business Meeting, Note Taking, Agenda, Minutes

Module 3: Business Etiquette and Corporate Life [9L]

Presenting oneself in the Business Environment, Corporate Dressing and Mannerism, Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.), E-mail Etiquette, Activity based Case Study.

Module 4: Movie Making : Corporate Business Meeting [9L]

Team based Brainstorming, Process Planning and Developing Plot, People management. Documentation and Scripting, Shooting the Movie: Location and Camera, Post Production and Editing, Movie Review: Feedback and Analysis.

Text/Reference Books:

1. P. Hartley, Interpersonal Communication,Routledge, 1993.
2. C.Garsten, Palgrave, Workplace Vagabonds: Career and Community in Changing Worlds of Work, Macmillan, 2008.
3. F.Moore, Ashgate,Transnational Business Cultures Life and Work in a Multinational Corporation,2005

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	3	-	-	2	-	1
CO2	1	3	3	-	-	-	3	-	-	2	-	-
CO3	-	-	2	1	2	2	-	-	-	2	-	1
CO4	-	-	2	1	2	2	-	-	-	3	-	-
CO5	2	-	2	-	1	2	-	-	-	3	-	1

Semester 4 Curriculum and Syllabus

SEMESTER-4							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS4001	Computer Organization and Architecture	3	0	0	3
2	PC	YCS4002	Design and Analysis of Algorithms	3	1	0	4
3	PC	YCS4003	Data Base Management System	3	0	0	3
4	PC	YCS4004	Formal Language and Automata	3	0	0	3
5	HS	YMG4001	Economics for Engineers	2	0	0	2
PRACTICAL							
6	PC	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	1.5
7	PC	YCS4102	Algorithms Laboratory	0	0	3	1.5
8	PC	YCS4103	Data Base Management System Laboratory	0	0	3	1.5
9	PC	YCS4104	Programming Practices II	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
10	MC	YCS4501	Constitution of India	3	0	0	0
SESSIONAL (ONLY INTERNAL EVALUATION)							
11	PROJ	YCS4201	Innovative Project II	0	0	3	1.5
TOTAL				**17**	**1**	**15**	**22.5**

Course Code	YCS4001			
Course Title	Computer Organization and Architecture			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Digital Circuits and Logic Design			

Learning Objective:

In this course, the students will learn about the evolution of computer systems and development in computer organization and architecture, and the various functional units of a computer system with special emphasis on how instructions get executed. This course will cover the processor unit, the arithmetic and logic unit, the memory unit and input/output organization.

After the completion of this course, the student will better understand how exactly the programs are executed in a computer system.

Course Outcome:

CO1: To explain the process of instruction execution

CO2: To analyze and design control unit of a computer system

CO3: To analyze and design adder, multiplier and division unit

CO4: To analyze and design memory subsystems

CO5: To explain and classify various input/output data transfer techniques

Course Content:

Module 1: Evolution of Computer System **[4L]**

Introduction to computing system: computer organization and architecture, basic functional units of a computer, evolution of computers, stored-program concept, Von-Neumann and Harvard models

Module 2: Basic Operation of Computer **[7L]**

Instruction Set Architecture: CPU registers, instruction format and encoding, addressing modes, instruction set, instruction types, instruction decoding and execution, basic instruction cycle, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC).

Case study: MIPS Instruction set, MIPS assembly language programming.

Module 3: Processor Unit Design **[7L]**

Register transfer operations, internal single and multi-bus architecture.

Design of control unit: hardwired control unit design, microprogrammed control unit design, concept of control word and control store.

Horizontal, vertical and diagonal microprogrammed control unit design.

Module 4: Arithmetic Unit Design **[6L]**

Adder and subtractor, shift-and-add multiplication.
Signed multiplication: Booths algorithm, integer division, restoring and non-restoring division.
Floating point representation: IEEE floating point format, floating point arithmetic.

Module 5: Memory Unit Design **[7L]**

Basic memory types: Random Access Memory (RAM), Read Only Memory (ROM), Static RAM, Dynamic RAM.
Memory hierarchy, Cache memory: mapping techniques, Memory interleaving.

Module 6: Input Output Organization **[5L]**

I/O mapped I/O and Memory mapped I/O, Synchronous and Asynchronous serial data communication. Secondary memory: disk, flash memory.
I/O Data transfer techniques: Programmed I/O, Interrupt-driven I/O, Direct Memory Access (DMA).

Text/Reference Books:

1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization (5th Ed.)", Tata-McGraw-Hill.
2. W. Stallings, "Computer Organization and Architecture (6th Ed.)", Prentice Hall of India.
3. D. A. Patterson, and J. L. Hennessy, "Computer Organization and Design – The Hardware/ Software Interface", Morgan Kaufmann.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	2	-	-	1	-	1	2
CO2	1	1	3	-	-	2	-	-	2	-	1	2
CO3	2	2	2	2	2	1	-	-	1	-	-	2
CO4	2	2	1	2	2	1	-	-	2	-	-	2
CO5	2	1	1	-	1	1	-	-	1	-	-	2

Course Code	YCS4002				
Course Title	Design and Analysis of Algorithms				
Category	Professional Core				
LTP & Credits	L	T	P	Credits	
	3	1	0	3	
Total Contact Hours	36				
Pre-requisites	a) Fundamentals of Programming b) Data Structures and Algorithms				

Learning Objective:

It will covers topics such as algorithm complexity concepts and diverse algorithmic designs such as dividing and conquering, dynamic programming and greedy algorithms. The course will also include important search and sorting algorithms, graphs, and basic approaches of optimization.

Course Outcome:

CO1: To understand the concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation

CO2: To apply design principles and concepts to algorithm design

CO3: To understand and analyze the mathematical foundation in analysis of algorithms

CO4: To explain and classify different algorithmic design strategies

CO5: To analyze the efficiency of algorithms using time and space complexity theory

Course Content:

Module 1: Complexity Analysis **[7L]**

Time and space Complexity, Different asymptotic notations – their mathematical significance. Solving recurrences: substitution method, recurrence tree method, Master Theorem.

Module 2: Divide and Conquer **[9L]**

Basic concept, Examples: binary search, merge sort, quick sort and their complexity (all three cases). Heap sort and its complexity, Karatsuba algorithm.
Lower Bound Theory: Comparisons trees, Oracle and adversary argument, State space method.

Module 3: Dynamic Programming **[14L]**

Basic concepts, matrix chain manipulation, Strassen's algorithm, longest common subsequence, all-pair shortest paths (Floyd Warshall), single-source shortest path (Dijkstra, Bellman-Ford), 0/1 Knapsack problem, Travelling Salesman problem.
Greedy Method: Basic concept, Examples: fractional Knapsack problem, job sequencing with deadlines, minimum cost spanning tree using Prim's and Kruskal's method, Huffman encoding and decoding.
Backtracking: Basic concept, Examples: n-queens problem, graph coloring problem.
Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by rank.

Module 4: String Matching Problem [10L] Different techniques: Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Amortized Analysis and Network Flow: Aggregate, Accounting, and Potential Method, Ford Fulkerson algorithm, Max-Flow Min-Cut.

Module 5: Notion of NP-Completeness [8L]

P class, NP class, NP hard class, NP complete class their interrelationship, Reductions and Polynomial time Reducibility, Satisfiability problem (3-SAT and 2-SAT), Cook-Levin's theorem, Clique decision problem, Vertex Cover problem.

Text/Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", MIT Press.
2. E. Horowitz and S. Shani, "Fundamentals of Computer Algorithms", Universities Press.
3. K. Mehlhorn and P. Sanders, "Data Structures and Algorithms", Springer.
4. A. Aho, J. Hopcroft and J. Ullman "Design and Analysis of Computer Algorithms", Addison-Wesley.
5. 5. D. E.Knuth, "The Art of Computer Programming (Vol. 3)", Addison-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	-	-	2	-	-	3
CO2	3	3	3	3	1	2	-	-	1	-	2	3
CO3	3	2	2	3	1	2	-	-	2	-	-	3
CO4	3	3	3	3	1	2	-	-	1	-	-	3
CO5	3	2	2	3	1	2	-	-	2	-	-	3

Course Code	YCS4003
Course Title	Data Base Management System
Category	Professional Core
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Data Structures and Algorithms

Learning Objective:

In this course, the students will be able to learn the data models, conceptualize and depict a database system; design system using E-R diagram; learn SQL & relational database design; understand the internal storage structures using different file and indexing techniques; know the concepts of transaction processing, concurrency control techniques and recovery procedure.

Course Outcome:

CO1: To apply the knowledge of E-R diagram for an application

CO2: To explain the creation of the normalized relational database model

CO3: To analyze real world queries to generate reports from it

CO4: To determine whether the transaction satisfies the ACID properties

CO5: To create and maintain the database of an organization

Course Content:

Module 1: Introduction **[3L]**

Concept and overview of DBMS, data models.
Database languages, database administrator, database users, three-schema architecture of DBMS.

Module 2: Entity-Relationship and Relational Database Model **[9L]**

Basic concepts, design issues, mapping constraints, keys, entity-relationship diagram, weak entity sets, extended E-R features, case study on E-R model.
Structure of relational databases, relational algebra, relational calculus, extended relational algebra operations, views, modifications of the database.

Module 3: SQL and Integrity Constraints **[6L]**

Concept of DDL, DML, DCL.
Basic structure, set operations, aggregate functions, null values, domain constraints, referential integrity constraints, assertions, views, nested sub-queries.
Database security application development using SQL, stored procedures and triggers.

Module 4: Relational Database Design **[6L]**

AFunctional dependency, Different anomalies in designing a Database.
Normalization using functional dependencies, decomposition, Boyce-Codd Normal Form, 3NF. normalization using multi-valued dependencies, 4NF, 5NF, Case Study.

Module 5: Internals of RDBMS **[6L]**

Physical data structures, query optimization: join algorithm, statistics and cost based optimization. Transaction processing, concurrency control and recovery management: transaction model properties, state serializability, lock base protocols; two phase locking, deadlock handling.

Module 6: File Organization & Index Structures **[6L]**

File and record Concept, placing file records on disk, fixed and variable sized records, Ttypes of single-level index (primary, secondary, clustering). Multilevel indices, dynamic multilevel indices using B-tree and B+ tree.

Text/Reference Books:

1. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", Addison Wesley Publishing.
2. C.J. Date, "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. J.D. Ullman, "Principles of Database Systems", Galgottia Publication.
4. G. Jim and R. Address, "Transaction Processing : Concepts and Techniques", Morgan Kauff-man.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	-	1	-	-	2	-	2	1
CO2	3	3	3	1	-	2	-	-	2	-	1	2
CO3	3	3	3	1	-	1	-	-	2	-	2	1
CO4	3	3	3	1	2	2	-	-	2	-	1	2
CO5	3	2	2	2	-	1	-	-	2	-	2	1

Course Code	YCS4004
Course Title	Formal Language and Automata Theory
Category	Professional Core
LTP & Credits	L | T | P | Credits 3 | 0 | 0 | 3
Total Contact Hours	36
Pre-requisites	a) Discrete Mathematics b) Programming and Data Structure

Learning Objective:

In this course the students will learn the theory of computation, different formal language classes and their relationships, various techniques to prove or disprove theorems in automata theory using its properties, approaches to determine the decidability and intractability of computational problems. At the end of the course student will be able analyze complex problems and automaton to find solutions of such problems.

Course Outcome:

CO1: To explain the basic properties of formal languages and grammars

CO2: To understand the tools for recognizing different formal languages

CO3: To differentiate between regular, context-free and recursively enumerable languages

CO4: To apply the theory of computation and computational models including decidability and intractability

Course Content:

Module 1: Introduction to Finite Automata [10L]

Finite Automata, Alphabets, Strings, Languages, Regular Languages, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation, State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Myhill-Nerode Theorem, FA with output - Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

Module 2: Properties of Regular Expression [7L]

Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages, Application of Pumping Lemma, Closure and decision properties of Regular Languages.

Module 3: Language & Grammar Formalism [9L]

Grammars, Regular grammars-Right linear and left linear grammars, Equivalence between regular linear grammar and FA, Context Free Grammar, Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs - CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs-

Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

Module 4: Push Down Automata **[4L]**

PDA Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA, PDA to CFG, Two stack PDA.

Module 5: Turing Machines and Decidability **[6L]**

Basic model, Definition and representation, Instantaneous Description, Language acceptance by TM, Computable functions, Types of Turing machines, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs, Post correspondence problem (PCP), Modified PCP.

Text/Reference Books:

1. J. D. Ullman, J. Hopcroft and R. Motwani, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 2007
2. P. Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett Learning, 2012
3. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", Prentice Hall India, 2008
4. M. Sipser, "Introduction to Theory of Computation", Thomson Course Technology, 2006
5. J. C. Martin , "Introduction to Languages and Theory of Computations", McGraw Hill, 2011
6. E. A. Rich, Automata, "Computability and Complexity", Pearson Education, Inc., 2019
7. D. Kozen, "Automata and Computability", Spinger, 1997
8. H. R. Lewis and C. H. Papadimitriou, "Elements of the Theory of Computation", Prentice Hall of India Private Ltd.,1998
9. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory", Cambridge University Press, 2010
10. D. I. A. Cohen, "Introduction to computer theory", John Wiley & Sons, Inc., 1986

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	2	-	-	1	-	-	1
CO2	3	3	1	1	-	1	-	-	2	-	-	1
CO3	3	2	1	1	1	2	-	-	1	-	-	1
CO4	3	2	1	1	1	1	-	-	2	-	-	1

Course Code	YMG4001
Course Title	Economics for Engineers
Category	Humanities
LTP & Credits	L / T / P / Credits: 2 / 0 / 0 / 2
Total Contact Hours	24
Pre-requisites	None

Learning Objective:

In this course the students will learn about the managerial economics, basics of accounting and financial management. At the end of the course, the students will be able to make different managerial decisions in terms of economics and also able to solve financial statement as well as they can make different financing decision for business and at personal level.

Course Outcome:

CO1: To apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio

CO2: To evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions

CO3: To compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and/or systems

CO4: To evaluate the profit of a firm, carry out the break-even analysis and employ this tool to make production decision

CO5: To discuss and solve advanced economic engineering analysis problems including taxation and inflation

Course Content:

Module 1: Introduction **[3L]**
Managerial Economics, Relationship with other disciplines, Firms: Types, Objectives and goals, Managerial Decisions-Decision Analysis.

Module 2: Demand and Supply Analysis **[5L]**
Demand: Types of demand, determinants of demand, Demand function, Demand Elasticity, Demand forecasting. Supply: Determinants of supply, Supply function, Supply Elasticity.

Module 3: Cost Analysis **[5L]**
Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – PV ratio.

Module 4: Elementary Economic Analysis **[4L]**
Inflation: Meaning of inflation, types, causes, measures to control inflation.
National Income: Definition, Concepts of national income, Method of measuring national income.

Module 5: Financial Accounting **[5L]**

Concepts and Definition of Accounting, Journal, Ledger, Trial Balance.
Trading A/C, Profit & Loss A/C and Balance Sheet.

Module 6: Investment Decision **[2L]**

Time value of money: Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Text/Reference Books:

1. B. Riggs and S.U. Randhwa, “Engineering Economics”, McGraw Hill Education India.
2. D. Vengedasalam and K. Madhavan, “Principles of Economics”, Oxford University Press.
3. W. G. Sullivan, E. M. Wicks and C. P. Koelling, “Engineering Economy”, Pearson.
4. R. P. Seelvan, “Engineering Economics”, Prentice-Hall of India.
5. H. L. Ahuja, “Principles of Micro Economics”, S. Chand & Company Ltd.
6. S. P. Gupta, “Macro Economics”, Tata McGraw Hill.
7. K. K. Dewett, “Modern Economic Theory”, S. Chand & Company Ltd.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	2	-	-	-	-	2	1
CO2	-	-	-	3	-	2	-	-	-	-	-	1
CO3	-	1	-	-	-	2	-	-	-	-	3	1
CO4	-	-	-	-	-	2	-	-	3	-	-	1
CO5	-	1	-	-	-	2	-	-	-	-	1	1

Course Code	YCS4101
Course Title	Computer Organization and Architecture Laboratory
Category	Professional Core
LTP & Credits	L | T | P | Credits
	0 | 0 | 3 | 1.5
Total Contact Hours	36
Pre-requisites	a)Digital Circuits Laboratory

Learning Objective:

In this laboratory course, the students will be conducting experiments using a MIPS instruction set simulator. They will also learn how to model various hardware blocks using the hardware description language Verilog. They shall be designing various functional units like adder, multiplier, processor, etc. using a Verilog.

Course Outcome:

CO1: To understand how to write assembly language programs in MIPS

CO2: To design various combinational and sequential circuits using

Verilog **CO3:** To design and analyze various CPU functional units using

Verilog **CO4:** To apply a pipelined processor using Verilog

Course Content:

1. Familiarization with MIPS assembly language programming using some instruction set simulator like QtSPIM.
   a. Reading and displaying an arbitrary string, and an integer.
   b. Store numbers sequentially in memory and find the minimum, maximum, and sum.
   c. Sort a set of numbers stored in memory. **[2 days]**

2. Familiarization of function calls with MIPS assembly language programming.
   a. Write a function to compute the factorial of a given number.
   b. Write a function to compute the GCD of two numbers.
   c. Write a function to compute the N-th Fibonacci number. **[2 days]**

3. Familiarization with a Verilog simulator like iVerilog, and write simple combinational and sequential modules using behavioral and structural modeling with Verilog.
   a. Write a module to implement an arbitrary Boolean function (e.g. F = A’BC + C’D).
   b. Write a module to implement a full adder, and hence a 4-bit ripple carry adder.
   c. Write a module to implement a D flip-flop, and hence a 4-bit shift register.
   d. Write a module to implement an 8-bit up-down counter with asynchronous clear. **[2 days]**

4. Write Verilog modules to implement functional blocks used in computer organization.
   a. Write a module to implement a 16-bit arithmetic and logic unit with 8 functions.
   b. Write a module to implement read/write operations in a 1024 x 16 memory system. **[2 days]**

5. Implement the MIPS 5-stage pipeline in Verilog, using a subset of 16 instructions. The design has to be tested by writing a test bench containing sample machine language programs stored in a memory module. **[4 days]**

Text/Reference Books:

1. qtSPIM simulator, http://spimsimulator.sourceforge.net/
2. MIPS overview, https://tams.informatik.uni-hamburg.de/applets/hades/webdemos/mips.html
3. M. M. Mano and M. D. Ciletti, "Digital Design: with an Introduction to Verilog HDL (5th Ed.)", Pearson Education.
4. J. Bhasker, "Verilog HDL Synthesis: A Practical Primer", B. S. Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	-	-	-	-	-	2	-	-	2
CO2	-	1	2	2	1	-	-	-	2	-	-	2
CO3	1	1	1	2	1	1	-	-	2	-	-	2
CO4	-	-	1	1	2	2	-	-	2	-	-	2

Course Code	YCS4102			
Course Title	Algorithms Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Programming Practices I			

Learning Objective:

The course aims to provide strategies (divide and conquer, dynamic, greedy) to solve problems in computer effectively. Using the many paradigms of solving problems, the innovative and effective approaches of solving a specific situation will be demonstrated. In each case, the focus is on the rigorous proof of the algorithm's validity.

Course Outcome:

CO1: To prove the correctness and analyze the running time of the basic algorithms

CO2: To design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy

CO3: To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem

CO4: To Identify and analyze criteria and specifications appropriate to new problems

Course Content:

1. Experiments on Divide and Conquer Approach. Binary Search (Recursive & Iterative).
   Merge Sort, Heap Sort, Quick Sort.
   Find Maximum and Minimum element from an array of integers. **[2 days]**

2. Experiments on Dynamic Programming.
   Minimum number of scalar multiplications needed for chain of matrix. All pair of shortest paths for a graph.
   Single-source shortest path for a graph (Dijkstra, Bellman Ford).
   Longest common subsequence problem. **[2 days]**

3. Experiments on Backtracking. The n-Queens problem.
   Graph Coloring problem. **[2 days]**

4. Experiments on Greedy Methods. Knapsack problem.
   Job sequencing with deadlines.
   Minimum cost spanning tree by Prim's and Kruskal's algorithm. **[2 days]**

5. Innovative Experiments
   Take the university time table for all departments. Write a computer program to find all

conflicts within the time table using graph colouring approach. Provide a solution using Backtracking. Compute the distance and find the stoppages every classmate of yours cover to

reach the institute. Then assume their speeds based on their travelling modes. Compute each student's minimum time to reach the institute premises.

[2 days]

Text/Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", MIT Press.
2. E. Horowitz and S. Shani, "Fundamentals of Computer Algorithms", Universities Press.
3. K. Mehlhorn and P. Sanders, "Data Structures and Algorithms", Springer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	1	1	-	-	2	-	-	3
CO2	3	2	2	3	1	-	-	-	2	-	-	3
CO3	3	3	2	3	1	1	-	-	2	-	-	3
CO4	3	3	2	1	1	-	-	-	2	-	-	3

Course Code	YCS4103
Course Title	Data Base Management System Laboratory
Category	Professional Core
LTP & Credits	L T P Credits 0 0 3 1.5
Total Contact Hours	36
Pre-requisites	a)Digital Circuits Laboratory

Learning Objective:

In this course, the students will able to learn the data models, conceptualize and depict a database system; learn the fundamental concepts of SQL queries; understand the concept of designing a database with the necessary attributes; know the methodology of Accessing, Modifying and Updating data & information from the relational databases; learn database design as well as to design user interface and how to connect with database.

Course Outcome:

CO1: To understand the basic concepts regarding database, SQL queries

CO2: To explain the concepts of PL/SQL

CO3: To differentiate between DBMS and advanced DBMS

CO4: To analyze database system concepts and apply normalization to the database

CO5: To apply and create different transaction processing and concurrency control applications

Course Content:

1. Experiments on fundamentals of database
   systems Creating a Database
   Creating a Table
   Specifying Relational Data Types
   Specifying Constraints
   Creating Indexes **[2 days]**

2. Experiments on database Tables and Record
   handling INSERT statement
   Use of SELECT and INSERT together
   DELETE, UPDATE, TRUNCATE statements
   DROP, ALTER statements **[2 days]**

3. Experiments on retrieving data from
   database The SELECT statement
   Use of the WHERE clause
   Use of the Logical Operators in the WHERE clause
   Use of IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
   Use of the Aggregate
   Functions Combining tables
   using JOINS
   Sub-queries **[3 days]**

4. Experiments on Miscellaneous Database
   Management Creating Views
   Creating Column Aliases
   Creating Database Users
   Use of GRANT and REVOKE **[1 day]**

5. Experiments on PL/SQL
   Use of decision making statement, different loop structures to solve simple programs (e.g., sum of few numbers, pattern prints, etc.).
   Inserting values into tables, reading data from a table.
   Basic working with CURSORS **[1 day]**

6. Innovative Experiments
   Case study of handling complex databases (e.g., College Management System, Hospital management System, Library management System, Payroll management System, etc.) **[3 days]**

Text/Reference Books:

1. H. F. Korth and A. Silberschatz, "Database System Concepts", McGraw Hill.
2. E. Ramez and S. Navathe, "Fundamentals of Database Systems", Benjamin Cummings Publishing Company.
3. C. J. Date, "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
4. G. Jim and R. Address, "Transaction Processing : Concepts and Techniques", Moragan Kauff-man.
5. J.D. Ullman, "Principles of Database Systems", Galgottia Publication.
6. I. Bayross , "SQL, PL/SQL the Programming Language of Oracle", BPB Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	1	-	-	1
CO2	3	2	2	1	2	-	-	-	1	-	-	1
CO3	1	2	3	-	-	-	-	-	1	-	-	2
CO4	3	1	2	2	1	-	-	-	1	-	1	2
CO5	2	2	3	1	-	-	-	-	1	-	1	2

Course Code	YCS4104
Course Title	Programming Practices II
Category	Professional Core
LTP & Credits	L / T / P / Credits: 0 / 0 / 3 / 1.5
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming b) Basic Problem Solving

Learning Objective:

In this practical course, the students will be learning Python programming basics and paradigm. python looping, control statements and string manipulations. Students will be made familiar with the concepts of various modules, packages and python libraries used for various applications (Machine learning, Deep learning etc.).

Course Outcome:

CO1: Understand and explain the basic principles of Python programming language and object oriented concept.

CO2: Define and demonstrate the use of built-in data structures along with the help of condition checking and looping structures.

CO3: Understand and apply various applications of different modules and packages in Python.

CO4: Learn to handle exceptions and files in Python.

Course Content:

1. History, Features, Setting up path, working with Python, Basic Syntax, Variable and Data Types, Operator. **[1 day]**

2. Conditional Statements: If, If- else, Nested if-else, Looping, For, While, Nested loops , Control Statements : Break, Continue, Pass. **[1 day]**

3. String Manipulation: Accessing Strings, Basic Operations, String slices, Function and Methods. Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods. **[2 days]**

4. Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods. Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties. **[2 days]**

5. Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables. **[1 day]**

6. Modules: Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file,

Reading and writing files, Functions. **[2 days]**

7. Exception and File Handling: Exception, Exception Handling, Except clause, Try & finally clause, User Defined Exceptions. **[1 day]**

8. A case study on using a computer game for teaching data structures on stacks and queues. The computer game is developed to help students visualize the data structures and data access operations on stacks and queues. This game-based learning is engaging, fun and, more importantly, abstract concepts in data structures can be visualized and learnt through game playing. **[2 days]**

Text/Reference Books:

1. T. R. Padmanabhan, "Programming with Python (1st Ed.)", Springer.
2. R. Thareja, "Python Programming: using Problem Solving Approach (1st Ed.)", Oxford University Press.
3. W. McKinney, "Python Data Analysis (2nd Ed.)", O.Reilly.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	2	1	-	1	-	-	-
CO2	3	1	1	-	1	2	1	-	-	-	-	2
CO3	3	3	1	1	1	2	1	-	1	-	-	2
CO4	3	2	2	1	1	2	1	-	-	-	-	2

Course Code	YCS4501			
Course Title	Constitution of India			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Upon completion of this lesson, students will be able to understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context. Understand and analyse the three organs of the state in the contemporary scenario. Understand and Evaluate the Indian Political scenario amidst the emerging challenges.

Course Outcome:

CO1: Develop human values , create awareness about law ratification and significance of Constitution

CO2: Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.

CO3: Create understanding of their Surroundings, Society, Social problems and their suitable solutions

CO4: Demonstrate with distribution of powers and functions of Local Self Government.

CO5: Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

Course Content:

1. Meaning of the constitution law and constitutionalism **[3L]**
2. Historical perspective of the Constitution of India **[2L]**
3. Salient features and characteristics of the Constitution of India **[1L]**
4. Scheme of the fundamental rights **[2L]**
5. The scheme of the Fundamental Duties and its legal status **[2L]**
6. The Directive Principles of State Policy – Its importance and implementation **[2L]**
7. Federal structure and distribution of legislative and financial powers between the Union and the States **[3L]**
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India **[2L]**
9. Amendment of the Constitutional Powers and Procedure **[2L]**
10. The historical perspectives of the constitutional amendments in India **[2L]**

11. Emergency Provisions: National Emergency, President Rule, Financial Emergency **[3L]**

12. Local Self Government – Constitutional Scheme in India **[3L]**
13. Scheme of the Fundamental Right to Equality **[3L]**
14. Scheme of the Fundamental Right to certain Freedom under Article 19 **[3L]**
15. Scope of the Right to Life and Personal Liberty under Article 21. **[3L]**

Text/Reference Books:

1. D.D. Basu, V.R. Manohar, B.P.Banerjee, S.A.Khan, , Introduction to the Constitution of India. Wadhwa, 2001.
2. P. M. Bakshi & S. C. Kashyap, he constitution of India. Universal Law Publishing, 1982.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	3	2	3	-	-	-	2
CO2	-	-	1	-	-	3	2	3	-	-	-	2
CO3	-	-	1	-	-	3	2	3	-	1	-	2
CO4	-	-	1	-	-	3	2	3	-	1	-	2
CO5	-	-	1	-	-	3	2	3	-	1	-	2

Semester 5 Curriculum and Syllabus

SEMESTER-5							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS5001	Operating Systems	3	0	0	3
2	PC	YCS5002	Embedded Systems	3	0	0	3
3	PC	YCS5003	Introduction to Data Science	3	0	0	3
4	PC	YCS5004	Advanced Computer Architecture	3	0	0	3
5	OE		Elective I	3	0	0	3
		YCS5005	Multimedia Technology				
		YCS5006	Operations Research				
		YCS5007	Communication Engineering				
PRACTICAL							
6	PC	YCS5101	Operating Systems Laboratory	0	0	3	1.5
7	PC	YCS5102	Embedded Systems Laboratory	0	0	3	1.5
8	PC	YCS5103	Data Science Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS5501	Environmental Science	3	0	0	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS5201	Innovative Project III	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**21**

Course Code	YCS5001
Course Title	Operating Systems
Category	Professional Core
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Data Structures and Algorithms b) Computer Organization and Architecture

Learning Objective:

In this course, the students will learn about the role of operating system as the interface between application programs and the computer hardware. The role of operating system in managing various computer resources shall be dealt with in detail.

The course will be very helpful for the students in strengthening their skills in handling large software projects.

Course Outcome:

CO1: To explain the role of operating system and how it acts as interface between hardware and software.

CO2: To contrast the concepts of processes and threads, and how they are scheduled.

CO3: To demonstrate the use of various synchronization tools in solving the critical section problem.

CO4: To explain and classify the various memory management techniques including virtual memory.

CO5: To apply the knowledge of data structures to explain how file systems can be implemented on secondary storage.

Course Content:

Module 1: Introduction to Operating Systems [4L]

Functionalities of operating system – hardware/software interface. Evolution of operating systems – batch, multi-programmed, time-sharing, real-time, distributed. Simultaneous Peripheral Operations On-Line (SPOOL).

Protection and Security – user/supervisory mode, privileged instructions, system calls (invoking OS services).

Module 2: Processes and Threads [7L]

Processes – basic concept, process control block (PCB), process state transition diagram.

Process scheduling – independent and co-operating processes, inter-process communication using shared memory and message passing. Case studies from Unix/Linux.

Threads – lightweight process concept, benefits of threads, user and kernel level threads, using thread library in Unix/Linux.

CPU Scheduling – scheduling criteria, preemptive and non-preemptive scheduling. Scheduling algorithms – FCFS, SJF, SRTF, RR, priority, multi-level feedback queue.

Module 3: Process Synchronization and Deadlocks **[7L]**

Classical problems of process synchronization – producer-consumer, reader-writer, dining philosopher, etc.
Critical section problem – illustration, software solutions, solution using synchronization hardware: test-and-set (TST) and SWAP instructions.
Semaphores – definition, binary and counting semaphores, implementation of semaphores, minimizing busy waiting. Case studies from Unix/Linux.
Deadlocks – deadlock characterization, methods of handling deadlock, deadlock prevention versus deadlock avoidance, Banker's algorithm.

Module 4: Memory Management **[8L]**

Logical versus physical address space, swapping, contiguous memory allocation, memory protection using fence registers.
Paging – basic concept, performance analysis, translation look-aside buffer (TLB). Segmentation.
Virtual memory – separation of logical and physical address space, demand paging, locality of reference.
Page replacement algorithms – FCFS, LRU, Optimal, Belady's anomaly. Thrashing, working set model.

Module 5: Device and File Management **[7L]**

Disk structure – cylinders, tracks and sectors.
Disk scheduling algorithms – FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.
File system – file concept, access methods, directory and file system structure, allocation methods (contiguous, linked, indexed), free space management. Case study for Unix/Linux.

Module 6: Miscellaneous Topics **[3L]**

Brief overview of real-time and distributed operating systems, mobile operating systems.

Text/Reference Books:

1. A. Silberschatz, P. B. Galvin and G. Gagne, "Operating System Concepts", Wiley Asia.
2. D. M. Dhamdhere, "Operating Systems: A Concept-Based Approach", Tata McGraw-Hill.
3. M. Bach, "Design of the Unix Operating System", Prentice-Hall of India.
4. W. Stallings, "Operating Systems: Internals and Design Principles", Prentice-Hall of India.
5. C. Crowley, "Operating System: A Design-Oriented Approach", Irwin Publishing.
6. G. J. Nutt, "Operating Systems: A Modern Perspective", Addison-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	-	-	-	2	2	-	-	-	1	2
CO2	-	2	3	-	2	-	2	-	-	-	1	2
CO3	-	2	3	2	2	1	2	-	-	-	1	2
CO4	1	2	2	-	2	-	2	-	1	-	1	2
CO5	2	2	3	1	2	1	2	-	1	-	1	2

Course Code	YCS5002			
Course Title	Embedded Systems			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Computer Organization and Architecture b) Digital Circuits and Logic Design			

Learning Objective:

In this course, the students will learn about microprocessor and microcontroller architectures and their use to develop embedded systems. Various case studies with popular development boards shall be discussed.

The course will be very helpful for students who want to apply the knowledge to develop real-life applications that involve embedded systems.

Course Outcome:

CO1: To explain the architecture of 8085 microprocessor and examine various applications.

CO2: To summarize the basic design principles of embedded systems.

CO3: To explain and compare the various microcontroller architectures and development boards.

CO4: To explain and demonstrate how sensors and actuators work in the context of embedded systems.

CO5: To apply the knowledge to develop various real-life applications.

Course Content:

Module 1: Basic 8085 Architecture and Interfacing [12L]

Introduction to 8085 microprocessor architecture – instruction execution and timing, memory and I/O interfacing, interrupt structure and DMA operation.

8085 assembly language programming – instruction set, writing simple programs, generating time delays, stacks and subroutines.

Basic interfacing concepts – 8255 programmable peripheral interface, interfacing examples.

Module 2: Introduction to Embedded Systems [4L]

Definitions and constraints, hardware and processor requirements, application dependent requirements, hardware-software co-design approach, example system design.

Embedded system hardware – microprocessors and microcontrollers, Von Neumann and Harvard architecture, RISC and CISC.

Module 3: Microcontroller Architecture [10L]

ARM processor architecture – instruction execution, instruction pipeline, ARM instruction set and addressing modes. Case study with an ARM development board.

Other popular microcontroller families – ATmega328P microcontroller (Arduino Uno), PIC microcontroller family, 8051 microcontroller family.

Module 4: Miscellaneous Topics **[4L]**

Digital signal processor (DSP) architecture – case studies and applications.
Memory for embedded systems – embedded SRAM, embedded DRAM, flash memory. Bus structures and standards for embedded systems.
Internet-of-things (IoT) – basic architecture and applications.

Module 5: Sensors and Actuators **[6L]**

Sensors and Actuators – temperature sensor, light sensor, pressure sensor, motion sensor, humidity sensor, gas sensor, relays, LED & LCD display units, WiFi interface module, GPS/GPRS module.
Example interfacing using microcontroller boards, programming environments (e.g., embedded C), home automation.

Text/Reference Books:

1. R. Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, Penram International Publisher.

2. W. Wolf, “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufmann.

3. M. A. Mazidi, J. G. Mazidi et al., “The 8051 Microcontroller and Embedded Systems”, Prentice-Hall of India.

4. M. Sloss, D. Symes, and C. Wright, “ARM System Developers Guide: Designing and Optimizing System Software”, (Online Resource).

5. P. Marwedel, “Embedded System Design”, Kluwer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	2	-	-	-	-	-	-	2
CO2	-	3	3	1	-	-	-	-	-	-	-	2
CO3	-	2	-	2	2	-	-	-	-	-	-	2
CO4	3	1	2	-	1	2	2	-	-	-	2	2
CO5	-	-	-	2	3	3	2	-	-	-	1	2

Course Code	YCS5003
Course Title	Introduction to Data Science
Category	Professional Core
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course, the students will learn about the fundamentals of data science. The course will also impart design thinking capability to build big-data. Also, developing design skills of models for big data problems shall be covered.

After the completion of this course, the students will be in a better position to learn and understand the basic programming tools for data sciences.

Course Outcome:

CO1: To understand and analyze data visualization in big-data analytics.

CO2: To explain and utilize Exploratory Data Analysis.

CO3: To explain and utilize matrix decomposition techniques to perform data analysis.

CO4: To explain and demonstrate data pre-processing techniques.

CO5: To apply basic machine learning algorithms in various applications.

Course Content:

Module 1: Introduction [4L]

Big Data and Data Science: Big Data Analytics, Business intelligence vs. Big data, big data frameworks, Current landscape of analytics, data visualization techniques, visualization software.

Module 2: Exploratory Data Analysis (EDA) [6L]

Exploratory Data Analysis (EDA), statistical measures, Basic tools (plots, graphs and summary statistics) of EDA, Data Analytics Lifecycle, Discovery.

Module 3: Basic Statistical Inference [5L]

Developing Initial Hypotheses, Identifying Potential Data Sources, EDA case study, testing hypotheses on means, proportions and variances.

Module 4: Regression models [5L]

Regression models: Simple linear regression, least-squares principle, MLR, logistic regression, Multiple correlation, Partial correlation.

Module 5: Linear Algebra Basics [4L]

Matrices to represent relations between data, Linear algebraic operations on matrices –Matrix decomposition: Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

Module 6: Data Pre-processing and Feature Selection **[6L]**

Data cleaning, Data integration, Data Reduction, Data Transformation and Data Discretization, Feature Generation and Feature Selection, Feature Selection algorithms: Filters, Wrappers, Decision Trees, Random Forests.

Module 7: Basic Machine Learning Algorithms **[6L]**

Classifiers: Decision tree, Naive Bayes classifier, k-Nearest Neighbors (k-NN), k-means, Support Vector Machine. Association Rule mining – Ensemble methods.

Text/Reference Books:

1. J. Leskovek, A. Rajaraman and J. Ullman, “Mining of Massive Datasets. v2.1”, Cambridge University Press.
2. S. Acharya and S. Chellappan, “Big Data Analytics”, Wiley.
3. J. Han, K. Kamber and J. Pei, “Data Mining: Concepts and Techniques”, Morgan Kaufmann.
4. J. Liebowitz, “Big Data and Business Analytics”, CRC Press.
5. C. Rajan, “Data mining methods, 2nd edition”, Narosa.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	2	2	2	-	-	2	-	1	3
CO2	1	2	2	2	2	2	-	-	1	-	1	3
CO3	1	2	2	2	1	2	-	-	2	-	1	3
CO4	2	1	1	1	1	2	-	-	1	-	1	1
CO5	2	1	1	1	1	2	-	-	2	-	1	3

Course Code	YCS5004
Course Title	Advanced Computer Architecture
Category	Professional Core
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Computer Organization and Architecture

Learning Objective:

In this course, the students will learn about the advanced features of computer architecture. The concept of quantitative principles of design, pipeline, multiprocessor systems will be taught in this course.

After the completion of this course, the student will better understand the architecture of modern day processors.

Course Outcome:

CO1: To analyze and measure quantitative principles in computer science.

CO2: To design and analyze pipelining system.

CO3: To explain and analyze instruction level parallelism.

CO4: To analyze and design memory systems for higher bandwidth.

CO5: To categorize multiprocessor systems and analyze their performance.

Course Content:

Module 1: Performance Evaluation and Pipeline Concept [10L]

Review of basic computer architecture, Quantitative principles in computer design, Measuring performance, Amdahl's law, Examples.
Concept of pipeline, Instruction pipeline, Arithmetic pipeline. Pipeline performance and optimization techniques (reservation table, minimum average latency).
Hazards: Data hazard, Structural hazard, Control hazard.
Techniques for handling hazard: data forwarding, delay slots, branch prediction, compiler optimization techniques.

Module 2: Instruction Level Parallelism [5L]

Instruction Level Parallelism (ILP), Techniques to increase ILP, Superscalar Architecture, Very Long Instruction Word (VLIW) Architecture.

Module 3: Memory System [7L]

Memory hierarchy, Inclusion, Coherence and locality properties, Cache optimization Techniques, Virtual memory concept, Translation Lookaside Buffer (TLB), Paging and segmentation, Memory replacement policies.

Module 4: Multiprocessor Systems **[10L]**

Taxonomy for parallel architectures, Centralized Shared memory architecture: synchronization and memory coherency, cache coherency problem, interconnection networks. Distributed shared memory architecture: Loosely couped systems, Uniform Memory Access (UMA) and Non- Uniform Memory Access (NUMA).

Module 5: Non-Conventional Architectures **[4L]**

Data flow computers, Systolic architectures, Domain specific architectures, GPUs, etc.

Text/Reference Books:

1. D. A. Patterson, and J. L. Hennessy, “Computer Organization and Design-The Hardware/-Software Interface”, Morgan Kaufmann.
2. L. Hennessy and D. A. Patterson, “Computer Architecture: A Quantitative Approach”, Morgan Kaufmann.
3. M. J. Flynn, “Computer Architecture: Pipelined and Parallel Processor Design”, Narosa Publishing House.
4. K. Hwang, “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	1	-	-	2	-	-	-	-	2
CO2	2	2	3	-	1	-	1	-	-	-	-	2
CO3	2	1	2	2	-	-	1	-	-	-	-	2
CO4	2	-	2	2	2	-	1	-	-	-	2	2
CO5	2	-	1	2	1	1	2	-	-	-	2	2

Course Code	YCS5005
Course Title	Multimedia Technology
Category	Open Elective
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	a) Design and Analysis of Algorithms

Learning Objective:

In this course, the students will learn to adopt factual knowledge and develop skills needed for independent development of multimedia systems and applications using available theory and different applications.

Course Outcome:

CO1: To explain the basic concept of multimedia and its applications.

CO2: To learn and analyze various multimedia Technologies.

CO3: To explain and analyze various multimedia creations.

CO4: To apply the basic understanding of concepts in real-world applications.

Course Content:

Module 1: Introduction to Multimedia [7L]

Introduction to multimedia: graphics, image and video representations, fundamental concepts of video, digital audio. Storage requirements of multimedia applications, need for compression, taxonomy of compression algorithms. Elements of information theory, error free compression, lossy compression.

Module 2: Text Compression [4L]

Huffman coding, adaptive Huffman coding, arithmetic coding, Shannon-Fano coding, Dictionary techniques – LZW family algorithms.

Module 3: Image Compression [6L]

Image Compression: Fundamentals, compression standards, JPEG Standard, sub-band coding, wavelet based compression.
Implementation using Filters – EZW, SPIHT coders, JPEG 2000 standard, JBIG and JBIG2 standards.

Module 4: Video Compression [6L]

Video compression techniques and standards – MPEG video coding: MPEG-1 and MPEG- 2 video coding, MPEG-3 and MPEG-4 motion estimation and compensation techniques, H.261 standard, DVI technology, DVI real time compression. Current trends in compression standards.

Module 5: Audio Compression [5L]

Audio compression Techniques, A-Law companding, frequency domain and filtering, basic sub-band coding, application o speech coding – G.722, MPEG audio, progressive encoding, silence compression, speech compression – Formant and CELP vocoders.

Module 6: Animation **[8L]**

Overview of Animation Techniques – Key framing. Computer animation: Motion capture and editing, forward/inverse kinematics, deformation models, facial animation. Raster methods, design of animation sequences, animation techniques, key-frame systems, motion specification – direct, dynamics, – rigid body animation, collision detection. Graphics file format – OpenGl animation procedures.

Text/Reference Books:

1. D. Hankerson, G. A. Harris and P. D. Johnson, "Introduction to Information Theory and Data Compression", CRC press.
2. D. Solomon, "Data Compression – The Complete Reference", Springer, New York.
3. M. S. Drew and Z. Li, "Fundamentals of Multimedia", Prentice-Hall of India.
4. P. Symes, "Digital Video Compression", McGraw Hill.
5. Y. Q. Shi and H. Sun, "Image and Video Compression for Multimedia Engineering: Algorithms and Fundamentals", CRC Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	2	2	-	2	-	-	3
CO2	1	2	2	-	2	-	1	-	2	-	-	3
CO3	3	1	2	-	2	-	1	-	2	-	-	3
CO4	1	2	3	2	1	-	2	-	2	-	-	3

Course Code	YCS5006			
Course Title	Operations Research			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Mathematics I & II b) Fundamentals of Programming			

Learning Objective:

In this course the students will learn about the basic knowledge of LPP, duality, transportation problem, assignment problem, game theory, queueing and inventory models. At the end of the course, the students will get knowledge about various decision making through operations research models.

Course Outcome:

CO1: To explain linear programming problems and appreciate their limitations.

CO2: To analyze and solve linear programming problems using appropriate techniques and optimization solvers.

CO3: To conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship.

CO4: To develop mathematical skills to analyze and solve transportation, assignment problem and network models arising from a wide range of applications.

CO5: To share and communicate ideas, explain procedures and interpret results and solutions in written and electronic forms to different audiences.

Course Content:

Module 1: Linear Programming Problem [10L]

Linear Programming Problem(LPP): Basics of LPP and its applications. General mathematical formulation of LPP. Definitions: Convex set, Solution, Feasible Solution, Basic and Non-Basic Variables, Basic Feasible Solution, Degenerate and Non-Degenerate solution, Optimum/Optimal Solution; Solution of LPP by Graphical Analysis/Method, Simplex Method, Charnes' Big M-Method; Duality Theory.

Module 2: Transportation Problem and Assignment Problem [6L]

Transportation Problem, Assignment Problem – problem solving.

Module 3: Game Theory [5L]

Game Theory: Introduction; Two person Zero Sum game, Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

Module 4: Network Optimization Models **[5L]**

Network Optimization Models: CPM, PERT, Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and stack. Critical path, Probability of meeting scheduled date of completion of project. Calculation of CPM network. Various floats for activities.

Module 5: Sequencing **[2L]**

Sequencing: Johnson's Algorithm (1957) For n Jobs and two machines, n Jobs and three machines.

Module 6: Queuing Theory **[5L]**

Queuing Theory: introduction and basic structure; Birth-and-Death Model (Poisson / Exponential distribution); Poisson Queue Models: (M/M/1):(∞/FIFO) and (M/M/1):(N/FIFO) and Problems.

Module 7: Inventory **[3L]**

Introduction to EOQ Models of Deterministic and Probabilistic, Safety Stock, Buffer Stock.

Text/Reference Books:

1. K. Swaroop and P. K. Manmohan, "Operations Research", Sultan Chand and Sons.
2. J. G. Chakraborty and P. R. Ghosh, "Linear Programming and Game Theory", Central Book Agency.
3. P. M. Karak, "Linear Programming and Theory of Games", ABS Publishing House.
4. D. K. Jana and T. K. Roy, "Operations Research", Chhaya Prakashani Pvt. Ltd.
5. H. A. Taha, "Operations Research", Pearson.
6. J. K. Sharma, "Operations Research Theory and Applications", Macmillan India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	1	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	1	1
CO5	3	3	2	-	-	-	-	-	-	-	1	1

Course Code	YCS5007
Course Title	Communication Engineering
Category	Open Elective
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Basic Electronics

Learning Objective:

In this course, the students will be taught about the fundamental concepts of modern communication systems. This will include various kinds of modulation techniques, information theory and coding techniques, and multiple access techniques.

The course will be very helpful for the students in understanding next level courses like Computer Networks.

Course Outcome:

CO1: To explain and compare the fundamental concepts of analog, pulse and digital modulation techniques.

CO2: To compare and contrast the essential concepts of information theory and coding techniques.

CO3: To explain and classify the various spread spectrum and multiple access techniques in data communication.

Course Content:

Module 1: Analog Modulation [5L]

Amplitude Modulation: AM, double sideband full carrier system (DSBSC), single sideband suppressed carrier system (SSBSC), Vestigial sideband system (VSB), power spectral density (PSD).

Modulators and demodulators, angle modulation, frequency and phase modulation. Superheterodyne receivers.

Module 2: Pulse Modulation [7L]

Low-pass sampling theorem, Quantization, pulse amplitude modulation (PAM).

Line coding: pulse code modulation (PCM), differential pulse code modulation (DPCM), delta modulation (DM), and adaptive differential pulse code modulation (ADPCM).

Time Division Multiplexing, Frequency Division Multiplexing.

Module 3: Digital Modulation and Transmission [8L]

Phase shift keying: binary phase shift keying (BPSK), differential phase shift keying (DPSK), quadrature phase shift keying (QPSK). Principles of M-ary signaling, M-ary PSK quadrature amplitude modulation (QAM). Pulse shaping, Duo binary encoding, Cosine filters, equalizers.

Module 4: Information Theory and Coding **[8L]**

Measure of information: entropy, source coding theorem, Shannon–Fano coding, Huffman coding, LZ coding. Channel capacity, Shannon-Hartley law, Shannon's limit.
Error control codes: cyclic codes, syndrome calculation, convolution coding, sequential and Viterbi decoding.

Module 5: Spread Spectrum and Multiple Access **[8L]**

Pseudo-Noise (PN) sequences: properties, m-sequence, direct sequence spread spectrum (DSSS). Processing gain, jamming, frequency hopping spread spectrum (FHSS). Synchronization and tracking, Multiple Access: frequency division multiple access (FDMA), time division multiple access (TDMA), code division multiple access (CDMA).

Text/Reference Books:

1. J. G. Proakis and M. Salehi, "Fundamentals of Communication Systems", Pearson Education.
2. S. Haykin, "Communication Systems", John Wiley and Sons.
3. B. Carlson, P. B. Crilly, and J. C. Ruteledge, "Communication Systems", McGraw-Hill.
4. R. E. Ziemer and W. H. Tranter, "Principle of Communication", John Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	2	2	-	-	-	1	-	3
CO2	1	1	2	1	2	2	-	-	-	2	-	3
CO3	1	1	1	1	2	2	-	-	-	1	-	3

Course Code	YCS5101			
Course Title	Operating Systems Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Data Structures and Algorithms b) Computer Organization and Architecture			

Learning Objective:

In this laboratory course, the students will be carrying out various software assignments on Unix/Linux shell programming and system calls. Also, assignments for simulating important OS modules like CPU scheduling, file system, etc. shall be carried out.

Course Outcome:

CO1: To learn how to write shell scripts.

CO2: To learn how to use Unix/Linux system calls and to design a shell program.

CO3: To analyze the performance of CPU scheduling algorithms through simulation. **CO4:** To learn how to use multi-threaded programming.

CO5: To design and implement one OS module like memory management, file system, etc.

Suggestive List of Experiments:

1. Write shell scripts using "bash" shell scripting language for simple system administration tasks, text search and replacement, directory and file manipulation, simple numeric computations, etc. **[2 days]**

2. Write programs in C for familiarization with the Unix/Linux system calls fork, exec, wait, exit, dup, pipe, shared memory, etc. **[2 days]**

3. Write a command line interpreter (shell) program using the Unix/Linux system calls with the facilities for: (a) running executable programs, (b) running a program in the background, (c) input and output redirection, (d) command piping. **[2 days]**

4. Implementation of various CPU scheduling algorithms in C, and compare their performances. **[2 days]**

5. Write programs using "pthread" library with multiple threads, and use semaphores for mutual exclusion. **[1 day]**

6. Design and implement a Unix-like memory-resident file system using the concept of inodes.

OR

Implementation of memory management system supporting virtual memory, and analyze the performance. **[3 day(s)]**

Text/Reference Books:

1. A. Silberschatz, P. B. Galvin and G. Gagne, "Operating System Concepts", Wiley Asia.
2. D. M. Dhamdhere, "Operating Systems: A Concept-Based Approach", Tata McGraw-Hill.
3. M. Bach, "Design of the Unix Operating System", Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	-	1	2	1	-	1	-	-	2
CO2	2	-	2	-	2	1	-	-	1	-	-	2
CO3	2	1	2	1	2	2	1	-	1	-	-	2
CO4	2	-	1	-	3	1	-	-	2	-	-	2
CO5	2	1	2	3	2	2	1	-	2	-	-	2

Course Code	YCS5102			
Course Title	Embedded Systems Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Computer Organization and Architecture b) Digital Circuits and Logic Design			

Learning Objective:

In this laboratory course, the students will be conducting hands-on sessions with various microprocessor and microcontroller development boards for a better understanding of the design of embedded systems. The sessions shall also involve interfacing of various sensors and actuators.

Course Outcome:

CO1: To learn programming on the 8085 development board, and interfacing simple peripherals.

CO2: To design programming and interfacing experiments on the Arduino UNO

board. **CO3:** To design programming and interfacing experiments on ARM

development board. **CO4:** To learn how to interface various sensors and actuators.

Suggestive List of Experiments:

1. Programming assignments based on 8085 microprocessor board – simple programs, looping, bit manipulation, subroutines. **[2 days]**
2. Interfacing switches, LEDs and 7-segment displays to the microprocessor kit, writing delay routines. **[2 days]**
3. Programming and interfacing experiments based on the Arduino UNO microcontroller board . **[3 days]**
4. Programming and interfacing experiments based on ARM development board. **[2 days]**
5. Design a home automation systems with multiple sensors and actuators, using some microcontroller board. **[3 days]**

Text/Reference Books:

1. R. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publisher.
2. W. Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufmann.
3. M. A. Mazidi, J. G. Mazidi et al., "The 8051 Microcontroller and Embedded Systems", Prentice-Hall of India.

4. M. Sloss, D. Symes, and C. Wright, “ARM System Developers Guide: Designing and Optimizing System Software”, (Online Resource).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	2	1	2	-	1	-	-	3
CO2	2	1	2	2	1	1	2	-	2	-	-	3
CO3	2	1	2	2	1	-	2	-	1	-	-	3
CO4	2	1	2	1	1	2	2	-	2	-	-	3

Course Code	YCS5103
Course Title	Data Science Laboratory
Category	Professional Core
LTP & Credits	L: 0, T: 0, P: 3, Credits: 1.5
Total Contact Hours	36
Pre-requisites	a) Programming Practices II

Learning Objective:

In this course, the students will learn to manipulate data objects, produce graphics, analyze data using common statistical methods and generate reproducible statistical reports with programming in Python and R.

After the completion of this course, the students will be in a better position to solve the analytical problems of data science using Python and R.

Course Outcome:

CO1: To be able to solve analytical problems using Python and R.

CO2: To develop competency in Python and Python libraries such as Pandas, Numpy, and Scipy.

CO3: To explain and analyze results effectively using visualizations in Python and R.

CO4: To demonstrate how to import, export and manipulate data and produce statistical summaries of continuous and categorical data in Python and R.

CO5: To be able to perform exploratory data analysis using Python and R.

Suggestive List of Experiments:

1. Experiments on basic Python programming.
   Expressions, operators, matrices, decision statements, control flow and functions.
   Classes, objects, packages and files.
   Tuples, lists, sequences, dictionaries, comprehensions. **[2 days]**

2. Experiments based on additional features of Python.
   Numpy arrays objects, creating arrays, basic operations, indexing, slicing and iterating, copying arrays, shape manipulation, identity array, eye function, universal function.
   Linear algebra with Numpy, eigenvalues and eigenvectors with Numpy. **[2 days]**

3. Experiments based on Aggregation, Joining and Pandas
   Object. Aggregation and joining.
   Pandas Object: concatenating and appending data frames, index objects.
   Handling time series data using Pandas, handling missing values using Pandas. **[3 days]**

4. Experiments based on advanced features and statistical
   techniques. Reading and writing the data including JSON data.
   Web scraping using python, combining and merging Datasets, Data transformations, Basic

matplotlib plots, common plots used in statistical analysis in python.
Common plots used in statistical analysis in python Data types in R. Sequence generation, Vector and subscript, Random number generation in R. Data frames and R functions, Data manipulation and Data Reshaping using plyr, dplyr, reshape. Parametric statistics and Non-parametric statistics. Continuous and Discrete Probability distribution using R.
Correlation and covariance, contingency tables, Overview of Sampling, different sampling techniques, R and data base connectivity.
Web application development with R using Shiny, Approaches to dealing with missing data in R, Exploratory data analysis with simple visualizations using R, Feature or Attribute selection using R, Dimensionality Reduction with R, Time series data analysis with R. **[5 days]**

Text/Reference Books:

1. J. Payne, "Beginning Python: Using Python 2.6 and Python 3.1", Wrox.
2. M. T. Goodrich, R. Tamassia and M. H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons.
3. I. Idris, "Python Data Analysis", Pact Publishing Limited.
4. C. Beeley, "Web Application Development with R Using Shiny", Pact Publishing.
5. M. J. Crawley, "The R Book", Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	-	2	-	1	-	-	3
CO2	2	1	3	2	3	1	2	-	2	-	-	3
CO3	1	1	1	1	1	-	2	-	1	-	-	3
CO4	2	1	2	2	3	-	2	-	2	-	-	3
CO5	1	2	1	1	1	-	2	-	1	-	-	3

Course Code	YCS5501			
Course Title	Environmental Science			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Students will be able to understand the natural environment and its relationships with human activities and able to apply the fundamental knowledge of science and engineering to assess environmental and health risk, to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues and to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome:

CO1: To understand the natural environment and its relationships with human activities.

CO2: To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

CO3: To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

CO4: Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course Content:

Module 1: General Natural Resources **[11L]**

Forest Resource, water resource, mineral resource, energy resources: alternative source of energy Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography Disaster Management: Types of disasters (Natural & Manmade), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control) Ecology & Ecosystem: Elements of ecology, definition of ecosystem-components types and function, Food chain & Food web, Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

Module 2: Air pollution and control Sources of Pollutants [10L] Point sources, nonpoint sources and manmade sources primary & secondary pollutant Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog), Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion control of air pollution (ESP,

cyclone separator, bag house, catalytic converter, scrubber (ventury).

Module 3: Pollution **[9L]**

Water Pollution Classification of water (Ground & surface water) Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds. Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control) Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride Layout of waste water treatment plant (scheme only).

Module 4: Land Pollution types of Solid Waste **[3L]**

Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (biomedical), E-waste Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages). Waste management: waste classification, waste segregation, treatment & disposal

Module 5: Noise Pollution **[3L]**

Definition of noise, effect of noise pollution on human health, Average Noise level of some common noise sources Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18 hr Index) . Noise pollution control.

Text/Reference Books:

1. Shashi Chawla, “A Textbook of Environmental Studies”, Tata McGraw Hill Education Private Ltd.
2. Dr. J P Sharma, “Environmental Studies”, University Science Press.
3. J K Das Mohapatra, “Environmental Engineering”, Vikas Publication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	1	2	2	2	-	-	-	2
CO2	3	2	2	-	-	2	2	2	-	-	-	3
CO3	2	2	2	-	1	2	-	2	-	-	-	2
CO4	2	2	2	-	-	-	2	2	-	-	-	2

Semester 6 Curriculum and Syllabus

SEMESTER-6							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS6001	Computer Networks	3	0	0	3
2	PC	YCS6002	Software Engineering	3	0	0	3
3	PC	YCS6003	Compiler Design	3	0	0	3
4	PC	YCS6004	Cryptography and Network Security	3	0	0	3
5	OE		Elective II	3	0	0	3
		YCS6005	Internet Technology				
		YCS6006	E-Commerce and ERP				
		YCS6007	Cloud Computing				
		YCS6008	Java Programming				
PRACTICAL							
6	PC	YCS6101	Computer Networks Laboratory	0	0	3	1.5
7	PC	YCS6102	Software Engineering Laboratory	0	0	3	1.5
BLENDED (MOOC + INTERNAL ASSESSMENT)							
8	OE	YCS6401	MOOCS Elective I	3	0	0	3
MANDATORY NON-CGPA COURSE							
9	MC	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS6201	Innovative Project IV	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**22.5**

Course Code	YCS6001
Course Title	Computer Networks
Category	Professional Core
LTP & Credits	L · T · P · Credits 3 · 0 · 0 · 3
Total Contact Hours	36
Pre-requisites	a) Computer Organization and Architecture b) Operating Systems

Learning Objective:

In this course, the students will learn about the fundamental concepts of computer networking, with detailed understanding about the TCP/IP protocol suite that drives the Internet. In addition, various important network applications shall be discussed.The course will be very helpful for the students in understanding how data flows through a real network and the various issues involved therein.

Course Outcome:

CO1: To explain the fundamental concepts of data communication

CO2: To illustrate how the various protocols at the data link layer level work

CO3: To explain the functionalities of the various protocols at the network and transport layer level

CO4: To demonstrate how various internetworking devices can be used to connect several different networks together

CO5: To learn about various network applications with particular emphasis on security

Course Content:

Module 1: Introduction to Data Communication Techniques [5L]

Data communication concepts, analog and digital signal transmission. Layered network architecture – the OSI model. Transmission media (guided and unguided) and data transmission techniques (analog and digital). Signal encoding techniques – NRZ, NRZI, AMI, Manchester, Differential Manchester, etc. Circuit switching and packet switching, virtual circuits and datagrams.

Module 2: Data Link Layer [7L]

Framing and flow-control techniques, stop-and wait and sliding-window protocols for frame transmission, performance analysis. Error control techniques – checksum and CRC, stop-and-wait ARQ, Go-back-N, selective reject protocols.

Multiple-access protocols: ALOHA, CSMA and CSMA/CD. IEEE 802.x Ethernet standards, switched Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LAN protocols and standards.

Module 3: Network Layer [8L]

TCP/IP protocol suite, internetworking concepts.

Internet Protocol (IP), IP addressing and routing, IP fragmentation and reassembly. IP subnets and masks – variable length subnet masks, classless inter-domain routing. Miscellaneous protocols – ARP and RARP, ICMP, BOOTP and DHCP. IPv6 – basic differences from IPv4.

Module 4: Transport Layer **[4L]**

Process-to-process delivery, TCP and UDP, TCP connection establishment and termination. Flow and congestion control in TCP – window advertisement, leaky-bucket and token-bucket algorithms.

Module 5: Internetworking Concepts **[6L]**

Internetworking devices – repeaters, hubs, bridges and routers.
Interconnecting LANs using bridges, frame forwarding and address learning.
Routing algorithms – shortest-path algorithm, distance vector algorithm, link state algorithm. RIP, OSPF and BGP algorithms.

Module 6: Network Applications **[6L]**

Client-server concept. Introduction to DNS, SMTP, SNMP, FTP, TELNET and HTTP.
Firewalls, Network Address Translator (NAT), Proxy Server, etc.
Basic concepts of cryptography – symmetric and asymmetric key cryptosystems, cryptographic hash functions. Digital signature, PGP, HTTPS.

Text/Reference Books:

1. W. Stallings, "Data and Computer Communication (5th Ed.)", PHI / Pearson Education.
2. B. A. Forouzan, "Data Communication and Networking (3rd Ed.)", Tata-McGraw Hill.
3. W. R. Stevens, "UNIX Network Programming (3rd Ed.), Prectice-Hall, Addision-Wesley.
4. A. Tanenbaum, "Computer Networks (4th Ed.), PHI / Pearson Education.
5. W. Stallings, "Cryptography and Network Security: Principles and Practice (4th Ed.)", PHI / Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	2	-	2	-	-	2
CO2	2	2	1	1	-	-	2	-	2	-	-	2
CO3	-	2	1	1	2	-		-	2	-	-	2
CO4	2	-	2	2	-	3	-	2	2	-	-	2
CO5	2	-	1	2	-	3	-	2	2	-	-	2

Course Code	YCS6002			
Course Title	Software Engineering			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Object Oriented Programming			

Learning Objective:

In this course, the students will learn about concepts in software engineering and its applications. They will learn about the layered architecture and the process framework, and analyze software process models like waterfall, spiral, evolutionary models.
After completing the course the students will be able to design software requirements and specifications of documents, understand project planning, scheduling, cost estimation, risk management and also describe data models, object models, context models and behavioural models and about the quality checking mechanism for software process and product.

Course Outcome:

CO1: To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

CO2: To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns

CO3: To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice

CO4: To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning

Course Content:

Module 1: Introduction **[6L]**
Characteristics, Components, Application, Definitions, Software Process models, Waterfall Model, Prototype model, RAD, Evolutionary Models, Incremental, Spiral, Software Project Planning, Feasibility Analysis, Technical Feasibility.

Module 2: Software Engineering Models **[8L]**
System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, Data Dictionary, Data Modelling, Software Requirements Specification
Software Design Aspects: Objectives, Principles, Concepts, HLD and LLD, Top-Down and Bottom- Up design, Decision tree, decision table and structured English, Structure chart, Transform analysis Functional Vs. Object- Oriented approach.

Module 3: Methodologies **[7L]**
Introduction to Agile Methodology, Agile Testing, Quality in agile software development, Unified Modelling Language: Class diagram, interaction diagram, Collaboration diagram, sequence diagram, State chart diagram, activity diagram, Implementation diagram, Use-Case diagram.

Module 4: Project Documentation **[4L]**

Coding and Documentation: Structured Programming, Modular Programming, Module Relationship- Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation. Testing–Levels of Testing, Integration Testing, System Testing, Test Cases-White Box and Black Box testing, Software Quality, Quality Assurance, Software Maintenance

Software Quality, Quality Assurance, Software Maintenance

Software Configuration Management, Software Architecture, Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management, Reactive vs. Proactive Risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Project Monitoring.

Module 5: Software Quality Assurance **[6L]**

Refinements and minimization of Risk in Software Engineering, Cost-Benefit Analysis, Basics of estimation: COCOMO (Basic, intermediate, Complete) model, SEI –CMM, CMM Levels and Industry Standard, New Strategies in Industry Based software Engineering, Containerization.

Text/Reference Books:

1. R. S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
2. P. Jalote, "Software Engineering", Wiley India.
3. R. Mall, "Software Engineering", Prentice-Hall of India.
4. M. L. Shooman, "Software Engineering", Tata McGraw Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	-	2	3	2	-	2	-	-	3
CO2	2	3	2	3	-	1	2	-	2	-	-	3
CO3	3	2	1	2	2	1	2	-	2	-	-	3
CO4	2	1	3	-	1	1	2	-	2	-	-	3

Course Code	YCS6003
Course Title	Compiler Design
Category	Professional Core
LTP & Credits	L | T | P | Credits 3 | 0 | 0 | 3
Total Contact Hours	36
Pre-requisites	a) Formal Language and Automata Theory b) Computer Organization and Architecture c) Programming and Data Structure

Learning Objective:

In this course the students will learn about the fundamental principles in compiler design, the algorithms and data structures involved in the construction of a compiler, automation tools like lex and yacc for translating high level language. At the end of the course student will be able to build different phases of compilers.

Course Outcome:

CO1: Understand the lexical, syntactic and semantic structures of a language.

CO2: Recall various techniques to modify grammar of a given language.

CO3: Understand intermediate representations including symbol table, parse/syntax tree and data structure required for such representations.

CO4: Understand different techniques for intermediate code and machine code optimization.

Course Content:

Module 1: Lexical Analysis **[8L]**

History of Compiler Design, Analysis of the Source Program, The Phases of a Compiler, Cousins of the Compiler, The Grouping of Phases, Compiler Construction Tools, Need and role of lexical analyzer, Lexical errors, Input Buffering, Specification of Tokens, Recognition of Tokens, Design of a Lexical Analyzer Generator, Use of Lex tool.

Module 2: Syntax Analysis **[9L]**

Need and role of the parser, Context Free Grammars, Top Down parsing, Recursive Descent Parser, Predictive Parser, LL (1) Parser, Shift Reduce Parser, LR Parser, LR (0) item, Construction of SLR Parsing table, Introduction to LALR Parser, Use of YACC/Bison tool, Design of a syntax analyzer for a sample language.

Module 3: Syntax Directed Translation **[7L]**

Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, Translation of assignment statements, Boolean expressions, Statements that alter the flow of control, postfix translation, Translation with a top down parser, Translation: Array references in arithmetic expressions, procedures call, declarations and case statements.

Module 4: Code Generation **[6L]**

Data structure for symbols tables, representing scope information, Three address code, quadruple & triples, Issues in the design of code generator, The target machine, Runtime Storage management, Basic Blocks and Flow Graphs, Next-use Information, A simple Code generator, DAG representation of Basic Blocks.

Module 5: Code Optimization **[6L]**

Sources of Optimization, Peephole Optimization, Optimization of basic Blocks, Introduction to Global Data Flow Analysis, Runtime Environments, Source Language issues, Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter Passing.

Text/Reference Books:

1. A. Aho, V. R. Sethi and D. J. Ullman, “Compilers Principles, Techniques and Tools”, Pearson Education.
2. M. L. Scott, “Programming Language Pragmatics”, Morgan Kaufmann Publishers.
3. C. N. Fischer, R. K. Cytron, and R. J. LeBlanc, ”Crafting a Compiler”, Addison-Wesley.
4. S. Chattopadhyay, “Compiler Design”, Prentice-Hall of India.
5. A. W. Appel, ”Modern Compiler Implementation in C”, Cambridge University Press.
6. R. Mark, “Writing Compilers and Interpreters: A Modern Software Engineering Approach Using Java”, Wiley Publishing.
7. K. D. Cooper and L. Torczon, “Engineering a Compiler”, Morgan Kaufmann Publishers.
8. A. I. Holub, “Compiler Design in C”, Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	1	-	2	-	-	1
CO2	3	2	2	1	2	1	2	-	1	-	-	1
CO3	3	2	2	1	2	2	1	-	2	-	-	1
CO4	3	2	2	1	2	1	2	-	1	-	-	1

Course Code	YCS6004			
Course Title	Cryptography and Network Security			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Data Structures and Algorithms b) Operating Systems c) Discrete Structures			

Learning Objective:

In this course, the students will learn about the various cryptographic techniques that are essential to understand how secure information systems can be built. In particular, various security applications shall be discussed as case studies.
The course will be very helpful for the students in strengthening their basic knowledge in cyber security.

Course Outcome:

CO1: To explain the basic concept of cryptography and its applications in network security

CO2: To learn and analyze various private-key cryptography algorithms

CO3: To learn and analyze various public-key cryptography algorithms

CO4: To explain various cryptographic hash functions and their applications in network security

CO5: To demonstrate how the basic concepts of cryptography can be used to develop practical security applications

Course Content:

Module 1: Introduction to Cryptography and Block Ciphers [4L]
Introduction to security attacks, services and mechanisms. Conventional encryption models – private-key and public-key cryptography. Classical encryption techniques –substitution and transposition ciphers.

Module 2: Private-key Cryptography [7L]
Block Cipher – Feistel structure, Shannon's theory of confusion and diffusion, DES, triple-DES, AES.
Linear and differential cryptanalysis – basic concepts. Key distribution problem.
Stream Cipher – basic concept, realization based on linear feedback shift register.

Module 3: Mathematical Background [8L]
Modular arithmetic, Fermat's and Euler's theorem, gcd, primality testing. Euclid's algorithm, Chinese remainder theorem.
Intractable problems – integer factorization problem, modular square root problem, discrete logarithm problem

Module 4: Public-key Cryptography **[6L]**

RSA algorithm, security of RSA, key management. Diffie-Hellman key exchange algorithm.
Elliptic curve cryptography – basic concepts.

Module 5: Cryptographic Hash Functions and Authentication **[5L]**

Properties of hash functions – MD5 message digest algorithm, secure hash algorithm (SHA-1).
Digital signatures – authentication protocols, various approaches, digital signature standard (DSS).

Module 6: Network Security **[8L]**

Authentication applications – Kerberos, X.509 directory authentication service.
Electronic mail security – pretty good privacy (PGP), S/MIME.
Certification – public-key infrastructure. Secure socket layer (SSL), transport layer security, secure HTTP (HTTPS), and other secure protocols on the Internet.
System security – viruses, worms and malware, firewall systems.

Text/Reference Books:

1. W. Stallings, "Cryptography and Network Security: Principles and Practices", Prentice-Hall of India.
2. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, "Handbook of Applied Cryptography", CRC Press.
3. D. Stinson, "Cryptography: Theory and Practice", CRC Press.
4. C. Kaufman, R. Perlman, and M. Speciner, "Network Security", Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	-	1	1	-	-	2	2
CO2	1	1	2	-	2	-	2	1	-	-	1	3
CO3	1	1	2	-	2	-	1	1	-	-	2	3
CO4	1	1	3	2	1	-	2	1	-	-	1	3
CO5	1	2	2	-	3	2	1	1	-	-	2	3

Course Code	YCS6005			
Course Title	Internet Technology			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Computer Networks			

Learning Objective:

In this course, the students will learn about the technology and protocols that drive the Internet. In addition, they will be taught about the various software technologies that are used in developing web pages and web-based applications. The course will be very helpful for the students as it will provide them with the background for developing web-enabled applications.

Course Outcome:

CO1: To explain the technology and protocols that drive the Internet

CO2: To appraise the software technologies required to develop web

pages **CO3:** To demonstrate how interactive web pages can be created

CO4: To explain the security technologies that are used to make Internet secure

Course Content:

Module 1: Introduction to Internet [6L]

Overview: Intranet, Extranet and Internet, world-wide web.
TCP/IP protocol suite. IP protocol – IP datagram format, IP addressing and routing, IP packet fragmentation, classful and classless addressing, IPv4 and IPv6. TCP and UDP protocols – header fields, TCP connection establishment, flow control and congestion control.
Routing algorithms – Intra- and inter-domain routing, RIP, OSPF and BGP protocols. Packet forwarding in routers with examples.

Module 2: Internet Applications [6L]

Client-server model, Berkeley socket interface.
Common protocols in TCP/IP suite – ARP and RARP, ICMP, BOOTP and DHCP, FTP, TELNET.
Domain Name System (DNS) – iterative versus recursive name resolution.
Simple Mail Transfer Protocol (SMTP) – command and response formats, POP3 and IMAP.
Hyper-Text Transport Protocol (HTTP) – request and response formats, HTTP server.

Module 3: Hyper-Text Markup Language (HTML) [6L]

HTML tags and attributes – Heading, Paragraph, Formatting, Ordered and Bulleted Lists, Hyperlinks, Table, Block, CSS. Advanced features – HTML forms, HTML frames, image maps.
Extensible Markup Language (XML) – Syntax, Tree, Elements, Attributes, Validation, Viewing. Introduction to XHTML.

Common Gateway Interface (CGI) Scripts – principle of operation, environment variables, GET and POST methods, server-side scripting.

Module 4: Internet Scripting Languages [6L]

PERL – variable, condition, loop, array. Implementing data structures – Hash, String, Regular Expression, File handling, I/O handling.
JavaScript – statements, variable, comparison, condition, switch, loop, break. Object -string, array, regular expressions.
Cookies – basic concept, creation and storing cookies with example.
Java Applets – container class, components, Applet life cycle, update method.
Embedding Applets within HTML page, parameter passing.

Module 5: Security and Privacy [6L]

Network Security – fundamental concepts, symmetric-key and asymmetric-key algorithms, cryptographic hash functions.
Common Security Protocols – Digital Signature, Pretty Good Privacy (PGP), HTTPS.
Network Security – Common vulnerabilities, Proxy Server and Network Address Translation (NAT), Packet-level and application-level firewalls, Secure transactions in ecommerce applications.

Module 6: Miscellaneous Topics [6L]

Internet Telephony – principle of operation, voice over IP (VoiP).
Multimedia Applications – multimedia over IP, RSVP, RTP, RTCP and RTSP protocols.
Streaming media, Codec and Plugins.
Search Engine and Web Crawler – principle of operation.
Introduction AJAX – AJAX Internals, XML HTTP request object, AJAX UI tags.

Text/Reference Books:

1. N. P. Gopalan and J. Akilandeswari, "Web Teclmology: A Developer's Perspective", PHI Learning.
2. R. Banerjee, "Intemetworking Technologies, An Engineering Perspective", PHI Learning.
3. S. Holzner, "HTML Black Book", Dremtech Press.
4. P. J. Deitel and H. M. Deitel, "Internet and World Wide Web: How to program?", Pearson Education.
5. B. A. Forouzan, "Data Communication and Networking (3rd Ed.)", Tata-McGraw Hill.
6. W. Stallings, "Cryptography and Network Security: Principles and Practice (4th Ed.)", PHI / Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	1	-	-	-	-	-	2
CO2	2	2	2	2	1	-	-	-	-	-	-	3
CO3	2	2	-	-	1	2	-	-	-	-	-	3
CO4	2	1	1		2	3	-	-	-	-	-	3

Course Code	YCS6006
Course Title	E-Commerce and ERP
Category	Open Elective
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	a) Software Engineering b) Computer Organization and Architecture

Learning Objective:

In this course, the students will learn about e-marketplaces, the major types of electronic markets, and also know about different types of intermediaries in e-commerce.
This subject also give the idea on electronic catalogs, shopping carts, search engines, and describe the various types of auctions and list their characteristics.

Course Outcome:

CO1: To explain the basic concept of E-Commerce and its applications

CO2: To learn and analyze various ERP Tools

CO3: To learn and analyze various E-Commerce concepts

CO4: To apply the basic understanding of ERP in business environment

Course Content:

Module 1: Introduction to E-Commerce [10L]

Introduction What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of E-Commerce, Inter Organizational E-Commerce Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework Network Infrastructure for E-Commerce Network Infrastructure for E-Commerce, Market forces behind I Way, Component of I way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

Module 2: Mobile Commerce and ERP [7L]

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices, Web Security Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, firewalls & Network Security.

Module 3: E-Commerce Payment and Gateways [8L]

Electronic Payments Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card I Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

Module 4: E-Commerce and EDA [5L]

Net Commerce EDA, EDI Application in Business, Legal requirement in E - Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

Module 5: Internet and E-Commerce **[6L]**

Internet and Electronic commerce, internet, extranet and enterprise solutions, information system for business operations, information system for managerial decision support, information system for strategic advantage.

Text/Reference Books:

1. T.P. Liang, “Electronic Commerce, A Managerial Perspective”, Prentice Hall
2. R. Kalakota and A. Whinston, “Frontiers of Electronic Commerce”, Addision Wesley.
3. D. Amor, “The E-Business Revolution”, Addision Wesley.
4. M. Greenstein, “Electronic Commerce”, McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	1	1	-	-	2	-	-	2
CO2	1	2	1	-	1	-	1	-	-	-	-	2
CO3	1	1	2	-	2	-	-	-	-	-	-	2
CO4	1	1	3	1	1	-	-	-	-	2	-	2

Course Code	YCS6007			
Course Title	Cloud Computing			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Computer Networks b) Operating Systems			

Learning Objective:

To provide students a sound foundation of the cloud computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios. To enable students exploring some important cloud computing driven commercial systems and applications.

Course Outcome:

CO1: To explain the Cloud architecture, different services and deployment models.

CO2: To learn the concepts of abstraction and different types of virtualization.

CO3: To identify and explain different cloud offerings with their usage namely Azure, Google Apps, Amazon web service

CO4: To explain the underlying concepts of cloud management and security and illustrate the use of Service Oriented Architecture (SOA)

Course Content:

Module 1: Definition of Cloud Computing and its Basics [10L]

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing. Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients. Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service(CaaS).

Module 2: Use of Platforms in Cloud Computing [9L]

Concepts of Abstraction and Virtualization Virtualization technologies:Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of

Open Virtualization Format

– OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance.

Module 3:Use of various Web Services **[5L]**

Concepts of Platform as a Service: Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks Use of Google Web Services: Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.Use of Amazon Web Services: Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service Use of Microsoft Cloud Services: Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 4: Cloud Infrastructure **[6L]**

Types of services required in implementation – Consulting, Configuration, Customization and Support, Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle), Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)

Module 5: Concepts of Services and Applications **[6L]**

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition

– Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.

Text/Reference Books:

1. B. Sosinsky, "Cloud Computing Bible (1st Ed.)", Wiley.
2. R. Buyya, C. Vecchiola, S. T. Selvi, "Mastering Cloud Computing (2nd Ed.)", McGraw Hill Education.
3. A. T. Velte, "Cloud computing: A practical approach (3rd Ed.)", Tata McGraw Hill.
4. C. Miller, "Cloud Computing (4th Ed.)", PHI / Pearson Education.
5. K. Saurabh, "Cloud Computing (2nd Ed.)", Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	1	-	-	-	-	-	-	2
CO2	2	2	2	-	1	-	-	1	1	-	-	2
CO3	3	1	2	-	1	2	-	-	2	-	-	1
CO4	3	3	3	-	1	2	-	1	1	-	-	2

Course Code	YCS6008
Course Title	Java Programming
Category	Open Elective
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming b) Object Oriented Programming

Learning Objective:

The course objective is to understand various properties of object oriented programming. The course focuses on basics of OOP such as: abstraction, encapsulation, polymorphism and inheritance. This course gives a detailed discourse on Java programming language. This course thereafter focuses on platform independence of Java, implementation of various OOP paradigm, special properties such as exception handling and GUI usage.

Course Outcome:

CO1: To explain the process of interaction between objects, classes & methods

CO2: To acquire a basic knowledge of Object Orientation with different properties

CO3: To analyze various different string handling functions with various I/O

operations **CO4:** To discuss basic code reusability feature w.r.t. Inheritance,

package and Interface.

CO5: To implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Content:

Module 1: JAVA Basics **[8L]**

Fundamentals of Java: JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes.

Module 2: Object Oriented Programming **[7L]**

Encapsulation, Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & initialization code block, Access Control, Modifiers, Nested methods, Inner & Anonymous Classes, Abstract Class & Interfaces Defining Methods, Argument Passing Mechanism , Method Overloading, Recursion.

Module 3: Inheritances and Polymorphism **[9L]**

Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword.

Packages and Interfaces: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces.

I/O Streams: Concepts of streams, Stream classes- Byte and Character stream, Reading

console Input and Writing Console output, File Handling.

Module 4: Exception Handling **[6L]**

Exception types, Usage of Try, Catch, Throw, Throws and Finally

Thread: Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads, Critical Factor in Thread, DeadLock.

Module 5: JAVA Applet **[6L]**

Applet vs. Application, Applet class, Advantages of Applet, Applet Lifecycle My First Applet, Applet tag, How to run applet?

GUI Programming: Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package).

Collection Framework Collections of Objects, Collection Types, Sets, Sequence, Map, Understanding Hashing, Use of ArrayList & Vector.

Text/Reference Books:

1. H. Schildt and C. Dann, “Java: the Complete Reference”, McGraw-Hill Education.
2. E. Balagurusamy, “Programming With Java: A Primer”, Tata McGraw-Hill.
3. B. Eckel, “Thinking in JAVA”, Prentice Hall.
4. G. Reese, “Database Programming with JDBC and JAVA”, O’Reilly Media, Inc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	1	-	-	2	-	2	-	-	3
CO4	-	-	2	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	-	2	2	2	3

Course Code	YCS6101			
Course Title	Computer Networks Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a. Operating Systems Laboratory b. Computer Organization and Architecture Laboratory			

Learning Objective:

In this laboratory course, the students will be learning network programming using the socket API system calls, and also analyze packets flowing over the network. Also, a number of algorithms at the datalink and network layers shall be simulated and the results analyzed.

Course Outcome:

CO1: To learn how to use socket API system calls for network programming

CO2: To learn how to capture network packets and analyze them

CO3: To analyze various algorithms at the datalink and network layers through simulation

Suggestive List of Experiments:

1. Familiarization with Berkeley socket interface system calls in C, and writing programs to communicate between two machines using both connection-oriented (TCP) and connection-less (UDP) protocols. **[3 days]**
2. Write programs in C to simulate the stop-and-wait and sliding-window protocols, and carry out performance analyses both in the absence of errors and also in presence of errors. **[2 days]**
3. Familiarization with a packet capturing and analysis tool (like Wireshark), and analyze packets as captured under various data transfer scenarios over the network. **[2 days]**
4. Write a program in C to simulate a router for filtering IP packets (make the specification of the problem as realistic as possible).. **[3 days]**
5. Write programs to implement the distance vector algorithm for building up the routing tables in a network of routers.. **[2 days]**

Text/Reference Books:

1. W. Stallings, "Data and Computer Communication (5th Ed.)", PHI / Pearson Education.
2. B. A. Forouzan, "Data Communication and Networking (3rd Ed.)", Tata-McGraw Hill.
3. W. R. Stevens, "UNIX Network Programming (3rd Ed.), Prectice-Hall, Addision-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	-	3	-	-	-	2	-	-	3
CO2	1	2	2	2	-	-	-	-	2	-	-	3
CO3	2	2	1	-	2	2	2	-	2	-	-	3

<table>
<tr><td>Course Code</td><td colspan="4">YCS6102</td></tr>
<tr><td>Course Title</td><td colspan="4">Software Engineering Laboratory</td></tr>
<tr><td>Category</td><td colspan="4">Professional Core</td></tr>
<tr><td rowspan="2">LTP & Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Total Contact Hours</td><td colspan="4">36</td></tr>
<tr><td>Pre-requisites</td><td colspan="4">a) Object Oriented Programming Laboratory</td></tr>
</table>

Learning Objective:

In this course students can build a fully functional, interactive, layered, distributed, database-backed software system from the ground-up as part of a small, agile, development team in a laboratory setting, become acquainted with historical and modern software methodologies. I also help to understand the phases of software projects and practice the activities of each phase, Practice clean coding, taking part in project management and become adept at such skills as distributed version control, unit testing, integration testing, build management, and deployment.

Course Outcome:

CO1: To construct, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

CO2: To design applicable solutions in one or more application domains using software engineering approaches with case studies

CO3: To develop the test cases from the design and effectively apply relevant standards and perform testing, and quality management and practice

CO4: To construct modern engineering architecture for software project management, time management and software reuse, and an ability to engage in life-long learning

Suggestive List of Experiments:

1. Write down the problem statement for a suggested system of relevance. **[1 day]**
2. Do Feasibility study along with requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system. **[1 day]**
3. To perform the function oriented diagram: Data Flow Diagram (DFD) and Structured chart. **[1 day]**
4. To perform the user's view analysis for the suggested system: Use case diagram. **[1 day]**
5. To draw the structural view diagram for the system: Class diagram, object diagram. **[1 day]**
6. To draw the behavioral view diagram: State-chart diagram, Activity diagram. **[1 day]**
7. To perform the behavioral view diagram for the suggested system: Sequence diagram, Collaboration diagram, timing diagram, component diagram, State diagram. **[1 day]**
8. To perform the implementation view diagram: Component diagram for the system. **[1 day]**
9. To perform the environmental view diagram: Deployment diagram for the system. **[1 day]**

10. To perform various testing using the testing tool unit testing, integration testing for a sample code of the suggested system. [1 day]

11. Perform Estimation of effort using FP Estimation for chosen system with other matrices. [1 day]

12. To prepare time line chart/Gantt Chart/PERT Chart for selected software project. [1 day]

Software required: MS Project, MS Visio, Docker

Text/Reference Books:

1. R. S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
2. P. Jalote, "Software Engineering", Wiley India.
3. R. Mall, "Software Engineering", Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	2	3	2	-	1	-	-	2
CO2	2	1	2	1	-	1	1	-	2	-	-	2
CO3	3	2	1	2	1	1	2	-	1	-	-	2
CO4	2	1	3	-	1	1	1	-	2	-	-	2

Course Code	YCS6501			
Course Title	Technical Report Writing and Presentation Skills			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	0	0	3	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

This course introduces students to the discipline of technical communication. Preparation of visuals to supplement text, workplace communication, descriptions of mechanisms, explanations of processes, and writing reports are the major topics included. This course is designed for students enrolled in technical degree programs.

Course Outcome:

CO1: To explain and demonstrate how to typeset documents using LaTeX

CO2: To explain and demonstrate how to write technical reports and research papers

CO3: To explain and demonstrate how to prepare and deliver presentations, and participate in group discussions

Suggestive List of Experiments:

1. Document preparation and typesetting using LATEX. **[3 days]**
2. Writing technical reports, styles and guidelines, data collection. **[2 days]**
3. Writing research papers, structure and guidelines, styles and formatting. **[3 days]**
4. Speaking skills, delivering seminars, group discussions. **[2 days]**
5. Guidelines for presentations, preparing presentations using Powerpoint or any other similar software tools. **[2 days]**

Text/Reference Books:

1. L. Lamport, "LaTeX: A Document Preparation System", Addison-Wesley.

2. S. Kumar and P. Lata,"Communication Skills", Oxford University Press.

3. A.J. Rutherfoord, "Basic Communication Skills for Technology", Pearson.

4. M.A. Rizvi, "Effective Technical Communication", McGraw Hill.

5. A. Leigh and M. Maynard, "The Perfect Presentation", Random House.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	2	1	1	2	-	2	-	1
CO2	1	3	3	-	1	1	2	2	2	-	-	1
CO3	1	2	2	-	3	1	1	2	-	-	-	1

Semester 7 Curriculum and Syllabus

SEMESTER-7							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG7001	Value and Ethics in Profession	2	0	0	2
2	PE		Elective III	3	0	0	3
		YCS7031	Fundamentals of Cyber Security				
		YCS7032	Design of Secured Systems	3			
3	PE		Elective IV	3	0	0	3
		YCS7031	Fundamentals of Cyber Security				
		YCS7032	Design of Secured Systems	3			
PRACTICAL							
4	PE	YCS7103	Stream Lab 1: Cyber Security	0	0	4	2
BLENDED(MOOC + INTERNAL ASSESSMENT)							
5	OE	YCS7401	MOOCS Elective II	3	0	0	3
SESSIONAL(ONLY INTERNAL EVALUATION)							
6	PROJ	YCS7204	Project I	0	0	6	3
MANDATORY NON-CGPA COURSE							
7	MC	YCS7501	Social Awareness	3	0	0	0
		YCS7502	History of Science and Technology				
		YCS7503	Indian Liberal Arts				
TOTAL				**14**	**0**	**10**	**16**

Course Code	YMG7001
Course Title	Values and Ethics in Profession
Category	Humanities
LTP & Credits	L / T / P / Credits: 2 / 0 / 0 / 2
Total Contact Hours	24
Pre-requisites	None

Learning Objective:

In this course, the students will learn to be awareness on professional ethics and human values.

Course Outcome:

CO1: To explain the core values that shape the ethical behavior of an engineer

CO2: To understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories

CO3: To analyze various social issues, industrial standards, code of ethics, and role of professional ethics in engineering field

CO4: To explain the responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer

CO5: To acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

Course Content:

Module 1: Introduction **[2L]**

Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

Module 2: Psycho-social theories of moral development **[4L]**

View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

Module 3: Ethical Concerns **[4L]**

Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society.

Nature of values: Value Spectrum of a good life.

Module 4: Ethics of Profession **[4L]**

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.

Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Module 5: Self Development **[4L]**

Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module 6: Effects of Technological Growth **[6L]**

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics.

Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text/Reference Books:

1. S. H. Unger, "Controlling Technology: Ethics and the Responsible Engineers", John Wiley & Sons.
2. D. Johnson, "Ethical Issues in Engineering", Prentice Hall.
3. A. N. Tripathi, "Human Values in the Engineering Profession", Monograph published by IIM, Calcutta, 1996.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	1	1	2	-	1
CO2	-	-	-	-	-	1	1	3	1	2	-	1
CO3	-	-	-	-	-	3	2	3		1	-	1
CO4	-	-	-	-	-	3	2	1	-	-	-	1
CO5	-	-	-	-	-	3	2	2		1	3	1

Course Code	YCS7031
Course Title	Fundamentals of Cyber Security
Category	Professional Elective
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Data Structures and Algorithms b) Cryptography and Network Security c) Discrete Structures

Learning Objective:

In this course, the students will learn the various system vulnerabilities and network based attacks that can be typically mounted on organization networks and systems. The different tools and techniques that are well practiced in this context shall also be discussed.

The course will be very helpful for the students to garner their skills as future ethical hackers that is a need of the society.

Course Outcome:

CO1: Understand and analyze the various vulnerabilities that exist in systems and networks

CO2: Understand and analyze various attacks that can be mounted to exploit the vulnerabilities

CO3: Learn about hardware based attacks and guidelines for secure implementation

CO4: Learn about various software tools that are available for mounting network based attacks

Course Content:

Module 1: : Introduction to Network Security **[8L]**

TCP/IP protocol stack – IP addressing and routing, internal working of routers, TCP connection establishment and connection termination, protocol vulnerabilities. Packet sniffing – ARP poisoning, DNS poisoning, denial of service attacks, hacking wireless networks.

Module 2: Network Based Attacks **[8L]**

Routing protocols – case studies with examples. Mounting network based attacks and countermeasures – exploiting vulnerabilities in protocols at the data-link, network, transport and application layers of the TCP/IP protocol stack.
Vulnerability assessment – OpenVAS, Nessus, etc. System hacking – password cracking, penetration testing, creating backdoors, etc.

Module 3: Practical Vulnerabilities and Case Studies **[8L]**

Secure online transactions – problems and countermeasures.
Ethical hacking – basic concept and scope, typical tools and techniques used.
Blockchain – secure method for carrying out transactions.

Module 4: Secure Implementation to Prevent Attacks **[6L]**

Elements of hardware security – Hardware Trojans, principle of operation and methods of detection. Physical unclonable functions (PUF) – use of PUF in developing highly secure applications.
Side-channel attacks – basic concept, timing and power analysis attacks, attack scenarios and countermeasures.

Module 5: Software Tools for Launching Network Based Attacks [6L]

The NMAP tool – various features available to mount attacks, internal working principles.
Hacking web applications – SQL injection, cross-site scripting, etc.
Popular platforms to mount attacks – Kali Linux.

Text/Reference Books:

1. W. Stallings, "Cryptography and Network Security: Principles and Practices", Prentice-Hall of India.
2. A. Kahate, "Cryptography and Network Security", McGraw-Hill.
3. B. Harsh, "Hacking", Khanna Publishing House.
4. P. Engebretson, "The Basic of Hacking and Penetration Testing", Syngress.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	2	-	-	-	-	3
CO2	-	1	2	3	3	3	2	1	-	-	-	3
CO3	2	2	-	-	2	-	2	-	-	-	-	3
CO4	-	1	1	1	3	2	2	1	-	-	-	3

Course Code	YCS7032
Course Title	Design of Secured Systems
Category	Professional Elective
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Cryptography and Network Security

Learning Objective:

In this course the students will be learning about the characteristics of secured systems and how to design them. For any applications it is very important to understand the security aspects. This course will help students analyze the vulnerabilities of a system and how those vulnerabilities could be mitigated through various approaches in developing complete systems.

Course Outcome:

CO1: To able to detect and analyze the vulnerabilities of a system

CO2: To able to assess the access control and protection mechanism

CO3: To able to identify security loopholes in web-based applications

Course Content:

Module 1: : Basic Cyber Security Concepts, Vulnerabilities and Exploits [12L]

Causes of vulnerabilities in network systems, threats from inside and outside, risk management, basic security design principles.

Vulnerabilities and exploits, buffer overflows, return-to-libc, ROPs, double frees, format string vulnerabilities, covert channels.

Module 2: Secured System Design: Access Control and Protection [8L]

Access control matrix, access control list, role-based access control, Multi-level security concepts, Unix-file security, access control in windows (NTFS), Android security resources.

Module 3: Web-Security [10L]

Basic web-security model, browser security model, authentication and session management, HTTPs, web-application security.

Web threat models, web-attacker, network-attacker, malware-attacker.

HTTP: rendering contents, document object model, HTML image tag security issues.

Port scanning, remote scripting, browser sandbox, security user interface.

Mixer contents and user attacks, cookies, frames and frame busting.

Module 4: Detection Mechanism and Case Studies [6L]

Malware detection mechanism, information-leak mechanism, static and dynamic techniques, static and dynamic techniques.

Case study of recent attacks.

Text/Reference Books:

1. M. Bishop, “Introduction to Computer Security”, Pearson Education.
2. W. Stallings, “Cryptography and Network Security: Principles and Practices”, Prentice-Hall of India.
3. A. Kahate, “Cryptography and Network Security”, McGraw-Hill.
4. P. Engebretson, “The Basic of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, Syngress Publisher.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	-	-	1	-	-	1	-	3
CO2	2	2	2	1	2	2	1	1	-	-	-	3
CO3	2	2	1	2	2	2	1	-	-	1	-	3

Course Code	YCS7103			
Course Title	Stream Laboratory 1 (Cyber Security)			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	0	0	4	2
Total Contact Hours	48			
Pre-requisites	a) Computer Network Laboratory b) Cryptography and Network Security			

Learning Objective:

By understanding the myriad cyber threats and actor motivations, the course will guide the students in accurately accessing threats, risks, and vulnerabilities, to minimize the potential for incidents and, when necessary, provide more thoughtful responses. Students will understand and protect the systems against security threats and software vulnerabilities and effectively apply their knowledge to the construction of secure software systems.

Course Outcome:

CO1: To learn how to describe various possible security attacks

CO2: To learn how to capture and classify various errors that lead to vulnerabilities

CO3: To apply knowledge to construct secure software systems

CO4: To understand various techniques for network protection and explore new tools and attacks in network security

CO5: To explain the protocols used for SSO and challenges, attacks related to Email communication

Suggestive List of Experiments:

1. Configure virtual networks using network simulator. **[1 day]**
2. Install Kali Linux and familiarization with various security assessment tools. **[2 days]**
3. Carry out port mapping and mounting network based attacks using NMAP tool. **[4 days]**
4. Exploit the vulnerabilities in a LAN environment to launch attacks. **[1 day]**
5. Analyze attack scenarios by observing network packets using WIRESHARK **[1 day]**
6. Perform the web penetration testing using BURPSUITE. **[2 days]**
7. Perform vulnerability assessment and auditing of wireless devices. **[1 day]**
8. Implementation of Windows and Android security using firewall and other tools. **[1 day]**

Text/Reference Books:

1. W. Stallings, “Cryptography and Network Security: Principles and Practices”, Prentice-Hall of India.

2. N. Godbole, “Information System Security”, Wiley.

3. P. Engebretson, "The Basic of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Publisher.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	3	3	-	1	-	2	-	-	2
CO2	1	2	2	1	1	1	2	-	2	-	-	1
CO3	1	3	1	2	2	2	1	-	2	-	-	1
CO4	1	3	2	-	1	-	2	-	1	-	-	-
CO5	1	1	1	1	2	1	1	-	1	-	-	2

Course Code	YCS7501
Course Title	Social Awareness
Category	Mandatory Non-CGPA Course
LTP & Credits	L: 3, T: 0, P: 0, Credits: 0
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course, the students will learn about the fundamental concepts of Social Awareness, with detailed understanding about the Human Rights. In addition, major social issues, religion-problems of the minorities, role of youth as a social agent shall be discussed. The course will be very helpful for the students in understand the society in different angles and form a holistic view.

Course Outcome:

CO1: To understand the agents of social change

CO2: To identify the tools to analyse the divided society scientifically through right-based approach

CO3: To identify and discuss the issues and problems prevalent in the society

Course Content:

Module 1: Basic concept and elements of Social Awareness [6L]

Understanding the Concept, need, basic guidelines for Social Awareness, The basic elements of Social Awareness: Respectfulness, Cleanliness, Thriftiness, Reason for the Weakening Social Responsibility, Education as the Core Method to Strengthen Stu-dent's Social Responsibility, Indianness Indian social ethos: Indian society, characteristics of Indian society, The concept of social problems, characteristics of social problem, types of social problem, social problem and social change in India.

Module 2: World trends & contemporary India [6L]

World trends today: Some basic data-Globalization- World Social Forum vs. World Economic Forum-the North South divide, Emerging challenges in contemporary India-(social, political, economic and cultural issues).

Module 3: Contemporary India: Social perspective [6L]

India: A land of cultural and religious diversity - secularism-communalism-fundamentalism, Indian politics and religion-problems of the minority and women empowerment.

Module 4: Major social problems and Mind set in India [6L]

Indian resources and Poverty; Manifestation and Measurement; Incidence and Magnitude; Causes, problems of poor and pains of poverty, Ignorance in Governance and corruption- The Concept; Causes and Impact of Corruption; Combating Corruption-Right to information act, Indian education system and illiteracy Illiteracy-Magnitude, Causes and Consequences -Functional illiteracy, Caste Discrimination – caste discrimination and process of exclusion, untouchability, caste and politics, Reservation policy, Child abuse, child labour -Child Population and the Working Children; Effects of Abuse on Children; Violence against woman- Women's Harassment; Nature, Extent and Char-

acteristics of Violence Against Women; Trans Gender issue.

Module 5: Role of the youth in social agent **[6L]**

Concept of Youth Unrest; Youth Protests, Agitations and Movements; Important Youth Agitations in India; Youth Leadership, Social Demands and Terrorism- The Concept; Characteristics, Causes and Consequences, Alcoholism, Drug Abuse, Drug Addiction and other social deviations- Aberrant Behaviour; Basic Concepts; Nature and Impact of Abusable Drugs; Extent and Nature of Drug Abuse; Role of Family & Peer Group in Drug in Abuse; Control over Drug Abuse, Youth and politics effective intervention by youth, Effective intervention by youth.

Module 6: Emerging alternatives **[6L]**

Participation in governance and Social Activism - Discovering social roles of individuals and groups, Human rights: Know your rights: Human rights (Universal Declaration of Human Rights- Concepts in human rights- Human rights violations.)and Economic, Social, Cultural rights, Educating the community - Influencing key decision makers, Changing local and national politics - Making our world a better place.

Text/Reference Books/Journals:

1. J. Berry, J. Trimble and E. Olmedo, "Assessment of acculturation: Field methods in cross-cultural research (pp. 291–324) (W. J. Lonner & J. W. Berry (Eds.))", Sage Publications, Inc.

2. C. Bichta, "Corporate Social Responsibility A Role in Government Policy and Regulation", CRI Publisher.

3. D. Jamali and R. Mirshak, "Corporate Social Responsibility (CSR): Theory and Practice in a Developing Country Context", Journal of Business Ethics, Vol-72, pp. 243-262, 2007

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	3	2	-	2	-	2
CO2	-	-	-	-	-	3	2	2	-	1	-	2
CO3	-	-	-	-	-	2	2	3	-	2	-	1

Course Code	YCS7502			
Course Title	History of Science and Technology			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Ancient Indian science and technology have contributed significantly to the foundations and growth of modern sciences. Yet there is little genuine material accessible to younger generations to help them understand and appreciate the extent of these contributions. Furthermore, History of Science and Technology acts as a natural bridge between humanities and sciences. This course will provide an overview of some of the chief landmarks in the development of science in India especially in the fields of mathematics, physics, astronomy, chemistry, medicine, etc. The modules will include not only specific advances or breakthroughs, but also discuss the epistemological and cultural contexts behind them. The course promises to be an eye-opener to students from a variety of disciplines.

Course Outcome:

CO1: To understand the evolution of science and technology in India.

CO2: To explain the origin of astronomy and mathematics in ancient India.

CO3: To assess the developments in various branches of science and technology.

Course Content:

Module 1: Understanding Science from the Ancient Indian Perspective [4L]

Ontology.
Epistemology.
Methodology.

Module 2: Developments in Science and Technology [6L]

Science and scientists: chronological development and evolution.
Development of science and technology in specific areas: space technology, nuclear technology, bio-technology renewable energy, etc.

Module 3: Astronomy [5L]

Ritual origins of classical Indian Astronomy.
Knowledge revealed in the *Samhitas*, *Brahmanas*, and *Sutras*.
Pre-*Siddhantic* and *Siddhantic* developments.

Module 4: Mathematics [6L]

Knowledge revealed in Vedic and Post-Vedic texts.

Contributions by eminent mathematicians: Aryabhata, Brahmagupta, Bhaskaracharya. The Kerala School of Mathematics.
Traditions of Computational Techniques.

Module 5: Medicine and Health Sciences **[5L]**

Ayurveda.
Yoga.
Contributions by Charaka and Sushruta.

Module 6: Allied Sciences and Technology **[10L]**

Contributions in the field of Architecture.
Developments and practices in Civil Engineering.
Advances in Metallurgy.
Findings and applications of Chemistry.

Text/Reference Books:

1. D.M. Bose, S.N. Sen and B.V. Subbarayappa, “A Concise History of Science in India”, 1989.
2. H. Selin and R. Narasimha (eds.), “Encyclopaedia of Classical Indian Sciences”, 2007.
3. A. Ghosh, “History of Science in India – Astronomy”, 2014.
4. D.P. Chattopadhyaya, “History of Science and Technology in Ancient India”, 1986.
5. S. Balachandra Rao, “Indian Astronomy – A Primer”, 2008.
6. B.S. Yadav et al. (eds.), “Ancient Indian Leaps into Mathematics”, 2011.
7. T. Padmanabhan (ed.), “Astronomy in India: A Historical Perspective”, 2010.
8. B.V. Subbarayappa (ed.), “Chemistry and Chemical Techniques in India”, 1999.
9. T.R.N. Rao and S. Kak (eds.), “Computing Science in Ancient India”, 2000.
10. G. Ifrah, “The Universal History of Numbers: From Prehistory to the Invention of the Computer, 2005.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	1	3	-	2	-	3
CO2	-	-	-	-	-	1	3	2	-	2	-	2
CO3	-	-	-	-	-	1	2	3	-	1	-	2

Course Code	YCS7503
Course Title	Indian Liberal Arts
Category	Mandatory Non-CGPA Course
LTP & Credits	L T P Credits 3 0 0 0
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course, the students will learn about the fundamental concepts of Indian Liberal Arts. Liberal Arts courses are rather new in India. They fulfill an important gap in the Indian education system. The course will be very helpful for the students to enhance their understanding of liberal arts.

Course Outcome:

CO1: To learn about the liberal Arts and how they are changing India

CO2: To remember and make the students aware of Indian constitution

CO3: To explain Globalization and the impact of Globalization India

CO4: To learn about Indian Economy and various concepts related to

that **CO5:** To illustrate various aspects of Culture Studies

CO5: To demonstrate Public Speaking and Dramatization as Performing Arts

Course Content:

Module 1: Principles of Liberal Arts [7L]

Definitions of Liberal Arts Greek centers of learning like Athens, Sparta and Gurukul in Ancient India. Changing Profiles of Liberal Arts education. Benefits of Liberal Arts education. Future trends and challenges of Liberal Arts. The via media between science, technology and culture. Fostering human values in the age of science and technology.

Module 2: Introduction to the Constitution of India [5L]

The Constituent Assembly and the Indian Constitution. Preamble to the Constitution of India. Rights and Fundamental Duties, Directive Principles. Concept of Welfare State and its different Constitutional Safeguards.

Module 3: Globalization, Sociology and Psychology of Social Change [6L]

Globalization- Nature and Concept. Impact of Globalization in general and in India. Dynamics of Globalization and Economic growth. Cultural dynamics of globalization. Implication of globalization on media, environment and folk arts.

Module 4: Indian Economics [5L]

Per Capita Income, National Income and its composition. Poverty, Inequality and Unemployment. Human Development Index. Foreign Direct Investment in India.

Module 5: Culture and Literary Studies **[8L]**

Concept of Culture: Meaning and Definition. Introduction to Cultural Studies: definition, aim, scope, methodology. Popular Culture: Meaning, Nature and definition. Rise of popular culture. Mass culture, popular culture and high culture. Popular culture in India. Reading Culture: Interdisciplinary perspectives. Digital culture and ethics,

Module 6: Dramatics Performing Arts and Public Speaking **[5L]**

Concept of performing arts. Definition, nature, scope and significance of dramatics. Role of director in the development of play. Acting as an art and science. Relationship between Indian theatre and new electronic media such as radio, TV and Cinema. Changing nature of Indian Dramatics and its presentation techniques. Public speaking as an art and its preparation.

Text/Reference Books/Journals:

1. "The Philosophy Book: Big Ideas Simply Explained", D. K. Publishers.
2. D. Pattanaik, "Indian Culture, Art and Heritage", Pearson Education India.
3. S. Nitin, "Art and Culture", McGraw-Hill Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	1	-	2	-	-
CO2	-	-	-	-	-	-	2	1	-	2	-	-
CO3	-	-	-	-	-	-	1	2	-	2	-	-
CO4	-	-	-	-	-	-	1	1	-	1	-	-
CO5	-	-	-	-	-	-	1	2	-	1	-	-

Semester 8 Curriculum and Syllabus

SEMESTER-8							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG8001	Principles of Management	2	0	0	2
2	PE		Elective V	3	0	0	3
		YCS8031	Cyber Law and Security Policy				
		YCS8032	Quantum Computing		0		
3	PE		Elective VI	3	0	0	3
		YCS8031	Cyber Law and Security Policy				
		YCS8032	Quantum Computing				
PRACTICAL							
4	PE	YCS8103	Stream Lab 2: Cyber Security	0	0	4	2
SESSIONAL(ONLY INTERNAL EVALUATION)							
5	PROJ	YCS7204	Project II	0	0	6	3
MANDATORY NON-CGPA COURSE							
6	MC	YCS8501	Indian Culture and Tradition	3	0	0	0
TOTAL				**11**	**0**	**10**	**13**

Course Code	YMG8001			
Course Title	Principles of Management			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the fundamental principles of management used in the industry and the different organizations. They will learn of the various field of study of management and the theories related to them and will be able to practically apply these theories in their management skills as well. At the end of the course, the students will be able to understand and interpret the proper knowledge and skills necessary to work as a proper manager in the field.

Course Outcome:

CO1: To familiarize the students with the origins of management principles and compare them with the modern trends in management theories

CO2: To understand the essential functions of management along with the theories framed by management experts in the business field

CO3: To explain the managerial process and the functions related to them which help them bring about change

CO4: To understand the proper relationship between the various levels of management in a business Organisation and the process by which to achieve the objectives

CO5: To explain the importance of feedback controlling of the management process along with the relevant theories, and to properly understand the process by which to apply proper management principles in modern day practices in the business Organisation and solve problems based on them

Course Content:

Module 1: Management [4L]

Management (Definition, Nature, Importance, Evolution), Contribution of Fayol, Taylor, Hawthorne, Maslow, Management- Art or Science?, Functions of Manager (Duties and responsibilities), Ethics in Management, Functions of Management

Module 2: Planning and Control [4L]

Planning (Steps, types and barriers), Mckinsey Approach, SWOT, Operational and Strategic Planning, Controlling (Concept, Relationship with Planning, Process, Dimensions), MBO

Module 3: Decision Making and Organizing [4L]

Decision Making Process, Certainty and Uncertainty of Decisions, Brainstorming, Process of Organizing, Authority and Responsibility, Delegation and Empowerment, Centralization and Decentralization, Departmentation

Module 4: Staffing **[4L]**

Manpower Planning, Job Design, Selection and Recruitment, Training and Development, Performance Appraisal

Module 5: Leadership and Communication **[3L]**

Role of leadership, theories of leadership, qualities of a good leader, Development of leadership, Communication process and types, Electronic Media

Module 6: Group Dynamics **[2L]**

Group- Concept, Stages of Group formation, types of groups

Module 7: Recent Trends in Management **[3L]**

Social Responsibility in management, Changes in management, TQM, Stress Management, International and Global Management, Crisis Management

Text/Reference Books:

1. H. Cortes, D. S. Bright and E. Hartman, “Principles of Management”.
2. R. B. Rudani, “Principles of Management”.
3. M. Gupta, “Principles of Management”.
4. L. M. Prasad, “Principles and Practice of Management”.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	1	2	1	1	-	3	-	3
CO2	2	3	1	-	2	1	1	-	2	3	2	2
CO3	1	-	1	1	2	1	-	1	1	1	3	2
CO4	3	1	2	1	-	1	-	-	-		1	1
CO5	2	1	1	3	-	-	1	1	-	1	3	2

Course Code	YCS8031			
Course Title	Cyber Law and Security Policy			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Cryptography and Network Security b) Fundamentals of Cyber Security			

Learning Objective:

In this course, the students will understand, explore and acquire a critical understanding of laws and regulations that exist in cyber space. Topics like IT Act 2000, legal issues in e-business, and case studies will be discussed.

Course Outcome:

CO1: To explain the fundamental concepts of Cyber Law and their implications

CO2: To analyze the essential concepts under IT Act 2000

CO3: To explain and analyze the rules and regulations that exists in cyber space

Course Content:

Module 1: Introduction to Cyber Law [8L]

Evolution of information technology: emergence of cyber space, cyber jurisprudence, jurisprudence and law, doctrinal approach, consensual approach.
Cyber ethics, cyber jurisdiction, hierarchy of courts, civil and criminal jurisdictions, cyberspace: web space, web hosting and web development agreement, legal and technological significance of domain names, Internet as a tool for global access.

Module 2: Information Technology Act [8L]

Overview of IT Act 2000, amendments and limitations of IT Act, digital signatures, drawbacks of public-key and private-key cryptography, electronic governance, legal recognition of electronic records, legal recognition of digital signature certifying authorities, cyber crime and offences, network service providers liability, cyber regulations appellate tribunal, penalties and adjudication.

Module 3 : Cyber Law and Related Legislation [8L]

Patent law, trademark law, copyright, software piracy, domain names and copyright disputes, electronic database and its protection, civil procedure code, IT act and criminal procedural code.
Relevant sections of: Indian evidence act,bankers book evidence act, Indian Penal Code, Reserve Bank of India Act. Law relating to employees and Internet, alternative dispute resolution, online disputes resolution.

Module 4 : Electronic Business and Legal Issues [6L]

Evolution and development in E- commerce, paper versus paper-less contracts. E-Commerce models: B2B, B2C, E-security.
Application area: business, taxation, electronic payments, supply chain, E-markets, emerging trends.

Module 5 : Case Studies on Cyber Crime **[6L]**

Harassment over emails, email spoofing, cyber pornography, cyber stalking.

Text/Reference Books:

1. K. Kumar, "Cyber Laws: Intellectual Property and E-Commerce Security", Dominant Publisher.
2. R. D. Ryder, "Guide to Cyber Laws", Wadhwa and Company.
3. NIIT, "Information Security: Policies and Implementation Issues", Prentice-Hall of India.
4. V. Sharma, "Handbook of Cyber Laws", Prentice-Hall of India.
5. Lawmann's, "The Information Technology Act 2000", Law Literature Publication, Kamal Publishers.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	-	-	1	-	-	-	2	1
CO2	1	-	1	3	3	3	2	2	-	-	1	1
CO3	1	1	2	2	2	2	1	-	-	-	2	1

Course Code	YCS8032				
Course Title	Quantum Computing				
Category	Professional Elective				
LTP & Credits	L	T	P	Credits	
	3	0	0	3	
Total Contact Hours	36				
Pre-requisites	a) Linear Algebra b) Formal Language and Automata Theory				

Learning Objective:

In this course, the students will be taught about the basic principles of quantum computing, the fundamental differences between conventional computing and quantum computing, several basic quantum computing algorithms and the classes of problems that can be expected to be solved well by quantum computers.

Course Outcome:

CO1: To explain thebasics of complex vector spaces

CO2: To learn and understand quantum mechanics as applied toquantum computing

CO3: To explain the fundamentals of quantum computations

CO4: To understand and analyze the basics quantum circuits and quantum gates

CO5: To apply the knowledge of quantum computing to analyze various quantum algorithms

Course Content:

Module 1: Introduction **[7L]**

Complex Vector Space & Matrices: complex number basics, properties of complex vector space, basis and dimension, bra-ket formalism, inner products and Hilbert space, outer products, Eigen values & Eigen Vectors, Hermitian, unitary and normal matrices, observables, spectral theorem, tensor products.

Module 2: Qubits and Quantum Operations **[7L]**

Quantum Mechanics: quantum states and superposition, entangled quantum state, unitary evolution of closed systems, general quantum operations: density operator of pure & mix state, measurement: projective measurement, Hermitian operator formalism for measurement, and Positive Operator- Valued Measures (POVM), EPR Paradox and Bell's Theorem.

Module 3: Quantum Gates and Quantum Circuits **[8L]**

Quantum Circuit Model: Bits & Qubits, classical, reversible and quantum gates, single-qubit Pauli and Hadamard gates, two-qubit controlled gates, quantum state transformation, No-Cloning theorem, quantum teleportation & dense coding, quantum parallelism, Deutsch-Jozsa algorithm, Simon's periodicity algorithm.

Module 4: Quantum Algorithms **[8L]**

Algorithms with super-polynomial speedup: Quantum Fourier transform and phase estimation, order finding problem, Shor's order finding (factoring) algorithm, Grover's search algorithm, amplitude amplification.

Module 5: Quantum Applications and Security **[6L]**

Quantum Information: basic quantum cryptography, quantum noise and error correction, physical realization of quantum computer, Recent trends in Quantum Computing Research: quantum algorithm compilation: constructing multi-qubit quantum operations, optimization of quantum circuit, nearest neighbor constraint, simulating quantum operation on a classical system, Quantum Computing Applications: machine learning, image processing, optimization, cyber security & cryptography.

Text/Reference Books:

1. M. A. Mannucci and N. S. Yanofsky, "Quantum computing for computer scientists (1st Ed.)",Cambridge University Press.
2. D. McMahon, "Quantum computing explained (1st Ed.)", Wiley.
3. M. A. Nielsen and I. L. Chuang, "Quantum computation and quantum information (2nd Ed.)", Cambridge University Press.
4. D. J. Griffiths, "Introduction to Quantum Mechanics (2nd Ed.)", Prentice Hall.
5. M. Lanzagorta and J. Uhlmann, "Quantum Computer Science (1st Ed.)", Morgan and Claypool Publishers.
6. P. Kaye, R. Laflamme and M. Mosca, "An Introduction to Quantum Computing (1st Ed.)", Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	-	-	1	-	-	-	-	1
CO2	2	3	1	2	-	-	1	-	-	-	-	1
CO3	3	2	2	1	-	-	1	-	-	-	-	1
CO4	3	3	2	3	3	-	1	-	-	-	-	2
CO5	3	3	3	3	3	-	1	-	-	-	-	3

Course Code	YCS8103			
Course Title	Stream Laboratory 2 (Cyber Security)			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	0	0	4	2
Total Contact Hours	48			
Pre-requisites	a) Computer Network Laboratory b) Cryptography and Network Security c) Stream Laboratory 1 (Cyber Security)			

Learning Objective:

By understanding the advance myriad cyber threats and actor motivations, and apply and configure different applications to protect software vulnerabilities and effectively apply their knowledge to the construction of secure software systems.

Course Outcome:

CO1: To explain and classify different cyber threats

CO2: To learn and study the technique to develop Cyber Threat Intelligence Systems

CO3: To apply knowledge to study active and passive attacks

CO4: To understand various techniques to collect cyber threat information

CO5: To explore how to help in analyzing and disseminating cyber threat intelligence

Suggestive List of Experiments:

1. Configure and working with Keylogger. **[1 day]**
2. Mounting distributed denial-of-service (DDoS) attacks. **[2 days]**
3. To implement cloud security posture management (CSPM). **[2 days]**
4. To perform SQL Vulnerability assessment and cross-site scripting. **[2 days]**
5. To attempt Bug Bounties and hackathons. **[1 day]**
6. Small project to develop a penetration testing tool with essential features. **[4 days]**

Text/Reference Books:

1. J. Robertson, A. Diab, E. Marin, E. Nunes, V. Paliath, J. Shakarian and P. Shakarian, “Dark-Web Cyber Threat Intelligence Mining”, Cambridge University Press.

2. B. Gourley, “The Cyber Threat”, Createspace Independent Publisher.

3. S. Davidoff and J. Ham, “Network Forensics: Tracking Hackers through Cyberspace”, Prentice Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	2	1	-	-	-	-	-	1
CO2	1	2	2	1	1	-	-	-	-	-	-	2
CO3	2	2	1	-	1	1	-	-	2	-	-	2
CO4	2	2	2	1	1	1	-	-	2	-	-	-
CO5	1	1	1	2	3	3	-	-	2	-	-	1

Course Code	YCS8501			
Course Title	Indian Culture and Tradition			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites				

Learning Objective:

India has a diverse and distinct culture that has been developing for thousands of years and varies from region to region.

The main objectives of this course are to familiarize students with various aspects of the culture and heritage of India, to develop among students a feeling of love and a sense of belonging towards the nation, to promote an integral and holistic growth of young minds, to develop the expressive and communicative power of logical reasoning, and to develop student sensibility with regard to issues of gender in contemporary India.

Course Outcome:

CO1: To understand the main features of Indian culture, civilization and Heritage.

CO2: To connect up and explain basics of Indian Traditional knowledge.

CO3: To explain the important issues related to gender in contemporary India.

CO4: To describe the socio-cultural insecurities caused by globalization.

CO5: To appreciate the ancient aesthetics and knowledge of construction, and also stimulate interest to know the subject in detail.

Course Content:

Module 1: Culture - An Introduction **[6L]**

Traditional and Modern concepts of Culture.
Notions of Culture in textual tradition, anthropological, archaeological and sociological understanding of the term culture.
Elements of Culture, concept of Indian culture and value system. Relation between culture and civilization.

Module 2: Indian Religion, Philosophy, and Practices **[6L]**

Pre-Vedic and Vedic Religion.
Buddhism, Jainism, Six System Indian Philosophy.
Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement.
Socio religious reform movement of 19*th* century, Modern religious practices.

Module 3: Indian Culture Studies **[8L]**

Indian Society and Culture in historical and contemporary perspectives.
Moments and Milestones in the history of India's freedom Movement, Historiography.
Multiculturalism, Ethnicity, New Social Thoughts and movements (including environmental movement), Diaspora.

Indian Polity, Impact of Globalization on Indian society, Post Modernism, World Politics and terrorism.
Feminism (including eco-feminism), Women's Empowerment, Gender discrimination &
Gender Violence.

Module 4: Cultural Heritage and Performing Arts **[6L]**
Cultural Heritage: its significance and its constituents.
Importance of Built Heritage at the level of Locality, Region, Nation and World.
Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals.
Current developments in Arts and Cultural.
Indian's Cultural Contribution to the World.

Module 5: Socio-Cultural Issues in Contemporary India **[5L]**
Caste System
Issues related to woman: Gender Discrimination, Dowry System
Communalism
Issues related to the Elderly
Issues of poverty and
Unemployment Problems of
Children

Module 6: Student Activism and Youth Culture **[5L]**
History of Youth Movement in India.
Nature of Students Activism in India.
Indian students' Unrest in Global Perspective.
Causes of student Activism.
Youth Culture and Future Development

Text/Reference Books:

1. N. Singhania, Indian Art and Culture, McGraw-Hill.
2. Y. Singh, Modernization of Indian Tradition, Publisher-Rawat.
3. V. Pandey, Indian Society And Culture, Publisher - Rawat.
4. N. Hasnain, Indian Society And Social Issues, McGraw-Hill.
5. D. Pattanaik, Indian Culture, Art and Heritage, Pearson Education India.
6. Dr. P. K. Agrawal, Indian Culture, Art and Heritage, Prabhat Prakashan.
7. Dr. S. S. Mathur, A Sociological Approach to Indian Education, Vinod Pustak Mandir Agra.
8. K. A. Jacobsen, Modern Indian Culture and Society, Routledge (1st edition).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	1	-	-	-	1
CO2	-	-	-	-	-	-	1	2	-	-	-	1
CO3	-	-	-	-	-	-	2	1	-	-	-	1
CO4	-	-	-	-	-	-	1	2	-	-	-	1
CO5	-	-	-	-	-	-	2	1	-	-	-	1

R21 Curriculum

B.Tech. in Computer Science and Engineering with specialization in "Embedded Systems and Robotics"

JIS University
Agarpara, Kolkata

SEMESTER-1							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT1001	Mathematics I	3	1	0	4
2	BS	YPH1001	Physics	3	1	0	4
3	ES	YCS1001	Basic Electronics	3	0	0	3
4	ES	YCS1002	Engineering Mechanics	3	0	0	3
5	ES	YCS1003	Basic Problem Solving	2	1	0	3
6	HS	YED1001	English for Communication	2	0	0	2
PRACTICAL							
7	BS	YPH1101	Physics Laboratory	0	0	3	1.5
8	ES	YCS1101	Basic Electronics Laboratory	0	0	3	1.5
9	ES	YCS1102	Engineering Drawing and Graphics	0	0	3	1.5
10	HS	YED1101	Language Laboratory	0	0	2	1
TOTAL				**16**	**3**	**11**	**24.5**

SEMESTER-2							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT2001	Mathematics II	3	1	0	4
2	BS	YCH2001	Chemistry	3	0	0	3
3	ES	YCS2001	Basic Electrical Engineering	3	0	0	3
4	ES	YCS2002	Fundamentals of Programming	2	1	0	3
PRACTICAL							
5	BS	YCH2101	Chemistry Laboratory	0	0	3	1.5
6	ES	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	1.5
7	ES	YCS2102	Programming Practices I	0	0	3	1.5
EMBEDDED(THEORY + PRACTICAL)							
8	ES	YCS2301	Workshop Practice	1	0	3	2
MANDATORY NON-CGPA COURSE							
9	MC	YCS2501	Universal Human Values and Professional Ethics	3	0	0	0
10	MC	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	0
TOTAL				**15**	**2**	**15**	**19.5**

SEMESTER-3							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT3001	Discrete Structures	3	0	0	3
2	BS	YMT3002	Probability and Statistics	3	0	0	3
3	PC	YCS3001	Digital Circuits and Logic Design	3	1	0	4
4	PC	YCS3002	Data Structures and Algorithms	3	1	0	4
5	OE	YCS3003	Object Oriented Programming	3	0	0	3
PRACTICAL							
6	PC	YCS3101	Digital Circuits Laboratory	0	0	3	1.5
7	PC	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	1.5
8	OE	YCS3103	Object Oriented Programming Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS3501	Behavioral and Interpersonal Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS3201	Innovative Project I	0	0	3	1.5
TOTAL				**15**	**2**	**15**	**23**

SEMESTER-4							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS4001	Computer Organization and Architecture	3	0	0	3
2	PC	YCS4002	Design and Analysis of Algorithms	3	1	0	4
3	PC	YCS4003	Data Base Management System	3	0	0	3
4	PC	YCS4004	Formal Language and Automata	3	0	0	3
5	HS	YMG4001	Economics for Engineers	2	0	0	2
PRACTICAL							
6	PC	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	1.5
7	PC	YCS4102	Algorithms Laboratory	0	0	3	1.5
8	PC	YCS4103	Data Base Management System Laboratory	0	0	3	1.5
9	PC	YCS4104	Programming Practices II	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
10	MC	YCS4501	Constitution of India	3	0	0	0
SESSIONAL (ONLY INTERNAL EVALUATION)							
11	PROJ	YCS4201	Innovative Project II	0	0	3	1.5
TOTAL				**17**	**1**	**15**	**22.5**

SEMESTER-5							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS5001	Operating Systems	3	0	0	3
2	PC	YCS5002	Embedded Systems	3	0	0	3
3	PC	YCS5003	Introduction to Data Science	3	0	0	3
4	PC	YCS5004	Advanced Computer Architecture	3	0	0	3
5	OE		Elective I	3	0	0	3
		YCS5005	Multimedia Technology				
		YCS5006	Operations Research				
		YCS5007	Communication Engineering				
PRACTICAL							
6	PC	YCS5101	Operating Systems Laboratory	0	0	3	1.5
7	PC	YCS5102	Embedded Systems Laboratory	0	0	3	1.5
8	PC	YCS5103	Data Science Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS5501	Environmental Science	3	0	0	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS5201	Innovative Project III	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**21**

SEMESTER-6							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS6001	Computer Networks	3	0	0	3
2	PC	YCS6002	Software Engineering	3	0	0	3
3	PC	YCS6003	Compiler Design	3	0	0	3
4	PC	YCS6004	Cryptography and Network Security	3	0	0	3
5	OE		Elective II	3	0	0	3
		YCS6005	Internet Technology				
		YCS6006	E-Commerce and ERP				
		YCS6007	Cloud Computing				
		YCS6008	Java Programming				
PRACTICAL							
6	PC	YCS6101	Computer Networks Laboratory	0	0	3	1.5
7	PC	YCS6102	Software Engineering Laboratory	0	0	3	1.5
BLENDED (MOOC + INTERNAL ASSESSMENT)							
8	OE	YCS6401	MOOCS Elective I	3	0	0	3
MANDATORY NON-CGPA COURSE							
9	MC	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS6201	Innovative Project IV	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**22.5**

SEMESTER-7							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG7001	Value and Ethics in Profession	2	0	0	2
2	PE		Elective III	3	0	0	3
		YCS7021	Architecture for Embedded Systems				
		YCS7022	Sensor Networks and IoT				
		YCS7023	Robotics				
3	PE		Elective IV	3	0	0	3
		YCS7021	Architecture for Embedded Systems				
		YCS7022	Sensor Networks and IoT				
		YCS7023	Robotics				
PRACTICAL							
4	PE	YCS7102	Stream Lab 1: Embedded Systems and Robotics	0	0	4	2
BLENDED(MOOC + INTERNAL ASSESSMENT)							
5	OE	YCS7401	MOOCS Elective II	3	0	0	3
SESSIONAL(ONLY INTERNAL EVALUATION)							
6	PROJ	YCS7204	Project I	0	0	6	3
MANDATORY NON-CGPA COURSE							
7	MC	YCS7501	Social Awareness	3	0	0	0
		YCS7502	History of Science and Technology				
		YCS7503	Indian Liberal Arts				
TOTAL				**14**	**0**	**10**	**16**

SEMESTER-8							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG8001	Principles of Management	2	0	0	2
2	PE		Elective V	3	0	0	3
		YCS8021	Embedded Control Systems				
		YCS8022	Computer Vision				
		YCS8023	Software for Embedded System				
3	PE		Elective VI	3	0	0	3
		YCS8021	Embedded Control Systems				
		YCS8022	Computer Vision				
		YCS8023	Software for Embedded System				
PRACTICAL							
4	PE	YCS8102	Stream Lab 2: Embedded System and Robotics	0	0	4	2
SESSIONAL(ONLY INTERNAL EVALUATION)							
5	PROJ	YCS7204	Project II	0	0	6	3
MANDATORY NON-CGPA COURSE							
6	MC	YCS8501	Indian Culture and Tradition	3	0	0	0
TOTAL				**11**	**0**	**10**	**13**

Credit Distribution Ratio:

Category	Credit Allocation As per Autonomy	Credit Allocation As per AICTE
Humanities, Social Sciences & Management Courses	9	12*
Basic Sciences Courses	24	25*
Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc	23	24*
Professional Core Courses	61.5	48*
Professional Elective Courses relevant to chosen	16	18*
Open Elective Courses-Electives from other technical and /or emerging subjects	16.5	18*
Project work, seminar and internship in industry or elsewhere	12	15*
Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracurricular activities		
Total	162	160*

Credit Distribution in details:

A. Humanities, Social Sciences & Management Courses (HS)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YED1001	English for Communication	2	0	0	2	2
2	YED1101	Language Laboratory	0	0	2	2	1
3	YMG4001	Economics for Engineers	2	0	0	2	2
4	YMG7001	Value and Ethics in Profession	2	0	0	2	2
5	YMG8001	Principles of Management	2	0	0	2	2
		Total Credit:					**9**

B. Basic Sciences Courses (BS)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YMT1001	Mathematics I	3	1	0	4	4
2	YPH1001	Physics	3	1	0	4	4
3	YPH1101	Physics Laboratory	0	0	3	3	1.5
4	YMT2001	Mathematics II	3	1	0	4	4
5	YCH2001	Chemistry	3	0	0	3	3
6	YCH2101	Chemistry Laboratory	0	0	3	3	1.5
7	YMT3001	Discrete Structures	3	0	0	3	3
8	YMT3002	Probability and Statistics	3	0	0	3	3
		Total Credit:					**24**

C. Engineering Sciences Courses including Workshop, Drawing, Basics of Elec-trical/Mechanical/Computer etc. (ES)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS1001	Basic Electronics	3	0	0	3	3
2	YCS1101	Basic Electronics Laboratory	0	0	3	3	1.5
3	YCS1002	Engineering Mechanics	3	0	0	3	3
4	YCS1102	Engineering Drawing and Graphics	0	0	3	3	1.5
5	YCS1003	Basic Problem Solving	2	1	0	3	3
6	YCS2001	Basic Electrical Engineering	3	0	0	3	3
7	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	3	1.5
8	YCS2002	Fundamentals of Programming	2	1	0	3	3
9	YCS2102	Programming Practices I	0	0	3	3	1.5
10	YCS2301	Workshop Practice	1	0	3	4	2
		Total Credit:					**23**

D. Professional Core Courses (PC)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	YCS3001	Digital Circuits and Logic Design	3	1	0	4	4
2	YCS3101	Digital Circuits Laboratory	0	0	3	3	1.5
3	YCS3002	Data Structures and Algorithms	3	1	0	4	4
4	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	3	1.5
5	YCS4001	Computer Organization and Architecture	3	0	0	3	3
6	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	3	1.5
7	YCS4002	Design and Analysis of Algorithms	3	1	0	4	4
8	YCS4102	Algorithms Laboratory	0	0	3	3	1.5
9	YCS4003	Data Base Management System	3	0	0	3	3
10	YCS4103	Data Base Management System Laboratory	0	0	3	3	1.5
11	YCS4004	Formal Language and Automata	3	0	0	3	3
12	YCS4104	Programming Practices II	0	0	3	3	1.5
13	YCS5001	Operating Systems	3	0	0	3	3
14	YCS5101	Operating Systems Laboratory	0	0	3	3	1.5
15	YCS5002	Embedded Systems	3	0	0	3	3
16	YCS5102	Embedded Systems Laboratory	0	0	3	3	1.5
17	YCS5003	Introduction to Data Science	3	0	0	3	3
18	YCS5103	Data Science Laboratory	0	0	3	3	1.5
19	YCS5004	Advanced Computer Architecture	3	0	0	3	3
20	YCS6001	Computer Networks	3	0	0	3	3
21	YCS6101	Computer Networks Laboratory	0	0	3	3	1.5
22	YCS6002	Software Engineering	3	0	0	3	3
23	YCS6102	Software Engineering Laboratory	0	0	3	3	1.5
24	YCS6003	Compiler Design	3	0	0	3	3
25	YCS6004	Cryptography and Network Security	3	0	0	3	3
		Total Credit:					**61.5**

E. Professional Elective Courses relevant to chosen specialization/Branch (PE)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS7021	Architecture for Embedded Systems	3	0	0	3	3
	YCS7022	Sensor Networks and IoT					
	YCS7023	Robotics					
2	YCS7021	Architecture for Embedded Systems	3	0	0	3	3
	YCS7022	Sensor Networks and IoT					
	YCS7023	Robotics					
3	YCS7102	Stream Lab 1: Embedded Systems and Robotics	0	0	4	4	2
4	YCS8021	Embedded Control Systems	3	0	0	3	3
	YCS8022	Computer Vision					
	YCS8023	Software for Embedded System					
5	YCS8021	Embedded Control Systems	3	0	0	3	3
	YCS8022	Computer Vision					
	YCS8023	Software for Embedded System					
6	YCS8102	Stream Lab 2: Embedded Systems and Robotics	0	0	4	4	2
		Total Credit:					**16**

F. Open Elective Courses-Electives from other technical and / or emerging subjects (OE)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS3003	Object Oriented Programming	3	0	0	3	3
2	YCS3103	Object Oriented Programming Laboratory	0	0	3	3	1.5
2	YCS5005	Multimedia Technology	3	0	0	3	3
	YCS5006	Operations Research					
	YCS5007	Communication Engineering					
4	YCS6005	Internet Technology	3	0	0	3	3
	YCS6006	E-Commerce and ERP					
	YCS6007	Cloud Computing					
	YCS6008	Java Programming					
5	YCS6401	MOOCS Elective I	3	0	0	3	3
6	YCS7401	MOOCS Elective II	3	0	0	3	3
		Total Credit:					**16.5**

G. Project work, seminar and internship in industry or elsewhere (PW)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS3201	Innovative Project I	0	0	3	3	1.5
2	YCS4201	Innovative Project II	0	0	3	3	1.5
3	YCS5201	Innovative Project III	0	0	3	3	1.5
4	YCS6201	Innovative Project IV	0	0	3	3	1.5
5	YCS7204	Project I	0	0	6	6	3
6	YCS8201	Project II	0	0	6	6	3
		Total Credit:					**12**

H. Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracur- ricular activities] (MC)							
Sl. No.	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
			L	T	P	Total	
1	YCS2501	Universal Human Values and Professional Ethics	3	0	0	3	0
2	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	3	0
3	YCS3501	Behavioral and Interpersonal Skills	0	0	3	3	0
4	YCS4501	Constitution of India	0	0	3	3	0
5	YCS5501	Environmental Science	0	0	3	3	0
6	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	3	0
7	YCS7501	Social Awareness	0	0	3	3	0
	YCS7502	History of Science and Tech- nology					
	YCS7503	Indian Liberal Arts					
8	YCS8501	Indian Culture and Tradition	0	0	0	3	0
		Total Credit:					**0**

Semester 1 Curriculum and Syllabus

SEMESTER-1							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT1001	Mathematics I	3	1	0	4
2	BS	YPH1001	Physics	3	1	0	4
3	ES	YCS1001	Basic Electronics	3	0	0	3
4	ES	YCS1002	Engineering Mechanics	3	0	0	3
5	ES	YCS1003	Basic Problem Solving	2	1	0	3
6	HS	YED1001	English for Communication	2	0	0	2
PRACTICAL							
7	BS	YPH1101	Physics Laboratory	0	0	3	1.5
8	ES	YCS1101	Basic Electronics Laboratory	0	0	3	1.5
9	ES	YCS1102	Engineering Drawing and Graphics	0	0	3	1.5
10	HS	YED1101	Language Laboratory	0	0	2	1
TOTAL				**16**	**3**	**11**	**24.5**

Course Code	YMT1001			
Course Title	Mathematics I			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the basic knowledge of matrix algebra, function of several variables and Improper integral. At the end of the course, the students will be able to solve engineering problems.

Course Outcome:

CO1: To understand and remember the distinctive characteristics of matrix algebra and calculus

CO2: To understand the theoretical concept of vector space and apply the concepts to solve problems

CO3: To understand and remember definite and improper integrals and apply the concept to solve problems

CO4: To understand the concept of functions of several variables and apply the concept to solve problems

Course Content:

Module 1: Matrix Algebra **[11L]**

Matrix Algebra: Inverse and rank of a matrix; Orthogonal matrix and its properties, trace of a matrix, Consistency and inconsistency of linear systems of equations, Solution of linear system of equation by Gauss elimination, matrix inverse method. Eigenvalues and eigenvectors; Cayley-Hamilton Theorem, Diagonalization of a matrix.

Module 2: Vector Spaces **[15L]**

Vector Spaces: Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map. Inner product spaces, Gram-Schmidt orthogonalization.

Module 3: Definite and Improper integral **[6L]**

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties.

Module 4 : Calculus **[6L]**

Calculus: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 5 : Function of Several variables **[10L]**

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian, Maxima and minima

of functions of two variables, Method of Lagrange multipliers.

Text/Reference Books:

1. E. Kreyszig, "Advanced Engineering Mathematics (9^{th} Edition)", John Wiley & Sons.
2. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
3. T. Veerarajan, "Engineering Mathematics for First Year", Tata McGraw-Hill.
4. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers.
5. N.P. Bali and M.Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	2	-	-	-	-	-	1
CO2	3	2	-	3	-	3	-	-	-	-	-	1
CO3	3	2	2	1	-	1	-	-	-	-	-	1
CO4	2	3	1	3	-	1	-	-	-	-	-	1

Course Code	YPH1001
Course Title	Physics
Category	Basic Science
LTP & Credits	L: 3, T: 1, P: 0, Credits: 4
Total Contact Hours	48
Pre-requisites	None

Learning Objective:

The aim of the course is to provide the students with adequate exposure about the basic principles of physics along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome:

CO1: To understand and remember the basic principle of Classical mechanics, Relativistic Mechanics, Quantum Mechanics and statistical mechanics and microscopic phenomena

CO2: To analyse and differentiate interference and diffraction ,

CO3: To understand the working principle of laser, optical fiber and holography amplifier and analyze its various applications enhance the knowledge in modern optics

CO4: To To understand and apply the knowledge in modern physics

Course Content:

Module 1: Mechanics **[10L]**

Representation of vector, scalar and vector fields, partial derivative of vector, gradient of scalar field, divergence and curl of vector field.
Friction, conservation laws, rigid body, moment of inertia, acceleration of rigid body, Mass energy Equivalence, Concept of photon.

Module 2: Quantum Theory **[6L]**

Black body Radiation spectrum, Wein's law , Rayleigh – Jeans law, Quantum theory of radiation, Wave mechanics, wave particle duality, De Broglie waves, Bohr's quantization rules, Phase and group velocities, Davission-Germer Experiment, Heisenberg Uncertainty Principle, Wave function and its significance, Schrodinger's wave equation.

Module 3: Laser, Fibre Optics and Holography **[5L]**

Laser: Spontaneous and stimulated emission of radiation, Population inversion, Einstein's coefficients, Concept of three and four level laser, Construction and working of Ruby laser, He-Ne lasers, Laser Applications.

Module 4 : Statistical Mechanics and Applications **[5L]**

Introduction to Statistical mechanics, Concept of energy levels and energy states. Classical limits of quantum statistics, Concept of Fermi level. Fermi level in metals,

Fermi level for intrinsic and extrinsic semiconductors (pictorial representations on temperature dependence and doping concentration viz. p type, n-type).

Module 5 : Electromagnetic Induction **[4L]**

Magnetic flux, Faraday's law of electromagnetic induction, electromotive force, Ampere's circuital law, Maxwell's equation.

Module 6 : Dielectrics **[4L]**

Types of dielectric, relation between dielectric constant and electric susceptibility, po-larizability, Clausius- Mossotti Equation, application of dielectric materials

Module 7 : Magnetic properties of materials **[2L]**

Magnetic flux density, magnetic permeability, magnetic susceptibility, classification of magnetic materials, diamagnetic materials, paramagnetic materials, Curie law.

Text/Reference Books:

1. A. Beiser, "Concepts of Modern Physics", McGraw Hill India.
2. D. K. Bhattacharya and P. Tandon, "Engineering Physics", Oxford India.
3. B. Lal and N. Subramanyam, "A Text Book Of Optics", S. Chand & Co.
4. I. Dominic and A Nahari, "A Text Book of Engineering Physics", Owl Book Publishers.
5. E. Hecht, "Optics", Pearson Education.
6. N. Mehta, "Applied Physics for Engineers", PHI Ltd.
7. J. C Palais, "Fiber Optic Communications", Pearson Education.
8. B. K. Pandey and S. Chathurvedi , "Engineering Physics", Cengage Learning.
9. J. Philip , "A text book of Engineering Physics", Educational Publishers.
10. B. Premlet , "Engineering Physics, McGraw Hill India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	3	2	-	-	3	-	-	3
CO2	2	2	1	1	1	1	-	-	-	-	-	3
CO3	1	3	1	2	2	1	-	-	1	-	-	3
CO4	2	2	2	1	1	1	-	-	1	-	-	3

Course Code	YCS1001			
Course Title	Basic Electronics			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the fundamental behavior and principle of operations of various electronic devices and circuits. At the end of the course, the students will be able to design useful electronic subsystems like rectifier, amplifier, oscillator, etc.

Course Outcome:

CO1: To understand and remember the principle of operation of semiconductor devices

CO2: To understand and analyze the operations of P-N junction diode, bipolar and field-effect transistors and solve design problems

CO3: To understand and remember the principle of working of operational amplifier and demonstrate its various applications

Course Content:

Module 1: Fundamentals of semiconductor **[6L]**

Conductors, Insulators, and Semiconductors: crystal structure, Fermi Dirac function, Fermi level, Energy band diagrams, valence band, conduction band, and band gap. Intrinsic and extrinsic (p-type and n-type) semiconductors, drift and diffusion current
— expression only (no derivation), mass action law, charge neutrality in semiconductor,
Einstein relationship in semiconductor, Numerical problems.

Module 2: P-N Junction Diode and its Applications **[8L]**

p-n junction diode, characteristics and parameters, diode approximations, static and dynamic resistance of diode, V-I characteristics and current expression of diode, temperature dependencies of V-I characteristics. p-n junction breakdown: conditions, avalanche and Zener breakdown, Concept of Junction capacitance, Zener diode and characteristics.
Diode half wave and full wave rectifiers (centre tapped and bridge) circuits and operation, ripple factor without filter, efficiency, reduction of ac ripples using filter circuit (Qualitative analysis). Design of diode clipper and clamper circuit: explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module 3: Bipolar Junction Transistor **[6L]**

BJT operation: PNP and NPN transistors, transfer characteristics, current conduction mechanism. Common Emitter, Common Base, Common Collector configurations and static characteristics, junction biasing condition for active, saturation and cut-off modes, DC load line and quiescent point, base bias, voltage divider bias, numerical problems.

BJT-based oscillator – design issues, numerical problems.

Module 4: Field Effect Transistor [6L]

Classification of field-effect transistors: JFET, MOSFET, operating principle of JFET. Drain and transfer characteristics of JFET (n-channel and p-channel), CS, CG, CD configurations, Relation between JFET parameters.

FET as an amplifier and as a switch: graphical analysis. E-MOSFET (n- channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems.

Module 5 : Feedback and Operational Amplifier [8L]

Concept of feedback: positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation.

Operational amplifier: electrical equivalent circuit, ideal characteristics, non-ideal characteristics of op-amp – offset voltages, bias current, offset current, slew rate; common-mode rejection ratio and bandwidth. Inverting and non-inverting amplifier: closed loop voltage gain, concept of virtual ground. Applications op-amp: adder, differentiator and integrator. Numerical problems.

Module 6 : Electronic Instruments and Measurements [2L]

Basics of measurement, cathode-ray and digital-storage oscilloscopes, measurement of voltage, frequency and phase; signal generators and analytical instruments.

Text/Reference Books:

1. J. Millman.,C. Halkias and C. D. Parikh, “Integrated Electronics”, McGraw-Hill Education.
2. D. A. Bell, “Electronic Devices and Circuits” Oxford University Press.
3. D. P. Kothari and I. J. Nagrath, “Basic Electronics” McGraw-Hill Education.
4. J. D. Ryder, “Electronic Fundamentals and Applications” Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	3	-	2	-	-	2
CO2	1	2	2	1	2	2	3	-	3	-	-	2
CO3	1	1	3	2	2	2	3	-	3	-	-	2

Course Code	YCS1002
Course Title	Engineering Mechanics
Category	Engineering Science
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course the students will learn how to apply Newtonian physics to relatively simple real-life applications. Specifically, topics on statics, dynamics and elementary strength of materials will be covered.

Course Outcome:

CO1: To understand and remember the representation of force, moments and analyze friction-based systems in static condition

CO2: To determine the centroid of an area and calculate moment of intertia of a section

CO3: To apply conservation of momentum and energy principle for particle dynamics and rigid body kinematics

CO4: To explain and analyze the concept of virtual work, rigid body dynamics and systems under vibration

Course Content:

Module 1: Introduction to Engineering Mechanics [6L]

Force systems: basic concepts, particle equilibrium in 2-D and 3-D, rigid body equilibrium, system of forces, coplanar concurrent forces.

Components in space: resultant, moment of forces and its application, couples and resultant of force system, equilibrium of system of forces, free body diagrams, equations of equilibrium of coplanar and spatial Systems.

Module 2: Friction and Basic Structural Analysis [5L]

Types of friction, limiting friction, laws of friction, static and dynamic Friction.

Motion of bodies, wedge friction, screw jack and differential screw jack.

Equilibrium in three dimensions, method of sections, method of joints, determine if a member is in tension or compression, simple trusses, zero force members, beams, frames and machines.

Module 3: Centroid and Centre of Gravity [5L]

Centroid of simple figures from first principles, centroid of composite sections.

Centre of gravity and its implications, area moment of inertia, moment of inertia of plane sections from first principles, theorems of moment of inertia, moment of inertia of standard and composite sections; Mass moment inertia of circular plate, cylinder, cone, sphere, hook.

Module 4: Virtual Work and Energy Method **[5L]**

Virtual displacements, virtual work for particle and ideal system of rigid bodies, degrees of freedom.

Active force diagram, systems with friction, mechanical efficiency.

Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium, applications of energy method for equilibrium, stability of equilibrium.

Module 5 : Fundamentals of Particle Dynamics [10L]

Rectilinear motion, plane curvilinear motion (rectangular, path, and polar coordinates), 3-D curvilinear motion, relative and constrained motion. Newton's second law (rectangular, path, and polar coordinates).

Work: kinetic energy, power, potential energy. Impulse: momentum (linear, angular), impact (Direct and oblique).

General principles in dynamics: types of motion, instantaneous centre of rotation in plane motion, D'Alembert's principle and its applications in plane motion and connected bodies, work energy principle and its application in plane motion of connected bodies, kinetics of rigid body rotation.

Module 6 : Mechanical Vibrations **[5L]**

Basic terminology, free and forced vibrations, resonance and its effects, degree of freedom. Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

Text/Reference Books:

1. H. Shames, "Engineering Mechanics", Prentice-Hall.
2. R. C. Hibbler, "Engineering Mechanics: Principles of Statics and Dynamics" Pearson Press.
3. F. P. Beer and E. R. Johnston, "Vector Mechanics for Engineers (Vol. I – Statics, Vol. II - Dynamics)" Tata McGraw-Hill.
4. Ruina and R. Pratap, "Introduction to Statics and Dynamics" Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	3	-	-	1	-	-	-
CO2	3	2	2	1	1	1	-	-	1	-	-	-
CO3	2	2	3	2	1	1	-	-	1	-	-	-
CO4	2	2	2	2	1	1	-	-	1	-	-	-

Course Code	YCS1003			
Course Title	Basic Problem Solving			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	2	1	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Algorithmic skill is a fundamental skill in modern times, and this course provides the students with the foundations of computational problem solving. The course emphasizes on principles and methods rather than on systems and tools.

Course Outcome:

CO1: Understand the basic model of computation

CO2: Apply algorithmic thinking to understand, define and solve problems

CO3: Design and implement algorithms for a given problem

Course Content:

Module 1: Introduction to Computation [8L]

Model of computation, stored-program concept, hardware and software. Number representation: basic concepts, decimal and binary.

Module 2: Problem Solving and Algorithmic Thinking [8L]

Overview – problem definition, logical reasoning. Flowcharts – symbols used, examples. Algorithm – definition, practical examples, properties, representation, algorithms vs programs. Elementary concepts about time complexity.

Module 3: Algorithmic Thinking [8L]

Constituents of algorithms – Sequence, Selection and Repetition, input-output. Computation – expressions, logic. Problem Understanding and Analysis – problem definition, input-output, variables, name binding. Data organization: lists, arrays, etc., algorithms to programs.

Module 4: Problem Solving with Algorithms [12L]

Examples and case studies, sorting and searching, statistical calculations. Numerical methods – solution of equations, root finding, solution of differential equations, integration.

Text/Reference Books:

1. D.D. Riley and K. A. Hunt, "Computational Thinking for the Modern Problem Solver", CRC Press.
2. P. F. Luccio, "Computational Thinking: First Algorithms, then Code" Springer.
3. S. S. Sastry, "Introductory Methods of Numerical Analysis" Prentice-Hall of India.
4. R. G. Dromey, "How to Solve it by Computer" Prentice-Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	-	-	2	-	-	3
CO2	1	1	2	1	2	2	-	-	2	-	-	3
CO3	1	2	2	1	1	1	-	-	2	-	-	3

Course Code	YED1001			
Course Title	English for Communication			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this course, the students will develop communicative competence in English so as to make them industry-ready, with special emphasis on knowledge in grammar and English writing.

Course Outcome:

CO1: To learn how to employ communication skills in the workplace

CO2: To understand and learn about the use of the different elements of English

CO3: To develop requisite skills for effective reading and comprehension of texts

CO4: To learn how to compose formal, written communication

Course Content:

Module 1: Communication in a Globalized World **[4L]**

Communication skills: definition and practical dimension. Use of technology in contemporary communication, communication in workplaces. Dimensions of workplace communication: ethics, cross-cultural contexts and virtual contexts.

Module 2: Functional Grammar **[8L]**

Articles and prepositions. Direct and indirect verbs, subject-verb agreement. Tense and voice, phrases and clauses, direct and indirect speech.

Module 3: Reading Comprehension **[6L]**

Reading purposes and skills: skimming, scanning and intensive reading. Reading comprehension: fictional and non-fictional prose. One-word substitution and sentence meeting.

Module 4: Writing Skills **[6L]**

Business emails: enquiry, order, complaint, job application and formal invitations. Minutes of meeting, proposals, notices. Importance of punctuation in writing.

Text/Reference Books:

1. Wren and Martin (Revised by N. D. V. Prasada Rao), “High School English Grammar and Composition”, S. Chand Publishing.

2. S. A. Beebe and T. P. Mottet, “Business and Professional Communication – Principles and Skills and Leadership” Pearson Education.

3. Sethi and B. Adhikari, “Business Communication” Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	-	1	1	1	1	2	-	2	2
CO2	1	2	1	-	-	1	1	1	-	3	-	-
CO3	1	-	3	-	2	1	1	2	1	1	2	1
CO4	1	3	2	-	2	1	1	3	-	-	1	1

Course Code	YPH1101			
Course Title	Physics Laboratory			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The objective of this course is to revise the basic concepts of physics through standard set of experiments to correlate them with the corresponding theory.

Course Outcome:

CO1: To discover an idea of different measurements and errors

CO2: To understand and apply basic laws of physics and experiments

CO3: To practice and generate experimental skills in different areas of physics and applications

Suggestive List of Experiments:

1. General idea about Measurements and Errors i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment. ii) Proportional error calculation using Carrey Foster Bridge. **[2 days]**
2. Determination of wavelength of light by Newton's ring method. **[1 day]**
3. Determination of wavelength of light by Laser diffraction method. **[1 day]**
4. Determination of Planck's constant using photoelectric cell. **[1 day]**
5. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment. **[2 days]**
6. Determination of Stefan's constant. **[1 day]**
7. Determination of band gap of a semiconductor. **[1 day]**
8. Study of dispersive power of material of a prism. **[1 day]**
9. Measurement of nodal and antinodal points along transmission wire and measurement of wave length. **[1 day]**
10. Determination of wave length of light by Fresnel's bi-prism method. . **[1 day]**

Text/Reference Books:

1. B. L. Flint and H. T. Worsnop, "Advanced Practical Physics for Students", Asia Publishing House.
2. M. Nelson and J. M. Ogborn, "Advanced Level Physics Practicals", Heinemann Educational Publishers.

3. S. Panigrahi and B. Mallick, “Engineering Practical Physics”, Cengage Learning.

4. I. Prakash and Ramakrishna, “A Text Book of Practical Physics”, Kitab Mahal.

5. D. P. Khandelwal, “A Laboratory Manual of Physics for Undergraduate Classes”, Vani Publication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	1	-	1	-	-	1
CO2	3	1	2	1	1	1	-	-	2	-	-	1
CO3	1	2	2	2	2	1	-	-	1	-	-	1

Course Code	YCS1101			
Course Title	Basic Electronics Laboratory			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this laboratory course, the students will learn to analyze and evaluate the functionality of various electronic components and their use in designing rectifiers, amplifiers and oscillators.

Course Outcome:

CO1: To study and evaluate the characteristics of basic electronic components (diode, transistor, FET)

CO2: To design and evaluate circuits like rectifier, amplifier and oscillator

CO3: To study and differentiate the functionality of operational amplifier and design adder, differentiator and integrator circuits

Suggestive List of Experiments:

1. Familiarization with testing and measuring instruments like oscilloscope, power supply, signal generator. **[1 day]**
2. Study the I-V characteristics of junction diode / zener diode. **[1 day]**
3. Design of half-wave and full-wave rectifier circuits and analyze their functionality.. **[2 days]**
4. Study the transfer characteristics of bipolar transistor. **[1 day]**
5. Design amplifier circuits using bipolar transistors and verify their operation. **[1 day]**
6. Design oscillator circuits using bipolar transistors and verify their operation. **[1 day]**
7. Study an operational amplifier chip and analyze its functionality. **[1 day]**
8. Design of non-inverting and inverting amplifiers using operational amplifiers. **[1 day]**
9. Design of adders, integrators and differentiators using operational amplifiers. Design an operation amplifier circuit to solve a given differential equation. **[2 days]**

Text/Reference Books:

1. J. Millman, C. Halkias and C. D. Parikh, "Integrated Electronics", McGraw-Hill Education.
2. D. A. Bell, "Electronic Devices and Circuits", Oxford University Press.
3. D. P. Kothari and I. J. Nagrath, "Basic Electronics", McGraw-Hill Education.
4. J. D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	2	1	-	2	-	-	1
CO2	1	2	2	1	2	2	-	-	1	-	-	1
CO3	2	2	2	1	2	1	-	-	2	-	-	1

Course Code	YCS1102			
Course Title	Engineering Drawing and Graphics			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn how to draw and model a system, component, or process that meets desired needs within realistic constraints. It will help students to use the techniques, skills, and modern engineering tools and communicate effectively.

Course Outcome:

CO1: To explain basic concepts of Engineering Graphics and visual aspects of design

CO2: To understand and apply common drafting tools with the knowledge of drafting standards

CO3: To apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints

CO4: To produce part models, carry out assembly operation and show working procedure of a designed project work using animation

Suggestive List of Experiments:

1. Introduction to Engineering Drawing: Lines, Lettering's, Dimensioning and Scales **[1 day]**
2. Geometrical Constructions and Curves. **[1 day]**
3. Projection of Pints ,Lines, and Lamina. **[1 day]**
4. Projection of Solids. **[1 day]**
5. Section of Solids. **[1 day]**
6. Development of Surfaces. **[1 day]**
7. Orographic Projections **[2 days]**
8. Isometric projections. **[2 days]**
9. Overview of Computer Graphics. **[2 days]**

Text/Reference Books:

1. N.D. Bhatt, V.M. Panchal and P.R. Ingle, "Engineering Drawing", Charotar Publishing House.
2. M.B. Shah and B. C. Rana, "Engineering Drawing and Computer Graphics", Pearson Education

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	-	-	-	-	1	2	1	-	-
CO2	2	1	2	-	1	1	-	2	1	2	1	1
CO3	2	1	3	2	3	-	-	2	2	2	1	1
CO4	2	1	3	3	3	1	1	2	2	2	2	2

Course Code	YED1101			
Course Title	Language Laboratory			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	0	0	2	1
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this laboratory course, the students will be exposed to the need of English in workplace, and to equip them with good language skills, communication skills and soft skills.

Course Outcome:

CO1: To apply different skills of technical communication in English

CO2: To use correct pronunciation when speaking English

CO3: To use appropriate techniques for effective and active listening

CO4: To learn to tell clearly and coherently in the professional arena

Suggestive List of Experiments:

1. Learn about phonetics and pronunciation guide (Introduction of phonetics and phonetic table, tongue and lip movements for vowels and consonants, monophthongs/diphthongs, voiced/un-voiced, aspirated/unaspirated, minimal pairs, syllables, stress and intonation). **[4 days]**

2. Training on listening and comprehension (Active listening and its techniques, academic listening versus business listening, listening activities: answering questions, form filling, summarizing news bulletin, presentation, video clip, lecture, story). **[6 days]**

3. Training on speaking skills (Basic parameters of speaking, fluency-focused activities: JAM, conversational role plays, speaking using picture, group discussions and personal interviews). **[6 days]**

4. Laboratory project work (Making 5-minute animation video with voiceover, OR making a 10-minute documentary film). **[8 days]**

Text/Reference Books:

1. P. Ladefoged, “A Course in Phonetics”, Harcourt Brace Jovanovich College Publishers.

2. J. Sullivan, “Simply Said: Communicating Better at Work and Beyond”, Wiley.

3. N. Leonardo, “Active Listening Techniques: 30 Practical Tooms to Hone your Communication Skills”, Rockridge Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	3	-	2	-	1	-	2	2	2	3
CO2	-	3	-	-	-	-	1	2	-	2	1	-
CO3	-	3	3	-	2	-	1	1	-	2	2	1
CO4	-	3	3	-	2	-	1	1	-	2	1	1

Semester 2 Curriculum and Syllabus

SEMESTER-2							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT2001	Mathematics II	3	1	0	4
2	BS	YCH2001	Chemistry	3	0	0	3
3	ES	YCS2001	Basic Electrical Engineering	3	0	0	3
4	ES	YCS2002	Fundamentals of Programming	2	1	0	3
PRACTICAL							
5	BS	YCH2101	Chemistry Laboratory	0	0	3	1.5
6	ES	YCS2101	Basic Electrical Engineering Laboratory	0	0	3	1.5
7	ES	YCS2102	Programming Practices I	0	0	3	1.5
EMBEDDED(THEORY + PRACTICAL)							
8	ES	YCS2301	Workshop Practice	1	0	3	2
MANDATORY NON-CGPA COURSE							
9	MC	YCS2501	Universal Human Values and Professional Ethics	3	0	0	0
10	MC	YCS2502	NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club	0	0	3	0
TOTAL				**15**	**2**	**15**	**19.5**

Course Code	YMT2001
Course Title	Mathematics II
Category	Basic Science
LTP & Credits	L | T | P | Credits 3 | 1 | 0 | 4
Total Contact Hours	48
Pre-requisites	None

Learning Objective:

In this course, the students will learn about the basic knowledge of double and triple integration, ordinary differential equation and laplace transform. At the end of the course, the students will be able to solve engineering problems.

Course Outcome:

CO1: To use mathematical tools to evaluate multiple integrals and vector integrals.

CO2: To apply mathematical tools for solving ordinary differential equations.

CO3: To understand the properties of Laplace Transform to evaluate multiple integrals.

CO4: To apply the concept of Laplace transform to solve ordinary differential equations.

Course Content:

Module 1: Multivariable Calculus (Integration) [12L]

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Module 2: First Order Ordinary Differential Equations [10L]

Solution of first order and first-degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for, solvable for solvable for and Clairaut's equation.

Module 3: Second Order Ordinary Differential Equations [12L]

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2nd order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

Module 4: Laplace Transform [14L]

Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of *t f(t)* , LT of $\frac{f(t)}{t}$, LT of derivatives of f (t), LT of $\int f(t)dt$, Evaluation of improper integrals using L^t LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Text/Reference Books:

1. E. Kreyszig, "Advanced Engineering Mathematics (9^{th} Ed.)", John Wiley & Sons.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill.
3. T. Veerarajan, "Engineering Mathematics for First Year", Tata McGraw Hill.
4. B. S. Grewal, "Higher Engineering Mathematics (20^{th} Ed.)", Khanna Publishers.
5. N. P. Bali and M. Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications.
6. G. B. Thomas and R. L. Finney, "Calculus and Analytic Geometry (9^{th} Ed.)", Pearson.
7. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India.
8. S. L. Ross, "Differential Equations (16^{th} Ed.)", Wiley India.
9. N. Piskunov, "Differential and Integral Calculus", Vol.I & Vol.II Mir Publishers.
10. E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall, India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	3	-	-	-	-	-	1
CO2	3	2	2	2	3	3	-	-	-	-	-	1
CO3	2	2	-	2	3	3	-	-	-	-	-	1
CO4	3	3	2	2	3	3	-	-	-	-	-	1

Course Code	YCH2001			
Course Title	Chemistry			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The concepts developed in this course will allow the students to quantify several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Course Outcome:

CO1: To describe the fundamental properties of atoms & molecules, atomic structure and periodic properties and acid-bases concepts.

CO2: To apply fundamental concepts of thermodynamics, electrochemistry in different engineering applications.

CO3: To develop the knowledge of modern organic chemistry in different engineering applications.

CO4: To apply the knowledge of water quality parameters, corrosion control & polymers to different industries and Design economically and new methods of synthesis nano materials.

CO5: To determine the structure of organic molecules using different spectroscopic techniques.

Course Content:

Module 1: Inorganic Chemistry [9L]

Atomic structure: Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Pauli's exclusion principle, Hund's rule, Aufbau principle and its limitation, Definition – Isotopes and Isobars. Periodic properties: Group trends and periodic trends in physical properties: electron affinity, electronegativity, polariz-ability, oxidation states, effective nuclear charges. Acids and Bases: Theories of Acids and Bases – Arrhenius Theory – Lowry – Bronsted Theory – Lewis Theory – Advantages of Lewis Theory – pH and pOH – Definition – Numerical problems – Indicator
–Buffer solution.

Module 2: Physical Chemistry [8L]

Thermodynamics and electrochemistry: Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2^{nd} Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications. Solution and colloids: Solutions: Definition, Methods of expressing concentration of a solution – Molarity, Molality, Normality, Mole fraction and Percentage Mass – Simple problems.

Module 3: Organic Chemistry **[6L]**

Fundamental organic chemistry: Concepts of inductive effect, resonance, hyperconjuga-tion, introduction to reactions involving substitution, addition, elimination, oxidation reduction. Stereochemistry: Chirality, optical activity, structural isomerism, enan-tiomers, diastereomers, configurations (D,L & cis trans), R/S-nomenclature, racemiza-tion.

Module 4: Industrial Chemistry **[10L]**

Water: Hardness, alkalinity, numerical. Corrosion: Definition – Types of Corrosion –Theories of corrosion, preventive measures. Polymers: Classification of polymers, conducting polymers, biodegradable polymers. Green Chemistry: Definition, Principle of green chemistry. Nano-Particles: Definition – Importance of Nano-particles. Synthesis of a commonly used drug molecule: Paracetamol, Aspirin.

Module 5: Spectroscopic techniques in Chemistry **[3L]**

Basic principle of infrared spectroscopy, UV-VIS spectroscopy, 1H Nuclear magnetic resonance spectroscopy and their application.

Text/Reference Books:

1. A. Bahl & A. Bahl, "A Text Book of Organic Chemistry (21^{st} Ed.)", S. Chand & Company.
2. N. Krishna Murthy, N. Y. S. Murthy and V. Anuradha, "A Text Book of Engineering Chem-istry", Maruthi Publications.
3. S. Sengupta, "Organic Chemistry (11^{th} Ed.)", Oxford University Press.
4. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", Tata-McGraw Hill.
5. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publisher.
6. R. B. Seymour, C. E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	-	2	3	-	-	-	-	1
CO2	2	2	1	1	-	1	-	-	-	1	-	1
CO3	3	3	3	-	-	-	-	-	3	3	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	3	3	3	3	1	1	1	1	-	-	2	2

Course Code	YCS2001			
Course Title	Basic Electrical Engineering			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the fundamentals of electrical circuits, in particular DC and AC circuits, transformers and rotating machines.

Course Outcome:

CO1: To understand and remember the working of basic electrical circuits, power distribution and safety measures.

CO2: To understand and analyze the functioning of DC and AC circuits.

CO3: To understand and remember the basic principles of transformers and rotating machines.

Course Content:

Module 1: DC Circuits Fundamentals [9L]

Electric circuits: linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, dependent source, node, branch, active and passive elements, Kirchhoff's laws, source equivalence and conversion. Network Theorems: superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Star-Delta conversions.

Module 2: AC Circuits Fundamentals [9L]

Sinusoidal quantities: average and RMS values, peak factor, form factor, phase and phase difference, concept of phasor diagram, V-I relationship in R, L, C circuits, R-L-C circuits in series and parallel with phasor diagrams, impedance and admittance, impedance triangle and power triangle, power factor, concept of resonance, simple problems (series and parallel circuit only), three-phase balanced circuits, concept of three-phase power measurement.

Module 3: Single-Phase Transformer [5L]

Single-phase transformer: brief idea on constructional parts, classifications, working principle. Problems on EMF equation, phasor diagram, equivalent circuit.

Module 4: Electrical Rotating Machines [8L]

DC Machines: constructional features, classifications, working principle of motor and generator. Simple problems on voltage equation. Three-phase Induction Motor: basic concept of three phase circuit and production of rotating magnetic field, working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problems.

Module 5: Electrical Installations [5L]

Power generation to distribution through overhead lines and underground cables with single line diagram.Earthing of electrical equipment, basic accessories: MCB, MCCB,

ELCB, SFU, Megger.

Text/Reference Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata-McGraw Hill.
2. V. Mittle and A. Mittal, "Basic Electrical Engineering", Tata-McGraw Hill.
3. E. Hughes, "Electrical and Electronics Technology", PHI/Pearson Education.
4. C. L. Wadhwa, "Basic Electrical Engineering", Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	-	1	-	-	1
CO2	1	2	2	1	1	1	-	-	1	-	-	1
CO3	1	2	2	1	1	1	-	-	2	-	-	1

Course Code	YCS2002
Course Title	Fundamentals of Programming
Category	Engineering Science
LTP & Credits	L: 2, T: 1, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	Basic Problem Solving

Learning Objective:

The course is oriented to those who want to advance structured and procedural programming understating and to improve C programming skills. The major objective is to provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

Course Outcome:

CO1: Understand the basics of computer generations and system architecture.

CO2: Learn the way of design, execution and debug programs in C language.

CO3: Understand and learn the data types, loops, functions and apply to solve different problems.

CO4: Apply to the dynamic behavior of memory by the use of pointers through Functions.

CO5: Design and analyze modular programs using control structure, selection Union and understand the file handling.

Course Content:

Module 1: Fundamentals of Computer System [6L]

History of Computer - Generation of Computer - Classification of Computers - Basic structure of Computer System - Primary & Secondary Memory, Processing Unit, Input & Output devices Overview of Procedural vs Structural language, compiler and assembler.

Module 2: Introduction to C Programming [5L]

Modular Programming, Structure vs Object oriented programming, C Fundamentals - Variable and Data Types: The C character set identifiers and keywords, data type & sizes - variable names, declaration, statements - Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion - C expressions, precedence and associativity, Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields.

Module 3: Branching, Decision making and Looping [9L]

Statement and blocks, if - else, switch case - goto and labels, Loops - while, for, do while - break and continue - One-dimensional arrays, Two-dimensional arrays - Multidimensional arrays. Passing an array to a function Character array and string - array of strings, Passing a string to a function - String related functions.

Module 4: Functions and Pointers in C [10L]

Function types, function prototypes, functions returning values - functions not returning values, scope rules - function recursion - auto, external, static and register variables Functions - C preprocessor and macro - Pointers, Pointer and Array, Pointer and String
- Pointer and functions - Dynamic memory allocation.

Module 5: Structures and File handling in C [6L]

Basic of structures, arrays of structures - structures and pointers, structures and functions - formatted and unformatted files - fopen, fclose, fgetc, fputc, fprintf, fscanf function - Command line arguments.

Text/Reference Books:

1. B. W. Kerninghan & D. M. Ritchie, "The C Programming Language (16*th* Ed.)", PHI/ Pearson Education.
2. Y. Kanetkar, "Let us C (15*th* Ed.)", BPB Publication.
3. E. Balagurusamy, "Programming in ANSI C (15*th* Ed.)", Tata-McGraw Hill.
4. K. R. Venugopal & S. R. Prasad, "Mastering C (7*th* Ed.)", Tata-McGraw Hill.
5. R. Thareja, "Introduction to C Programming (4*th* Ed.)", Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	1	1	-	-	2	-	1	1
CO2	2	1	2	-	1	1	-	-	2	-	1	2
CO3	2	2	-	-	1	1	-	-	2	-	1	2
CO4	2	2	1	-	1	1	-	-	2	-	1	2
CO5	2	3	2	-	1	1	-	-	2	-	1	2

Course Code	YCH2101			
Course Title	Chemistry Laboratory			
Category	Basic Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To impart the students with scientific approach and to familiarize them with experiments in chemistry required to solve engineering problems and practical implementation of fundamental concepts.

Course Outcome:

CO1: To utilize the fundamental laboratory techniques for analyses such as titrations, separation/purification and spectroscopy.

CO2: To learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.

CO3: To be able estimate the ions/metal ions present in domestic/industry waste water.

CO4: To be able to analyze and gain experimental skill.

CO5: To design innovative experiments applying the fundamentals of chemistry.

Suggestive List of Experiments:

1. Determination of alkalinity in the given water sample. **[1 day]**
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution. **[2 days]**
3. Determination of available chlorine in bleaching powder. **[1 day]**
4. Determination of chloride content in water sample. **[1 day]**
5. Determination of iron content in the given water sample by Mohr's method. **[1 day]**
6. pH- metric titration. **[1 day]**
7. Viscosity of an addition polymer like polyester by viscometer. **[1 day]**
8. Thin layer chromatography. **[1 day]**
9. Element detection and functional group identification in organic compounds. **[1 day]**
10. Preparation of Bakelite and Urea formaldehyde resin. **[1 day]**
11. Innovative experiments (any one) **[1 day]**
    a. Synthesis of Nano particles
    b. Green synthesis

Text/Reference Books:

1. G. Svehla and B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", PHI/ Pearson Education.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning.
3. M. Arif, "Engineering Chemistry Lab Manual", Owl publishers.
4. J. Ahad, "Engineering Chemistry Lab Manual", Jai Publications.
5. R. K. Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers.
6. S. C. George and R. L. Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	-	-	-	-	-	-	-	1
CO2	3	3	3	3	-	1	-	-	-	1	-	1
CO3	3	3	3	-	-	-	-	-	-	-	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	3	3	3	3	1	1	1	1	-	-	2	2

Course Code	YCS2101
Course Title	Basic Electrical Engineering Laboratory
Category	Engineering Science
LTP & Credits	L / T / P / Credits: 0 / 0 / 3 / 1.5
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course the students will learn about the basic electrical components, machineries, instruments and safety measures.

Course Outcome:

CO1: To identify and apply common electrical equipment and instruments.

CO2: To develop electric networks using various components and analyze the circuit behavior.

CO3: To apply and analyze the basic characteristics of transformers and electrical machines.

Suggestive List of Experiments:

1. Familiarization with basic safety precautions (earthing), measuring instruments (voltmeter, ammeter, wattmeter), resistor, capacitor, inductor. **[1 day]**
2. Verification of Thevenin's and Norton's theorem. **[1 day]**
3. Verification of superposition and maximum power transfer theorem. **[1 day]**
4. Characteristics of fluorescent, tungsten and carbon filament lamps. **[1 day]**
5. Electrical analysis of R-L-C series circuit. **[1 day]**
6. Three-phase power measurement using two wattmeter method. **[1 day]**
7. Demonstration of cut-out sections of machines: DC machine (commutator-brush arrangement), Induction machine (squirrel-cage rotor). **[1 day]**
8. Measurement of primary and secondary voltage and current of single-phase transformer: short-circuit and open-circuit tests. **[1 day]**
9. Torque-speed characteristics of DC machine and three-phase induction motor. **[2 days]**
10. Characteristics of single-phase energy meter. **[1 day]**
11. Starting, reversing and speed control of DC shunt motor. **[1 day]**

Text/Reference Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata-McGraw Hill.
2. V. Mittle and A. Mittal, "Basic Electrical Engineering", Tata-McGraw Hill.

3. E. Hughes, “Electrical and Electronics Technology”, Pearson.

4. C. L. Wadhwa, “Basic Electrical Engineering”, Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	1	-	-	1	-	-	1
CO2	2	2	2	1	-	1	-	-	1	-	-	1
CO3	1	2	2	2	1	1	-	-	1	-	-	1

Course Code	YCS2102			
Course Title	Programming Practices I			
Category	Engineering Science			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	Basic Problem Solving			

Learning Objective:

The course is oriented to those who want to advance structured and procedural programming understating and to improve C programming skills. The major objective is to provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

Course Outcome:

CO1: Learn and understand the DOS system commands and familiarize with C programming environment.

CO2: Learn and translate the algorithms into simple programs and understand the flowchart design and test.

CO3: Understand and implement conditional branching, iteration and recursion.

CO4: Apply and analyze various C programs with Arrays, Pointers, Structures, Union along with functions.

CO5: Apply programming to solve matrix addition and multiplication problems and understand the file handling.

Suggestive List of Experiments:

1. Familiarization with basic DOS commands and programming design with the help of Flowcharts using Raptor. **[1 day]**
2. Familiarization with C programming environment, Variable types and type Conversions, Simple computational problems using arithmetic expressions. **[1 day]**
3. Branching and logical expressions, Problems involving if-then-else structures. **[1 day]**
4. Loops, while and for loops, Iterative problems e.g., sum of series, patterns print. **[2 days]**
5. 1D Arrays: searching, sorting, 1D Array manipulation, 2D arrays and Strings, Matrix problems, String operations. **[2 days]**
6. Functions, call by value, Simple functions implementations, function recursion. **[2 days]**
7. Pointers, structures and dynamic memory allocation, Union. **[2 days]**
8. File handling, file reading, writing, copying etc. **[1 day]**

Text/Reference Books:

1. B. W. Kerninghan & D. M. Ritchie, "The C Programming Language (16^{th} Ed.)", PHI/ Pearson Education.
2. Y. Kanetkar, "Let us C (15^{th} Ed.)", BPB Publication.
3. E. Balagurusamy, "Programming in ANSI C (15^{th} Ed.)", Tata-McGraw Hill.
4. K. R. Venugopal & S. R. Prasad, "Mastering C (7^{th} Ed.)", Tata-McGraw Hill.
5. R. Thareja, "Introduction to C Programming (4^{th} Ed.)", Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	-	2	1	-	1	-	1	-
CO2	2	2	2	1	1	2	2	-	1	-	1	2
CO3	3	2	-	1	1	2	1	-	2	-	1	2
CO4	3	2	1	1	1	2	2	-	1	-	1	2
CO5	3	3	2	1	1	2	1	-	2	-	1	2

Course Code	YCS2301				
Course Title	Workshop Practice				
Category	Engineering Science				
LTP & Credits	L	T	P	Credits	
	1	0	3	2	
Total Contact Hours	48				
Pre-requisites	None				

Learning Objective:

To understand the basic knowledge of workshop practice and safety. To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking, Cutting etc. To expose students to different types of manufacturing/ fabrication processes.

Course Outcome:

CO1: To learn and design components with their own hands.

CO2: To illustrate practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

CO3: To produce and design small devices of their interest for project or research purpose

Suggestive List of Experiments:

1. Introduction to Workshop Practice & Theoretical Discussions **[1 day]**
2. Machine Shop. **[2 days]**
3. Fitting Shop. **[2 days]**
4. Carpentry Shop. **[2 days]**
5. Welding Shops. **[2 days]**
6. Electrical Electronics House Wiring & Soldering. **[2 days]**
7. Smithy Shop. **[2 days]**
8. Casting Shop. **[1 day]**
9. Plastic Moulding & Glass Cutting. **[2 days]**

Text/Reference Books:

1. S. K. Hajra Choudhury, A. K. Hajra Choudhury, and N. Roy, “Elements of WorkshopTech-nology”, Media promoters and Publishers.
2. P. N. Rao, “Manufacturing Technology”, Tata-McGraw Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	1	-	1	-	2	1	-	2
CO2	3	3	2	2	1	-	1	-	2	1	-	2
CO3	3	2	2	2	1	1	1	1	2	2	3	2

Course Code	YCS2501			
Course Title	Universal Human Values and Professional Ethics			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	Universal Human Values and Professional Ethics			

Learning Objective:

The course shall help the students appreciate the essential complementarily between “VAL-UES” and “SKILLS” to ensure sustained happiness and prosperity, which are the core aspirations of all human beings. It shall facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. It shall help the student to have Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcome:

CO1: Understand the importance of human values and ethics in the study and application of acquired knowledge in multiple domains for the wellbeing of the planet.

CO2: Understand the importance and role of natural acceptance and experiential validation in the daily practices and living in harmony with the society as a whole.

CO3: Understand and distinguish between the ego and the self, the importance of present moment and awareness, with a realization that desires arise out of the ego.

CO4: Understand the importance of creativity, participation, interconnectedness in the nature, sustainable solutions to the existing problems, and grasp the right utilization of their knowledge in their own discipline of study.

Course Content:

Module 1: Course Introduction Need, Basic Guidelines, Content and Process for Value Education [6L]

Understanding the need, basic guidelines, content and process for Value Education, Self Exploration–what is it? - its content and process; ‘Natural Acceptance’ and experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself [6L]

Understanding human being as a co-existence of the sentient ‘I’ and the material

'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the

characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Swasthya, Practice Exercises and Case Studies will be taken up in Practice Session.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human - Human Relationship [9L]

Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family, Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence [4L]

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence, Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics [11L]

Natural acceptance of human values ,Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations.

Text/Reference Books:

1. R.R Gaur, R. Sangal, G. P. Bagaria, "A foundation course in Human Values and professional

Ethics", Excel books.

2. R.R. Gaur, R. Sangal, G. P. Bagaria, "A foundation course in Human Values and professional Ethics – Teachers Manual", Excel books.
3. B. L. Bajpai, "Indian Ethos and Modern Management", New Royal Book Company.
4. P.L. Dhar, R.R. Gaur, "Science and Humanism", Commonwealth Publishers.
5. S. George, "How the Other Half Dies", Penguin Press.

6. I. Illich, “Energy & Equity”, The Trinity Press.

7. D. H. Meadows, D. L. Meadows, J. Randers, W. W. Behrens, “limits to Growth”, Universe Books.

8. S. Palekar, “How to practice Natural Farming”, Pracheen(Vaidik) Krishi Tantra Shodh.

9. A Nagraj, “Jeevan Vidya ek Parichay”, Divya Path Sansthan.

10. E.F. Schumacher, “Small is Beautiful: a study of economics as if people mattered”, Blond & Briggs.

11. A.N. Tripathy, “Human Values”, New Age International Publishers.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	2	2	2	-	1	-	2
CO2	2	2	2	-	-	2	-	2	-	1	-	2
CO3	2	2	2	-	-	-	2	2	-	1	-	2
CO4	3	2	2	2	-	3	3	3	-	1	-	3

Course Code	YCS2502			
Course Title	National Service Scheme (NSS)			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	0	0	3	0
Total Contact Hours	36			
Pre-requisites	a) Knowledge on Data Analysis, b) Aims to do Social Service			

Learning Objective:

This course will give a better understanding about the community in which student volunteers want to work and their relation along with identify the needs and problems of the community and involve them in problem-solving. They will develop capacity to meet emergencies and natural disasters, practice national integration and social harmony and utilize their knowledge in finding practical solutions to individual and community problems.

Course Outcome:

CO1: To develop knowledge about disadvantages of society and the process to be required to overcome it.

CO2: To propagate national integration among society.

CO3: To organize social campaign in society to aware people on their legal rights, health rights, cultural rights, environmental rights etc.

CO4: This subject makes students disciplined and helps the students to become a social campaigner.

Course Content:

Module 1: National Service Scheme **[10L]**

History and its Objectives, Organizational structure of N.S.S. at National, State, University and College Levels, Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation.

Module 2: National Integration **[6L]**

Need of National integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems.

Module 3: Special Programme **[6L]**

Legal awareness, Health awareness, First-aid Career guidance, Leadership training - cum - Cultural Programme, Globalization and its Economic Social Political and Cultural impacts.

Module 4: Special Camping programme **[7L]**

Nature and its objectives, Selection of camp site and physical arrangement Organization of N.S.S. camp through various committees and discipline in the camp, Activities to be undertaken during the N.S.S. camp. Use of the mass media in the N.S.S. activities.

Module 5: N.S.S. Regular Activities **[7L]**

Traffic regulation, working with Police Commissioner's Office, Working with Health De-

partment, Blind assistance, Garments collection, Non-formal education 'Environmental Education, Awareness and Training (EEAT)', Blood donation.

Text/Reference Books:

1. H.Y.Siddiqui, "Social Work and Human Relations", Rawat Publications.
2. R.R.Shastri, "Social Work tradition in India", Welfare Research Organization.
3. S. Singh and S.P. Srivastava , "Social Work Education in India, Challenge and opportunities", New Royal Book Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	-	3	1	3	1	1	1	-
CO2	1	-	-	1	-	3	1	2	1	1	1	-
CO3	-	1	1	1	1	3	1	2	1	1	1	-
CO4	1	-	-	-	1	3	1	3	-	1	1	-

Semester 3 Curriculum and Syllabus

SEMESTER-3							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	BS	YMT3001	Discrete Structures	3	0	0	3
2	BS	YMT3002	Probability and Statistics	3	0	0	3
3	PC	YCS3001	Digital Circuits and Logic Design	3	1	0	4
4	PC	YCS3002	Data Structures and Algorithms	3	1	0	4
5	OE	YCS3003	Object Oriented Programming	3	0	0	3
PRACTICAL							
6	PC	YCS3101	Digital Circuits Laboratory	0	0	3	1.5
7	PC	YCS3102	Data Structures & Algorithms Laboratory	0	0	3	1.5
8	OE	YCS3103	Object Oriented Programming Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS3501	Behavioral and Interpersonal Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS3201	Innovative Project I	0	0	3	1.5
TOTAL				**15**	**2**	**15**	**23**

Course Code	YMT3001
Course Title	Discrete Structures
Category	Basic Science
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course, the students will learn about the mathematical foundations of computer science. The specific topics that would be covered include propositional calculus and proof techniques, set theory and other derived algebraic structures, recurrence relations, and the theory of graphs. The course will be very helpful for the students as it acts as prerequisite for various next level courses like algorithms, automata theory, artificial intelligence, etc.

Course Outcome:

CO1: To explain the distinctive characteristics of propositional logic and its applications.

CO2: To demonstrate the applications of various proof techniques.

CO3: To explain the basic concepts of sets, relations, functions and various algebraic structures.

CO4: To understand the concept of recurrence relations and methods of solution.

CO5: To explain and analyze the concept of graphs and various graph algorithms.

Course Content:

Module 1: Propositional Logic **[6L]**

Introduction to Propositional Calculus: Propositions, Logical Connectives, Conjunction, Disjunction, Negation. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Bi-conditional statements, Logical Equivalence, Tautology. Conjunc-tive and disjunctive normal forms.

Module 2: Proof Techniques **[6L]**

Forward proof, proof by contradiction, contrapositive proofs, proof by mathematical induction, proof of necessity and sufficiency.

Module 3: Sets, Relations and Functions **[8L]**

Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations. Finite and infinite seta, countable and uncountable sets. Algebraic structures with one binary operation: semigroups, monoids and groups. Algebraic structures with two binary operations: rings and fields.

Module 4: Recurrence Relations **[6L]**

Recurrence relations: Formulation of different counting problems in terms of recurrence relations. Solution of recurrence relations with constant coefficients by (i) iterative method, (ii) characteristic roots method, (iii) generating functions method.

Module 5: Introduction to Graphs **[10L]**

Graphs and their basic properties: digraphs, weighted graph, connected and disconnected graph, bipartite graph, complement of a graph, regular graph, complete graph, walk, path, circuit, Euler graph, cut set, cut vertices, adjacency and incidence matrices of a graph, isomorphism. Graph coloring problem, planar graphs, trees.

Text/Reference Books:

1. C. L. Liu, "Elements of Discrete Mathematics", Tata McGraw-Hill.
2. J-P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw-Hill Education.
3. S. K. Chakraborty and B. K. Sarkar, "Discrete Mathematics", Oxford University Press.
4. R. Graham, D.E. Knuth and O. Patashnik, "Concrete Mathematics: A Foundation for Computer Science", Addison-Wesley.
5. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	1	1
CO2	2	1	2	-	2	1	-	-	-	-	-	1
CO3	2	3	2	2	-	-	-	-	-	-	1	1
CO4	-	2	3	2	1	-	-	-	-	-	-	1
CO5	1	-	2	1	1	2	-	-	-	-	1	1

Course Code	YMT3002
Course Title	Probability and Statistics
Category	Basic Science
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	None

Learning Objective:

In this course the students will learn about the basic knowledge of probability and statistics. At the end of the course, the students will be able to solve different real life problems in the field of artificial intelligence, data science etc.

Course Outcome:

CO1: To explain and demonstrate the distinctive characteristics of probability distribution.

CO2: To analyze the probability of real world uncertain phenomena by identifying probability distribution that fits the phenomena.

CO3: To explain and demonstrate the distinctive characteristics of statistics.

CO4: To apply and analyze the uses and limitations of statistical analysis.

Course Content:

Module 1: Basic Probability **[3L]**

Sample space and events, probability, axioms of probability, some elementary theorems, conditional probability, Baye's Theorem.

Module 2: Random Variable and Distribution **[12L]**

Discrete and continuous random variable, Probability density function and probability mass function for single variable only, Distribution function and its properties, Definitions of Expectation and Variance, properties and examples, Some important discrete distribution: Binomial and Poisson distribution and related problems. Some important continuous distribution: Normal, uniform and Exponential distributions and related problems.

Module 3: Basic Statistics **[9L]**

Measures of central tendency, Measure of dispersion, Measure of skewness and kurtosis, Correlation, regression and rank correlation.

Module 4: Applied Statistics **[12L]**

Curve fitting by the method of least squares: fitting of straight lines, second-degree parabolas and more general curves. Sampling, Testing of hypothesis: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Small samples Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text/Reference Books:

1. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons.
2. B. S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers.
3. N. G. Das, “Statistical Methods (Combined Volume)”, Tata-McGraw Hill.
4. R. Garg and C. Prasad, “Advanced Engineering Mathematics”, Khanna Publishers.
5. S. Ross, “A First Course in Probability”, Pearson Education India.
6. W. Feller, “An Introduction to Probability Theory and its Applications, Vol. 1”, Wiley.
7. J. E. Freund and R. E. Walpole, “Mathematical Statistics”, Prentice Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	-	-	2	1
CO2	3	2	1	1	-	-	-	-	-	-	1	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	3	2	2	1	-	-	-	-	-	-	1	1

Course Code	YCS3001
Course Title	Digital Circuits and Logic Design
Category	Professional Core
LTP & Credits	L / T / P / Credits: 3 / 1 / 0 / 4
Total Contact Hours	48
Pre-requisites	None

Learning Objective:

In this course, the students will be taught about the representation of numbers in a computer system, and how digital circuits can be designed using logic gates and flip-flops. Also, the process of digital-to-analog and analog-to-digital conversion shall be covered. After the completion of this course, the students will be in a better position to learn and understand the basic operation of a computer system and how the various functional blocks can be implemented.

Course Outcome:

CO1: To explain the binary number system, and its importance in digital circuit design.

CO2: To classify and analyze various ways of minimizing switching functions.

CO3: To understand the process of designing combinational logic circuits.

CO4: To understand the process of designing sequential logic circuit modules.

CO5: To understand and remember the process of analog-to digital and digital-to-analog conversion.

Course Content:

Module 1: Number Systems and Binary Codes **[7L]**

Introduction to number systems: decimal, binary, octal, hexadecimal. Conversion from one number system to another.
Signed number representation: sign-magnitude, 1's complement and 2's complement. Addition and subtraction of numbers.
Binary codes: BCD, excess-3 code, Gray code.

Module 2: Logic Families and Minimization of Switching Functions **[10L]**

Logic gates and their functionalities.
Logic families: TTL, nMOS, CMOS, pass transistor logic. Realization of gates.
Boolean algebra, truth tables and switching functions. Minimization of completely and incompletely specified switching functions: Karnaugh Map and Quine-McCluskey methods.

Module 3: Combinational Logic Circuits **[9L]**

Realization of Boolean functions using NAND/NOR gates. Half-adder, full-adder and ripple-carry adder/subtractor.
Decoders, Encoders and Multiplexers: applications in logic design.

Module 4: Sequential Logic Circuits **[9L]**

Clocks, flip-flops and latches.

Types of flip-flops: SR, D, JK, T; Edge-triggered and master-slave flip-flops.
State table and state diagram, state minimization, synthesis of finite state machines (FSMs).

Module 5: Counters and Registers **[6L]**

Synchronous and asynchronous counters, up/down counters. Applications of counters. Registers: parallel-in parallel-out and shift registers, linear feedback shift register (LFSR).
Applications of registers in data paths.

Module 6: D/A and A/D Conversion Techniques **[7L]**

Boolean algebra, truth tables and switching functions. Minimization of completely and incompletely specified switching functions: Karnaugh Map and Quine-McCluskey methods.
Digital-to-analog converters: principle of operation, weighted resistor and resistive ladder D/A converters.
Analog-to-digital converters: resolution and accuracy. Types of A/D converters: flash type, counter type, successive-approximation type.

Text/Reference Books:

1. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory (3rd Ed.)", Cambridge University Press.
2. M. Morris Mano, "Digital Design (3rd Ed.)", Pearson.
3. G. De Micheli, "Synthesis and Optimization of Digital Circuits", Tata-McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	2	-	-	2	-	1	2
CO2	1	3	3	-	-	2	-	-	2	-	1	1
CO3	2	2	2	1	2	2	-	-	2	-	1	2
CO4	2	2	2	1	2	2	-	-	2	-	1	1
CO5	2	2	2	-	1	2	-	-	2	-	1	2

Course Code	YCS3002			
Course Title	Data Structures and Algorithms			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Fundamentals of Programming			

Learning Objective:

In this course, the students will be taught about the significance of non-linear data structures with respect to the access and organization of data, various algorithmic approaches to write programs to solve problems in different engineering domains by using different data structures, merits and demerits of altered algorithms in terms of time-complexity.

Course Outcome:

CO1: To differentiate how the choices of data structure and algorithm methods impact the performance of program.

CO2: To solve problems based upon different data structure and also write programs.

CO3: To identify appropriate data structure and algorithmic methods in solving problem.

CO4: To discuss the computational efficiency of the principal algorithms for sorting, search-

ing, and hashing.

CO5: To compare and contrast the benefits of dynamic and static data structures implementations.

Course Content:

Module 1: Introduction of Data Structure **[11L]**

Concepts of data structures, Abstract Data Type.
Algorithms and programs, basic idea of pseudo-code, Properties of an algorithm.
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.
Array: Different representations – row major, column major.
Sparse matrix – its implementation and usage, Array representation of polynomials. Linked List: Singly linked list – operations, Doubly linked list – operations.
Circular linked list – operations, Linked list representation of polynomial and applications.
Binary codes: BCD, excess-3 code, Gray code.

Module 2: Linear Data Structure **[10L]**

Stack and its implementations (using array and linked list).
Applications (Infix, Prefix, and Postfix with their conversions, Postfix Evaluation). Queue, circular queue, de-queue.
Implementation of queue- linear and circular (using array and linked list).

Recursion:Principles of recursion - use of stack, tail recursion.
Applications - The Tower of Hanoi, Eight-queen problem.

Module 3: Nonlinear Data Structure **[18L]**

Trees: Basic terminologies, forest, tree representation (using array and linked list).
Binary trees - binary tree traversal (pre-, in-, post- order).
Threaded binary tree – operations.
Binary search tree- operations (creation, insertion, deletion, searching). Concept of Max-Heap and Min-Heap (creation, deletion).
Height balanced binary tree – AVL tree (insertion, deletion with examples only).
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS)
– concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge). Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods).

Module 4: Searching and Sorting **[9L]**

Sorting Algorithms: Bubble sort, Insertion sort, Selection sort – with notion of complexity.
Quick sort, Merge sort – with complexity, Radix sort – with complexity.
Searching: Sequential search, Binary search, Interpolation Search– with complexity.
Hashing: Hashing functions, Collision resolution techniques.

Text/Reference Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed, "Fundamentals of Data Structures of C", Universities Press.
2. S. Lipschutz, "Data Structures", Tata McGraw Hill Education (India) Private Limited.
3. A. M. Tanenbaum, "Data Structures in C", Pearson.
4. R. Thareja, "Data Structures Using C", Oxford.
5. A.K. Rath, A. K. Jagadev, "Data Structure Using C", Scitech Publications.
6. T. H. Coreman, "Introduction to Algorithms", MIT Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	-	-	-	-	3	-	2
CO2	2	2	1	2	1	2	3	2	2	-	-	2
CO3	2	2	1	2	1	2		-	2	3	-	2
CO4	2	1	2	2	1	2	-	-	-	-	-	2
CO5	3	2	2	2	1	3	-	-	-	-	-	2

Course Code	YCS3003			
Course Title	Object Oriented Programming			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	Fundamentals of Programming			

Learning Objective:

This course introduces the student to the concepts of C++ in computer science. The course will allow the students to acquire knowledge to make functions, files with emphasis on different object oriented paradigm used in C++.

Course Outcome:

CO1: To study the process of interaction between objects, classes and functions.

CO2: To acquire basic knowledge of Object Orientation with different

properties. **CO3:** To analyze various string handling functions with various

I/O operations. **CO4:** To remember basic code reusability feature with respect to

Inheritance.

Course Content:

Module 1: C++ Introduction **[8L]**

Introduction to C++ and object-oriented concepts, C++ Standard Library, Basics of a Typical C++ Environment, Pre-processors Directives, illustrative C++ programs. Header Files and Namespaces, library files. Introduction to objects and object-oriented programming, Encapsulation (Information Hiding), Access Modifiers: Controlling access to a class, method, or variable (public, protected, private, package), Other Modifiers, Polymorphism: Overloading, Inheritance, Overriding Methods, Abstract Classes, Reusability, Class' behaviors.

Module 2: Classes and Data Abstraction **[7L]**

Introduction, Structure Definitions, Accessing Members of Structures, Class Scope and accessing Class Members, Separating Interface from Implementation, Controlling Access Function And Utility Functions, Initializing Class Objects: Constructors, Using Default Arguments With Constructors, Using Destructors, Classes : Const(Constant) Object And Const Member Functions, Object as Member of Classes, Friend Function and Friend Classes, Using This Pointer, Dynamic Memory Allocation with New and Delete, Static Class Members, Container Classes And Integrators, Proxy Classes, Function overloading.

Module 3: Inheritance and Polymorphism **[9L]**

Operator Overloading, Inheritance, and Virtual Functions and Polymorphism: Fundamentals of Operator Overloading, Restrictions On Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading, ¡¡, ¿¿ Overloading Unary Operators, Overloading Binary Operators.

Introduction to Inheritance,

Base Classes And Derived Classes, Protected Members, Casting Base-Class Pointers to Derived-Class Pointers, Using Member Functions, Overriding Base–Class Members

in a Derived Class, Public, Protected and Private Inheritance, Using Constructors and Destructors in derived Classes, Implicit Derived–Class Object To Base- Class Object Conversion, Composition Vs. Inheritance. Introduction to Virtual Functions, Abstract Base Classes and Concrete Classes, Polymorphism, New Classes and Dynamic Binding, Virtual Destructors, Polymorphism, Dynamic Binding.

Module 4: Files and I/O Streams and Templates [6L]

Files and Streams, Creating a Sequential Access File, Reading Data From A Sequential Access File, Updating Sequential Access Files, Random Access Files, Creating A Random Access File, Writing Data Randomly To a Random Access File, Reading Data Sequentially from a Random Access File. Stream Input/Output Classes and Objects, Stream Output, Stream Input, Unformatted I/O (with read and write), Stream Manipulators, Stream Format States, Stream Error States. Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters, Templates and Inheritance, Templates and Friends, Templates and Static Members.

Module 5: Exception Handling [6L]

Introduction, Basics of C++ Exception Handling: Try Throw, Catch, Throwing an Exception, Catching an Exception, Rethrowing an Exception, Exception specifications, Processing Unexpected Exceptions, Stack Unwinding, Constructors, Destructors and Exception Handling, Exceptions and Inheritance.

Text/Reference Books:

1. H. M. Deitel, "Instructor's Manual: C++ how to Program", Prentice Hall.
2. S. Lipschutz, "Data Structures", Tata McGraw Hill Education (India) Private Limited.
3. E. Balagurusamy, "Object-Oriented Programming with C++", Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	2	3	-	3
CO2	3	2	-	-	2	2	-	-	2		-	3
CO3	3	3	3	1	2	2	2	-	2	-	-	3
CO4	2	2	2	3	2	2	-	-	1	-	-	3

Course Code	YCS3101			
Course Title	Digital Circuits Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this laboratory course, the students will be conducting hands-on sessions for the design and implementation of combinational and sequential digital circuit modules, and also interfacing LED and 7-segment display units.

Course Outcome:

CO1: To understand and test the functionalities of basic gates.

CO2: To understand Boolean functions using various combinational circuit modules (like gates, multiplexer, decoder, etc.)

CO3: To understand and verify the functions of flip-flops and other sequential circuit elements (like counter, register, etc.)

CO4: To understand and analyze complex digital systems and verify the functionality.

Course Content:

1. Design a basic inverter using transistors, obtain the transfer characteristics, and measure the propagation delay. Repeat the experiment using an inverter chip. **[1 day]**

2. Given a Boolean function, minimize it and realize the function using NAND gates. Using 555 timer, design a rectangular waveform generator of a given frequency. **[1 day]**

3. Design full-adder using basic gates. Cascade two such full-adders to realize a 2-bit adder. Connect LEDs to observe the outputs, and verify the functionality. **[1 day]**

4. Verify the functionality of multiplexer and decoder chips. Implement a 4-variable Boolean function using 8-to-1 multiplexer. **[1 day]**

5. Implement RS and JK master-slave flip-flops using NAND gates and verify their functionalities. Verify the functionality of J-K flip-flop chip. **[1 day]**

6. Using JK or D flip-flops, design a 4-bit shift register and verify the functionality. Modify the designs to make it into (a) ring counter, (b) Johnson counter and verify the functionality. **[1**

day]

7. Design a 3-bit synchronous counter that counts in some arbitrary count sequence. Apply a square wave at the clock input, and analyze the waveforms observed. **[1 day]**

8. Design a 2-digit BCD counter, and display the count value on 7-segment display units. **[1 day]**

9. Design an 8-bit modulo-N counter for some arbitrary value of N. Connect a D/A converter at the output of the counter and observe the output waveform. Analyze the operation for various values of N. Use the circuit to display the transfer characteristic of a NOT gate on the oscilloscope. **[1 day]**

10. Design a data path consisting of an ALU, registers and multiplexers. Hence design the control path to compute the GCD of two numbers. **[1 day]**

Text/Reference Books:

1. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory (3rd Ed.)", Cambridge University Press
2. M. Morris Mano, "Digital Design (3rd Ed.).
3. G. De Micheli, "Synthesis and Optimization of Digital Circuits", Tata-McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	2	3	2	-	-	2	-	2	3
CO2	1	2	2	1	-	2	-	-	2	-	2	3
CO3	1	2	2	1	1	2	-	-	2	-	2	3
CO4	2	2	2	2	1	2	-	-	2	-	2	3

Course Code	YCS3102
Course Title	Data Structures and Algorithms Laboratory
Category	Programme Core
LTP & Credits	L | T | P | Credits
	0 | 0 | 3 | 1.5
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming

Learning Objective:

In this course, the students will learn about C program based implementation ofdifferent algorithmic approaches by using non-linear and linear data structures to solve problems in different engineering domains.

Course Outcome:

CO1: To choose appropriate data structure as applied to specified problem definition.

CO2: To compare operations like searching, insertion, deletion, traversing mechanism on various data structures.

CO3: To explain various practical applications of data structures.

CO4: To analyze how to store, manipulate and arrange data in an efficient manner.

CO5: To demonstrate how to implement various data structures using arrays and linked list.

Suggestive List of Experiments:

1. Experiments on arrays **[1 day]**
   Addition and Multiplication of Arrays
   Implementation of Sparse Matrices

2. Experiments on Abstract Data Types **[2 days]**
   Implementation of stack using Array
   Applications of stack –infix to postfix conversion, expression evaluation

3. Experiments on Linked List **[2 days]**
   Implementation of linked lists and its operations– insertion, deletion and reverse
   Implementation of stacks and queues using linked list.
   Polynomial addition and polynomial multiplication.

4. Experiments on Searching and Sorting **[2 days]**
   Searching: Linear Search, Binary Search
   Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort

5. Experiments on Non-linear Data Structures **[2 days]**
   Traversals of binary tree, Binary Search Tree (BST), Threaded binary tree
   Height balanced binary tree – AVL tree (insertion, deletion)
   B- Trees – insertion, deletion

6. Experiments on Hashing **[1 day]**
Implementation of Hash tables and its operations – searching, inserting, and deleting, handling collisions.

7. Innovative Experiments **[2 days]**
Case study of solving complex problems from various engineering domains using suitable data structures (e.g., mesh analysis in electrical circuits, event-driven simulation, etc.).

Text/Reference Books:

1. C. E. Balagurusamy, "Data Structures using C", McGraw Hill.

2. E. Horowitz, S. Sahni and S. Anderson-freed, "Fundamentals of Data Structures of C", Universities Press.

3. A. K. Sharma, "Data Structures using C", Pearson.

4. 4. R. Thareja, "Data Structures using C", Oxford University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	-	-	2	1	-	-
CO2	-	2	2	-	2	2	-	-	2	1	-	2
CO3	2	1	1	-	-	2	-	-	2	-	-	-
CO4	3	2	-	2	-	2	-	-	2	-	1	-
CO5	-	-	2	1	2	2	-	-	2	-	1	2

Course Code	YCS3103
Course Title	Object Oriented Programming Laboratory
Category	Open Elective
LTP & Credits	L T P Credits 0 0 3 1.5
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming

Learning Objective:

The main objectives of this course is to understand the fundamental principles and approaches of object oriented programming using C++.

Course Outcome:

CO1: To understand and remember object-oriented programming concepts using the C++ language.

CO2: To understand and analyze the principles of data abstraction, inheritance and polymorphism.

CO3: To understand and remember the concepts of virtual functions.

CO4: To understand formatted and unformatted I/O operations.

CO5: To apply exception handling.

Course Content:

1. Programming using basic features of C++.
Executing programs in UNIX environment. Understand pre-processors directives, header Files and namespaces, library files, variables, data types, operators, control, basic loop control, through simple C++ programs. **[3 days]**

2. Functions and String Manipulation
Writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures and unions.
Longest common subsequence problem. **[2 days]**

3. Object Oriented Programming
Programs to demonstrate fundamentals of classes, abstract class, virtual class, overriding, template class, constructors-destructors and deal with member functions, operator overloading and polymorphism (both static and dynamic), inheritance, derived class handling. **[2 days]**

4. Exception handling, Input/output and Dynamic Memory Management
Write simple programs to demonstrate exception handling, I/O management, creation of linked list using dynamic memory management. **[3 days]**

5. Innovative Experiments
Demonstrate read write operations from USB flash drive. Generate command line-based tic-tac-toe game. institute premises.

[2 days]

Text/Reference Books:

1. H. M. Deitel, “Instructor’s Manual: C++ how to Program”, Prentice Hall.
2. E. Balagurusamy, “Object-Oriented Programming with C++”, Tata McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	-	-	1	-	-	1
CO2	3	2	2	-	1	2	-	-	1	-	-	2
CO3	2	3	2	3	1	2	-	-	2	-	-	1
CO4	1	-	-	-	1	2	-	-	1	2	-	2
CO5	2	1	1	-	1	2	1	-	2	-	-	2

Course Code	YCS3501			
Course Title	Behavioral and Interpersonal Skills			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	0	0	3	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will be taught about how to represent himself as a good human being and also able to learn to deal with different people with his/her interpersonal skillsets and behaviour. After the completion of this course, the students will be in a better position to learn and understand the basic interpersonal skills.

Course Outcome:

CO1: To understand how to handle workplace interpersonal communication in an effective manner.

CO2: To enhance the students skills with strong oral and written interpersonal communication.

CO3: To prepare students to critically analyze workplace situations and take appropriate decisions.

CO4: To prepare students campus ready through proper behavioral and interpersonal grooming.

CO5: To enhance skill set to design and frame team based Project Report and Presentation.

Course Content:

Module 1: Interpersonal Communication [9L]

The skills of Interpersonal Communication, Gender/Culture Neutrality, Rate of Speech, Pausing, Pitch Variation and Tone, Corporate Communication, Branding and Identity.

Module 2: Interpersonal Communication Vs Workspace Communication [9L]

Workplace Communication, Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.), Communication with Clients, Customers, Suppliers etc., Organizing/Participating in Business Meeting, Note Taking, Agenda, Minutes

Module 3: Business Etiquette and Corporate Life [9L]

Presenting oneself in the Business Environment, Corporate Dressing and Mannerism, Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.), E-mail Etiquette, Activity based Case Study.

Module 4: Movie Making : Corporate Business Meeting [9L]

Team based Brainstorming, Process Planning and Developing Plot, People management. Documentation and Scripting, Shooting the Movie: Location and Camera, Post Production and Editing, Movie Review: Feedback and Analysis.

Text/Reference Books:

1. P. Hartley, Interpersonal Communication,Routledge, 1993.
2. C.Garsten, Palgrave, Workplace Vagabonds: Career and Community in Changing Worlds of Work, Macmillan, 2008.
3. F.Moore, Ashgate,Transnational Business Cultures Life and Work in a Multinational Corporation,2005

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	3	-	-	2	-	1
CO2	1	3	3	-	-	-	3	-	-	2	-	-
CO3	-	-	2	1	2	2	-	-	-	2	-	1
CO4	-	-	2	1	2	2	-	-	-	3	-	-
CO5	2	-	2	-	1	2	-	-	-	3	-	1

Semester 4 Curriculum and Syllabus

SEMESTER-4							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS4001	Computer Organization and Architecture	3	0	0	3
2	PC	YCS4002	Design and Analysis of Algorithms	3	1	0	4
3	PC	YCS4003	Data Base Management System	3	0	0	3
4	PC	YCS4004	Formal Language and Automata	3	0	0	3
5	HS	YMG4001	Economics for Engineers	2	0	0	2
PRACTICAL							
6	PC	YCS4101	Computer Organization and Architecture Laboratory	0	0	3	1.5
7	PC	YCS4102	Algorithms Laboratory	0	0	3	1.5
8	PC	YCS4103	Data Base Management System Laboratory	0	0	3	1.5
9	PC	YCS4104	Programming Practices II	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
10	MC	YCS4501	Constitution of India	3	0	0	0
SESSIONAL (ONLY INTERNAL EVALUATION)							
11	PROJ	YCS4201	Innovative Project II	0	0	3	1.5
TOTAL				**17**	**1**	**15**	**22.5**

Course Code	YCS4001			
Course Title	Computer Organization and Architecture			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Digital Circuits and Logic Design			

Learning Objective:

In this course, the students will learn about the evolution of computer systems and development in computer organization and architecture, and the various functional units of a computer system with special emphasis on how instructions get executed. This course will cover the processor unit, the arithmetic and logic unit, the memory unit and input/output organization.
After the completion of this course, the student will better understand how exactly the programs are executed in a computer system.

Course Outcome:

CO1: To explain the process of instruction execution

CO2: To analyze and design control unit of a computer system

CO3: To analyze and design adder, multiplier and division unit

CO4: To analyze and design memory subsystems

CO5: To explain and classify various input/output data transfer techniques

Course Content:

Module 1: Evolution of Computer System **[4L]**
Introduction to computing system: computer organization and architecture, basic functional units of a computer, evolution of computers, stored-program concept, Von-Neumann and Harvard models

Module 2: Basic Operation of Computer **[7L]**
Instruction Set Architecture: CPU registers, instruction format and encoding, addressing modes, instruction set, instruction types, instruction decoding and execution, basic instruction cycle, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC).
Case study: MIPS Instruction set, MIPS assembly language programming.

Module 3: Processor Unit Design **[7L]**
Register transfer operations, internal single and multi-bus architecture.
Design of control unit: hardwired control unit design, microprogrammed control unit design, concept of control word and control store.
Horizontal, vertical and diagonal microprogrammed control unit design.

Module 4: Arithmetic Unit Design **[6L]**

Adder and subtractor, shift-and-add multiplication.
Signed multiplication: Booths algorithm, integer division, restoring and non-restoring division.
Floating point representation: IEEE floating point format, floating point arithmetic.

Module 5: Memory Unit Design **[7L]**

Basic memory types: Random Access Memory (RAM), Read Only Memory (ROM), Static RAM, Dynamic RAM.
Memory hierarchy, Cache memory: mapping techniques, Memory interleaving.

Module 6: Input Output Organization **[5L]**

I/O mapped I/O and Memory mapped I/O, Synchronous and Asynchronous serial data communication. Secondary memory: disk, flash memory.
I/O Data transfer techniques: Programmed I/O, Interrupt-driven I/O, Direct Memory Access (DMA).

Text/Reference Books:

1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization (5th Ed.)", Tata-McGraw-Hill.
2. W. Stallings, "Computer Organization and Architecture (6th Ed.)", Prentice Hall of India.
3. D. A. Patterson, and J. L. Hennessy, "Computer Organization and Design – The Hardware/ Software Interface", Morgan Kaufmann.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	2	-	-	1	-	1	2
CO2	1	1	3	-	-	2	-	-	2	-	1	2
CO3	2	2	2	2	2	1	-	-	1	-	-	2
CO4	2	2	1	2	2	1	-	-	2	-	-	2
CO5	2	1	1	-	1	1	-	-	1	-	-	2

Course Code	YCS4002			
Course Title	Design and Analysis of Algorithms			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	1	0	3
Total Contact Hours	36			
Pre-requisites	a) Fundamentals of Programming b) Data Structures and Algorithms			

Learning Objective:

It will covers topics such as algorithm complexity concepts and diverse algorithmic designs such as dividing and conquering, dynamic programming and greedy algorithms. The course will also include important search and sorting algorithms, graphs, and basic approaches of optimization.

Course Outcome:

CO1: To understand the concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation

CO2: To apply design principles and concepts to algorithm design

CO3: To understand and analyze the mathematical foundation in analysis of algorithms

CO4: To explain and classify different algorithmic design strategies

CO5: To analyze the efficiency of algorithms using time and space complexity theory

Course Content:

Module 1: Complexity Analysis **[7L]**

Time and space Complexity, Different asymptotic notations – their mathematical significance. Solving recurrences: substitution method, recurrence tree method, Master Theorem.

Module 2: Divide and Conquer **[9L]**

Basic concept, Examples: binary search, merge sort, quick sort and their complexity (all three cases). Heap sort and its complexity, Karatsuba algorithm.
Lower Bound Theory: Comparisons trees, Oracle and adversary argument, State space method.

Module 3: Dynamic Programming **[14L]**

Basic concepts, matrix chain manipulation, Strassen's algorithm, longest common subsequence, all-pair shortest paths (Floyd Warshall), single-source shortest path (Dijkstra, Bellman-Ford), 0/1 Knapsack problem, Travelling Salesman problem.
Greedy Method: Basic concept, Examples: fractional Knapsack problem, job sequencing with deadlines, minimum cost spanning tree using Prim's and Kruskal's method, Huffman encoding and decoding.
Backtracking: Basic concept, Examples: n-queens problem, graph coloring problem.
Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by rank.

Module 4: String Matching Problem [10L] Different techniques: Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Amortized Analysis and Network Flow: Aggregate, Accounting, and Potential Method, Ford Fulkerson algorithm, Max-Flow Min-Cut.

Module 5: Notion of NP-Completeness [8L]

P class, NP class, NP hard class, NP complete class their interrelationship, Reductions and Polynomial time Reducibility, Satisfiability problem (3-SAT and 2-SAT), Cook-Levin's theorem, Clique decision problem, Vertex Cover problem.

Text/Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", MIT Press.
2. E. Horowitz and S. Shani, "Fundamentals of Computer Algorithms", Universities Press.
3. K. Mehlhorn and P. Sanders, "Data Structures and Algorithms", Springer.
4. A. Aho, J. Hopcroft and J. Ullman "Design and Analysis of Computer Algorithms", Addison-Wesley.
5. 5. D. E.Knuth, "The Art of Computer Programming (Vol. 3)", Addison-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	-	-	2	-	-	3
CO2	3	3	3	3	1	2	-	-	1	-	2	3
CO3	3	2	2	3	1	2	-	-	2	-	-	3
CO4	3	3	3	3	1	2	-	-	1	-	-	3
CO5	3	2	2	3	1	2	-	-	2	-	-	3

Course Code	YCS4003
Course Title	Data Base Management System
Category	Professional Core
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Data Structures and Algorithms

Learning Objective:

In this course, the students will be able to learn the data models, conceptualize and depict a database system; design system using E-R diagram; learn SQL & relational database design; understand the internal storage structures using different file and indexing techniques; know the concepts of transaction processing, concurrency control techniques and recovery procedure.

Course Outcome:

CO1: To apply the knowledge of E-R diagram for an application

CO2: To explain the creation of the normalized relational database model

CO3: To analyze real world queries to generate reports from it

CO4: To determine whether the transaction satisfies the ACID properties

CO5: To create and maintain the database of an organization

Course Content:

Module 1: Introduction **[3L]**

Concept and overview of DBMS, data models.
Database languages, database administrator, database users, three-schema architecture of DBMS.

Module 2: Entity-Relationship and Relational Database Model **[9L]**

Basic concepts, design issues, mapping constraints, keys, entity-relationship diagram, weak entity sets, extended E-R features, case study on E-R model.
Structure of relational databases, relational algebra, relational calculus, extended relational algebra operations, views, modifications of the database.

Module 3: SQL and Integrity Constraints **[6L]**

Concept of DDL, DML, DCL.
Basic structure, set operations, aggregate functions, null values, domain constraints, referential integrity constraints, assertions, views, nested sub-queries.
Database security application development using SQL, stored procedures and triggers.

Module 4: Relational Database Design **[6L]**

AFunctional dependency, Different anomalies in designing a Database.
Normalization using functional dependencies, decomposition, Boyce-Codd Normal Form, 3NF. normalization using multi-valued dependencies, 4NF, 5NF, Case Study.

Module 5: Internals of RDBMS **[6L]**

Physical data structures, query optimization: join algorithm, statistics and cost based optimization. Transaction processing, concurrency control and recovery management: transaction model properties, state serializability, lock base protocols; two phase locking, deadlock handling.

Module 6: File Organization & Index Structures **[6L]**

File and record Concept, placing file records on disk, fixed and variable sized records, Ttypes of single-level index (primary, secondary, clustering). Multilevel indices, dynamic multilevel indices using B-tree and B+ tree.

Text/Reference Books:

1. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", Addison Wesley Publishing.
2. C.J. Date, "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. J.D. Ullman, "Principles of Database Systems", Galgottia Publication.
4. G. Jim and R. Address, "Transaction Processing : Concepts and Techniques", Morgan Kauff-man.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	-	1	-	-	2	-	2	1
CO2	3	3	3	1	-	2	-	-	2	-	1	2
CO3	3	3	3	1	-	1	-	-	2	-	2	1
CO4	3	3	3	1	2	2	-	-	2	-	1	2
CO5	3	2	2	2	-	1	-	-	2	-	2	1

Course Code	YCS4004
Course Title	Formal Language and Automata Theory
Category	Professional Core
LTP & Credits	L: 3, T: 0, P: 0, Credits: 3
Total Contact Hours	36
Pre-requisites	a) Discrete Mathematics b) Programming and Data Structure

Learning Objective:

In this course the students will learn the theory of computation, different formal language classes and their relationships, various techniques to prove or disprove theorems in automata theory using its properties, approaches to determine the decidability and intractability of computational problems. At the end of the course student will be able analyze complex problems and automaton to find solutions of such problems.

Course Outcome:

CO1: To explain the basic properties of formal languages and grammars

CO2: To understand the tools for recognizing different formal languages

CO3: To differentiate between regular, context-free and recursively enumerable languages

CO4: To apply the theory of computation and computational models including decidability and intractability

Course Content:

Module 1: Introduction to Finite Automata [10L]

Finite Automata, Alphabets, Strings, Languages, Regular Languages, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation, State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Myhill-Nerode Theorem, FA with output - Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

Module 2: Properties of Regular Expression [7L]

Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages, Application of Pumping Lemma, Closure and decision properties of Regular Languages.

Module 3: Language & Grammar Formalism [9L]

Grammars, Regular grammars-Right linear and left linear grammars, Equivalence between regular linear grammar and FA, Context Free Grammar, Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs - CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs-

Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

Module 4: Push Down Automata **[4L]**

PDA Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA, PDA to CFG, Two stack PDA.

Module 5: Turing Machines and Decidability **[6L]**

Basic model, Definition and representation, Instantaneous Description, Language acceptance by TM, Computable functions, Types of Turing machines, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs, Post correspondence problem (PCP), Modified PCP.

Text/Reference Books:

1. J. D. Ullman, J. Hopcroft and R. Motwani, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 2007
2. P. Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett Learning, 2012
3. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", Prentice Hall India, 2008
4. M. Sipser, "Introduction to Theory of Computation", Thomson Course Technology, 2006
5. J. C. Martin , "Introduction to Languages and Theory of Computations", McGraw Hill, 2011
6. E. A. Rich, Automata, "Computability and Complexity", Pearson Education, Inc., 2019
7. D. Kozen, "Automata and Computability", Spinger, 1997
8. H. R. Lewis and C. H. Papadimitriou, "Elements of the Theory of Computation", Prentice Hall of India Private Ltd.,1998
9. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory", Cambridge University Press, 2010
10. D. I. A. Cohen, "Introduction to computer theory", John Wiley & Sons, Inc., 1986

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	2	-	-	1	-	-	1
CO2	3	3	1	1	-	1	-	-	2	-	-	1
CO3	3	2	1	1	1	2	-	-	1	-	-	1
CO4	3	2	1	1	1	1	-	-	2	-	-	1

<table>
<tr><td>Course Code</td><td colspan="4">YMG4001</td></tr>
<tr><td>Course Title</td><td colspan="4">Economics for Engineers</td></tr>
<tr><td>Category</td><td colspan="4">Humanities</td></tr>
<tr><td rowspan="2">LTP & Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Total Contact Hours</td><td colspan="4">24</td></tr>
<tr><td>Pre-requisites</td><td colspan="4">None</td></tr>
</table>

Learning Objective:

In this course the students will learn about the managerial economics, basics of accounting and financial management. At the end of the course, the students will be able to make different managerial decisions in terms of economics and also able to solve financial statement as well as they can make different financing decision for business and at personal level.

Course Outcome:

CO1: To apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio

CO2: To evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions

CO3: To compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and/or systems

CO4: To evaluate the profit of a firm, carry out the break-even analysis and employ this tool to make production decision

CO5: To discuss and solve advanced economic engineering analysis problems including taxation and inflation

Course Content:

Module 1: Introduction **[3L]**

Managerial Economics, Relationship with other disciplines, Firms: Types, Objectives and goals, Managerial Decisions-Decision Analysis.

Module 2: Demand and Supply Analysis **[5L]**

Demand: Types of demand, determinants of demand, Demand function, Demand Elasticity, Demand forecasting. Supply: Determinants of supply, Supply function, Supply Elasticity.

Module 3: Cost Analysis **[5L]**

Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – PV ratio.

Module 4: Elementary Economic Analysis **[4L]**

Inflation: Meaning of inflation, types, causes, measures to control inflation.
National Income: Definition, Concepts of national income, Method of measuring national income.

Module 5: Financial Accounting **[5L]**

Concepts and Definition of Accounting, Journal, Ledger, Trial Balance.
Trading A/C, Profit & Loss A/C and Balance Sheet.

Module 6: Investment Decision **[2L]**

Time value of money: Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Text/Reference Books:

1. B. Riggs and S.U. Randhwa, “Engineering Economics”, McGraw Hill Education India.
2. D. Vengedasalam and K. Madhavan, “Principles of Economics”, Oxford University Press.
3. W. G. Sullivan, E. M. Wicks and C. P. Koelling, “Engineering Economy”, Pearson.
4. R. P. Seelvan, “Engineering Economics”, Prentice-Hall of India.
5. H. L. Ahuja, “Principles of Micro Economics”, S. Chand & Company Ltd.
6. S. P. Gupta, “Macro Economics”, Tata McGraw Hill.
7. K. K. Dewett, “Modern Economic Theory”, S. Chand & Company Ltd.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	2	-	-	-	-	2	1
CO2	-	-	-	3	-	2	-	-	-	-	-	1
CO3	-	1	-	-	-	2	-	-	-	-	3	1
CO4	-	-	-	-	-	2	-	-	3	-	-	1
CO5	-	1	-	-	-	2	-	-	-	-	1	1

Course Code	YCS4101			
Course Title	Computer Organization and Architecture Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a)Digital Circuits Laboratory			

Learning Objective:

In this laboratory course, the students will be conducting experiments using a MIPS instruction set simulator. They will also learn how to model various hardware blocks using the hardware description language Verilog. They shall be designing various functional units like adder, multiplier, processor, etc. using a Verilog.

Course Outcome:

CO1: To understand how to write assembly language programs in MIPS

CO2: To design various combinational and sequential circuits using

Verilog **CO3:** To design and analyze various CPU functional units using

Verilog **CO4:** To apply a pipelined processor using Verilog

Course Content:

1. Familiarization with MIPS assembly language programming using some instruction set simulator like QtSPIM.
   a. Reading and displaying an arbitrary string, and an integer.
   b. Store numbers sequentially in memory and find the minimum, maximum, and sum.
   c. Sort a set of numbers stored in memory. **[2 days]**

2. Familiarization of function calls with MIPS assembly language programming.
   a. Write a function to compute the factorial of a given number.
   b. Write a function to compute the GCD of two numbers.
   c. Write a function to compute the N-th Fibonacci number. **[2 days]**

3. Familiarization with a Verilog simulator like iVerilog, and write simple combinational and sequential modules using behavioral and structural modeling with Verilog.
   a. Write a module to implement an arbitrary Boolean function (e.g. F = A'BC + C'D).
   b. Write a module to implement a full adder, and hence a 4-bit ripple carry adder.
   c. Write a module to implement a D flip-flop, and hence a 4-bit shift register.
   d. Write a module to implement an 8-bit up-down counter with asynchronous clear. **[2 days]**

4. Write Verilog modules to implement functional blocks used in computer organization.
   a. Write a module to implement a 16-bit arithmetic and logic unit with 8 functions.
   b. Write a module to implement read/write operations in a 1024 x 16 memory system. **[2 days]**

5. Implement the MIPS 5-stage pipeline in Verilog, using a subset of 16 instructions. The design has to be tested by writing a test bench containing sample machine language programs stored in a memory module. **[4 days]**

Text/Reference Books:

1. qtSPIM simulator, http://spimsimulator.sourceforge.net/
2. MIPS overview, https://tams.informatik.uni-hamburg.de/applets/hades/webdemos/mips.html
3. M. M. Mano and M. D. Ciletti, "Digital Design: with an Introduction to Verilog HDL (5th Ed.)", Pearson Education.
4. J. Bhasker, "Verilog HDL Synthesis: A Practical Primer", B. S. Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	-	-	-	-	-	2	-	-	2
CO2	-	1	2	2	1	-	-	-	2	-	-	2
CO3	1	1	1	2	1	1	-	-	2	-	-	2
CO4	-	-	1	1	2	2	-	-	2	-	-	2

Course Code	YCS4102			
Course Title	Algorithms Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Programming Practices I			

Learning Objective:

The course aims to provide strategies (divide and conquer, dynamic, greedy) to solve problems in computer effectively. Using the many paradigms of solving problems, the innovative and effective approaches of solving a specific situation will be demonstrated. In each case, the focus is on the rigorous proof of the algorithm's validity.

Course Outcome:

CO1: To prove the correctness and analyze the running time of the basic algorithms

CO2: To design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy

CO3: To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem

CO4: To Identify and analyze criteria and specifications appropriate to new problems

Course Content:

1. Experiments on Divide and Conquer Approach. Binary Search (Recursive & Iterative).
   Merge Sort, Heap Sort, Quick Sort.
   Find Maximum and Minimum element from an array of integers. **[2 days]**

2. Experiments on Dynamic Programming.
   Minimum number of scalar multiplications needed for chain of matrix. All pair of shortest paths for a graph.
   Single-source shortest path for a graph (Dijkstra, Bellman Ford).
   Longest common subsequence problem. **[2 days]**

3. Experiments on Backtracking. The n-Queens problem.
   Graph Coloring problem. **[2 days]**

4. Experiments on Greedy Methods. Knapsack problem.
   Job sequencing with deadlines.
   Minimum cost spanning tree by Prim's and Kruskal's algorithm. **[2 days]**

5. Innovative Experiments
   Take the university time table for all departments. Write a computer program to find all

conflicts within the time table using graph colouring approach. Provide a solution using Backtracking. Compute the distance and find the stoppages every classmate of yours cover to

reach the institute. Then assume their speeds based on their travelling modes. Compute each student's minimum time to reach the institute premises.

[2 days]

Text/Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", MIT Press.
2. E. Horowitz and S. Shani, "Fundamentals of Computer Algorithms", Universities Press.
3. K. Mehlhorn and P. Sanders, "Data Structures and Algorithms", Springer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	1	1	-	-	2	-	-	3
CO2	3	2	2	3	1	-	-	-	2	-	-	3
CO3	3	3	2	3	1	1	-	-	2	-	-	3
CO4	3	3	2	1	1	-	-	-	2	-	-	3

Course Code	YCS4103			
Course Title	Data Base Management System Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a)Digital Circuits Laboratory			

Learning Objective:

In this course, the students will able to learn the data models, conceptualize and depict a database system; learn the fundamental concepts of SQL queries; understand the concept of designing a database with the necessary attributes; know the methodology of Accessing, Modifying and Updating data & information from the relational databases; learn database design as well as to design user interface and how to connect with database.

Course Outcome:

CO1: To understand the basic concepts regarding database, SQL queries

CO2: To explain the concepts of PL/SQL

CO3: To differentiate between DBMS and advanced DBMS

CO4: To analyze database system concepts and apply normalization to the database

CO5: To apply and create different transaction processing and concurrency control applications

Course Content:

1. Experiments on fundamentals of database
   systems Creating a Database
   Creating a Table
   Specifying Relational Data Types
   Specifying Constraints
   Creating Indexes **[2 days]**

2. Experiments on database Tables and Record
   handling INSERT statement
   Use of SELECT and INSERT together
   DELETE, UPDATE, TRUNCATE statements
   DROP, ALTER statements **[2 days]**

3. Experiments on retrieving data from
   database The SELECT statement
   Use of the WHERE clause
   Use of the Logical Operators in the WHERE clause
   Use of IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
   Use of the Aggregate
   Functions Combining tables
   using JOINS
   Sub-queries **[3 days]**

4. Experiments on Miscellaneous Database
 Management Creating Views
 Creating Column Aliases
 Creating Database Users
 Use of GRANT and REVOKE **[1 day]**

5. Experiments on PL/SQL
 Use of decision making statement, different loop structures to solve simple programs (e.g., sum of few numbers, pattern prints, etc.).
 Inserting values into tables, reading data from a table.
 Basic working with CURSORS **[1 day]**

6. Innovative Experiments
 Case study of handling complex databases (e.g., College Management System, Hospital management System, Library management System, Payroll management System, etc.) **[3 days]**

Text/Reference Books:

1. H. F. Korth and A. Silberschatz, "Database System Concepts", McGraw Hill.
2. E. Ramez and S. Navathe, "Fundamentals of Database Systems", Benjamin Cummings Publishing Company.
3. C. J. Date, "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
4. G. Jim and R. Address, "Transaction Processing : Concepts and Techniques", Moragan Kauff-man.
5. J.D. Ullman, "Principles of Database Systems", Galgottia Publication.
6. I. Bayross , "SQL, PL/SQL the Programming Language of Oracle", BPB Publications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	1	-	-	1
CO2	3	2	2	1	2	-	-	-	1	-	-	1
CO3	1	2	3	-	-	-	-	-	1	-	-	2
CO4	3	1	2	2	1	-	-	-	1	-	1	2
CO5	2	2	3	1	-	-	-	-	1	-	1	2

Course Code	YCS4104
Course Title	Programming Practices II
Category	Professional Core
LTP & Credits	L T P Credits 0 0 3 1.5
Total Contact Hours	36
Pre-requisites	a) Fundamentals of Programming b) Basic Problem Solving

Learning Objective:

In this practical course, the students will be learning Python programming basics and paradigm. python looping, control statements and string manipulations. Students will be made familiar with the concepts of various modules, packages and python libraries used for various applications (Machine learning, Deep learning etc.).

Course Outcome:

CO1: Understand and explain the basic principles of Python programming language and object oriented concept.

CO2: Define and demonstrate the use of built-in data structures along with the help of condition checking and looping structures.

CO3: Understand and apply various applications of different modules and packages in Python.

CO4: Learn to handle exceptions and files in Python.

Course Content:

1. History, Features, Setting up path, working with Python, Basic Syntax, Variable and Data Types, Operator. **[1 day]**

2. Conditional Statements: If, If- else, Nested if-else, Looping, For, While, Nested loops , Control Statements : Break, Continue, Pass. **[1 day]**

3. String Manipulation: Accessing Strings, Basic Operations, String slices, Function and Methods. Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods. **[2 days]**

4. Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods. Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties. **[2 days]**

5. Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables. **[1 day]**

6. Modules: Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file,

Reading and writing files, Functions. **[2 days]**

7. Exception and File Handling: Exception, Exception Handling, Except clause, Try & finally clause, User Defined Exceptions. **[1 day]**

8. A case study on using a computer game for teaching data structures on stacks and queues. The computer game is developed to help students visualize the data structures and data access operations on stacks and queues. This game-based learning is engaging, fun and, more importantly, abstract concepts in data structures can be visualized and learnt through game playing. **[2 days]**

Text/Reference Books:

1. T. R. Padmanabhan, "Programming with Python (1st Ed.)", Springer.

2. R. Thareja, "Python Programming: using Problem Solving Approach (1st Ed.)", Oxford University Press.

3. W. McKinney, "Python Data Analysis (2nd Ed.)", O.Reilly.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	2	1	-	1	-	-	-
CO2	3	1	1	-	1	2	1	-	-	-	-	2
CO3	3	3	1	1	1	2	1	-	1	-	-	2
CO4	3	2	2	1	1	2	1	-	-	-	-	2

Course Code	YCS4501			
Course Title	Constitution of India			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Upon completion of this lesson, students will be able to understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context. Understand and analyse the three organs of the state in the contemporary scenario. Understand and Evaluate the Indian Political scenario amidst the emerging challenges.

Course Outcome:

CO1: Develop human values , create awareness about law ratification and significance of Constitution

CO2: Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.

CO3: Create understanding of their Surroundings, Society, Social problems and their suitable solutions

CO4: Demonstrate with distribution of powers and functions of Local Self Government.

CO5: Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

Course Content:

1. Meaning of the constitution law and constitutionalism **[3L]**
2. Historical perspective of the Constitution of India **[2L]**
3. Salient features and characteristics of the Constitution of India **[1L]**
4. Scheme of the fundamental rights **[2L]**
5. The scheme of the Fundamental Duties and its legal status **[2L]**
6. The Directive Principles of State Policy – Its importance and implementation **[2L]**
7. Federal structure and distribution of legislative and financial powers between the Union and the States **[3L]**
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India **[2L]**
9. Amendment of the Constitutional Powers and Procedure **[2L]**
10. The historical perspectives of the constitutional amendments in India **[2L]**

11. Emergency Provisions: National Emergency, President Rule, Financial Emergency **[3L]**

12. Local Self Government – Constitutional Scheme in India **[3L]**
13. Scheme of the Fundamental Right to Equality **[3L]**
14. Scheme of the Fundamental Right to certain Freedom under Article 19 **[3L]**
15. Scope of the Right to Life and Personal Liberty under Article 21. **[3L]**

Text/Reference Books:

1. D.D. Basu, V.R. Manohar, B.P.Banerjee, S.A.Khan, , Introduction to the Constitution of India. Wadhwa, 2001.
2. P. M. Bakshi & S. C. Kashyap, he constitution of India. Universal Law Publishing, 1982.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	3	2	3	-	-	-	2
CO2	-	-	1	-	-	3	2	3	-	-	-	2
CO3	-	-	1	-	-	3	2	3	-	1	-	2
CO4	-	-	1	-	-	3	2	3	-	1	-	2
CO5	-	-	1	-	-	3	2	3	-	1	-	2

Semester 5 Curriculum and Syllabus

SEMESTER-5							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS5001	Operating Systems	3	0	0	3
2	PC	YCS5002	Embedded Systems	3	0	0	3
3	PC	YCS5003	Introduction to Data Science	3	0	0	3
4	PC	YCS5004	Advanced Computer Architecture	3	0	0	3
5	OE		Elective I	3	0	0	3
		YCS5005	Multimedia Technology				
		YCS5006	Operations Research				
		YCS5007	Communication Engineering				
PRACTICAL							
6	PC	YCS5101	Operating Systems Laboratory	0	0	3	1.5
7	PC	YCS5102	Embedded Systems Laboratory	0	0	3	1.5
8	PC	YCS5103	Data Science Laboratory	0	0	3	1.5
MANDATORY NON-CGPA COURSE							
9	MC	YCS5501	Environmental Science	3	0	0	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS5201	Innovative Project III	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**21**

Course Code	YCS5001			
Course Title	Operating Systems			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Data Structures and Algorithms b) Computer Organization and Architecture			

Learning Objective:

In this course, the students will learn about the role of operating system as the interface between application programs and the computer hardware. The role of operating system in managing various computer resources shall be dealt with in detail.

The course will be very helpful for the students in strengthening their skills in handling large software projects.

Course Outcome:

CO1: To explain the role of operating system and how it acts as interface between hardware and software.

CO2: To contrast the concepts of processes and threads, and how they are scheduled.

CO3: To demonstrate the use of various synchronization tools in solving the critical section problem.

CO4: To explain and classify the various memory management techniques including virtual memory.

CO5: To apply the knowledge of data structures to explain how file systems can be implemented on secondary storage.

Course Content:

Module 1: Introduction to Operating Systems **[4L]**

Functionalities of operating system – hardware/software interface. Evolution of operating systems – batch, multi-programmed, time-sharing, real-time, distributed. Simultaneous Peripheral Operations On-Line (SPOOL).
Protection and Security – user/supervisory mode, privileged instructions, system calls (invoking OS services).

Module 2: Processes and Threads **[7L]**

Processes – basic concept, process control block (PCB), process state transition diagram.
Process scheduling – independent and co-operating processes, inter-process communication using shared memory and message passing. Case studies from Unix/Linux.

Threads – lightweight process concept, benefits of threads, user and kernel level threads, using thread library in Unix/Linux.
CPU Scheduling – scheduling criteria, preemptive and non-preemptive scheduling. Scheduling algorithms – FCFS, SJF, SRTF, RR, priority, multi-level feedback queue.

Module 3: Process Synchronization and Deadlocks **[7L]**

Classical problems of process synchronization – producer-consumer, reader-writer, dining philosopher, etc.
Critical section problem – illustration, software solutions, solution using synchronization hardware: test-and-set (TST) and SWAP instructions.
Semaphores – definition, binary and counting semaphores, implementation of semaphores, minimizing busy waiting. Case studies from Unix/Linux.
Deadlocks – deadlock characterization, methods of handling deadlock, deadlock prevention versus deadlock avoidance, Banker's algorithm.

Module 4: Memory Management **[8L]**

Logical versus physical address space, swapping, contiguous memory allocation, memory protection using fence registers.
Paging – basic concept, performance analysis, translation look-aside buffer (TLB). Segmentation.
Virtual memory – separation of logical and physical address space, demand paging, locality of reference.
Page replacement algorithms – FCFS, LRU, Optimal, Belady's anomaly. Thrashing, working set model.

Module 5: Device and File Management **[7L]**

Disk structure – cylinders, tracks and sectors.
Disk scheduling algorithms – FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.
File system – file concept, access methods, directory and file system structure, allocation methods (contiguous, linked, indexed), free space management. Case study for Unix/Linux.

Module 6: Miscellaneous Topics **[3L]**

Brief overview of real-time and distributed operating systems, mobile operating systems.

Text/Reference Books:

1. A. Silberschatz, P. B. Galvin and G. Gagne, "Operating System Concepts", Wiley Asia.
2. D. M. Dhamdhere, "Operating Systems: A Concept-Based Approach", Tata McGraw-Hill.
3. M. Bach, "Design of the Unix Operating System", Prentice-Hall of India.
4. W. Stallings, "Operating Systems: Internals and Design Principles", Prentice-Hall of India.
5. C. Crowley, "Operating System: A Design-Oriented Approach", Irwin Publishing.
6. G. J. Nutt, "Operating Systems: A Modern Perspective", Addison-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	-	-	-	2	2	-	-	-	1	2
CO2	-	2	3	-	2	-	2	-	-	-	1	2
CO3	-	2	3	2	2	1	2	-	-	-	1	2
CO4	1	2	2	-	2	-	2	-	1	-	1	2
CO5	2	2	3	1	2	1	2	-	1	-	1	2

Course Code	YCS5002
Course Title	Embedded Systems
Category	Professional Core
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Computer Organization and Architecture b) Digital Circuits and Logic Design

Learning Objective:

In this course, the students will learn about microprocessor and microcontroller architectures and their use to develop embedded systems. Various case studies with popular development boards shall be discussed.

The course will be very helpful for students who want to apply the knowledge to develop real-life applications that involve embedded systems.

Course Outcome:

CO1: To explain the architecture of 8085 microprocessor and examine various applications.

CO2: To summarize the basic design principles of embedded systems.

CO3: To explain and compare the various microcontroller architectures and development boards.

CO4: To explain and demonstrate how sensors and actuators work in the context of embedded systems.

CO5: To apply the knowledge to develop various real-life applications.

Course Content:

Module 1: Basic 8085 Architecture and Interfacing [12L]

Introduction to 8085 microprocessor architecture – instruction execution and timing, memory and I/O interfacing, interrupt structure and DMA operation.

8085 assembly language programming – instruction set, writing simple programs, generating time delays, stacks and subroutines.

Basic interfacing concepts – 8255 programmable peripheral interface, interfacing examples.

Module 2: Introduction to Embedded Systems [4L]

Definitions and constraints, hardware and processor requirements, application dependent requirements, hardware-software co-design approach, example system design.

Embedded system hardware – microprocessors and microcontrollers, Von Neumann and Harvard architecture, RISC and CISC.

Module 3: Microcontroller Architecture [10L]

ARM processor architecture – instruction execution, instruction pipeline, ARM instruction set and addressing modes. Case study with an ARM development board.

Other popular microcontroller families – ATmega328P microcontroller (Arduino Uno), PIC microcontroller family, 8051 microcontroller family.

Module 4: Miscellaneous Topics **[4L]**

Digital signal processor (DSP) architecture – case studies and applications.
Memory for embedded systems – embedded SRAM, embedded DRAM, flash memory. Bus structures and standards for embedded systems.
Internet-of-things (IoT) – basic architecture and applications.

Module 5: Sensors and Actuators **[6L]**

Sensors and Actuators – temperature sensor, light sensor, pressure sensor, motion sensor, humidity sensor, gas sensor, relays, LED & LCD display units, WiFi interface module, GPS/GPRS module.
Example interfacing using microcontroller boards, programming environments (e.g., embedded C), home automation.

Text/Reference Books:

1. R. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publisher.
2. W. Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufmann.
3. M. A. Mazidi, J. G. Mazidi et al., "The 8051 Microcontroller and Embedded Systems", Prentice-Hall of India.
4. M. Sloss, D. Symes, and C. Wright, "ARM System Developers Guide: Designing and Optimizing System Software", (Online Resource).
5. P. Marwedel, "Embedded System Design", Kluwer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	2	-	-	-	-	-	-	2
CO2	-	3	3	1	-	-	-	-	-	-	-	2
CO3	-	2	-	2	2	-	-	-	-	-	-	2
CO4	3	1	2	-	1	2	2	-	-	-	2	2
CO5	-	-	-	2	3	3	2	-	-	-	1	2

Course Code	YCS5003			
Course Title	Introduction to Data Science			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn about the fundamentals of data science. The course will also impart design thinking capability to build big-data. Also, developing design skills of models for big data problems shall be covered.

After the completion of this course, the students will be in a better position to learn and understand the basic programming tools for data sciences.

Course Outcome:

CO1: To understand and analyze data visualization in big-data analytics.

CO2: To explain and utilize Exploratory Data Analysis.

CO3: To explain and utilize matrix decomposition techniques to perform data analysis.

CO4: To explain and demonstrate data pre-processing techniques.

CO5: To apply basic machine learning algorithms in various applications.

Course Content:

Module 1: Introduction [4L]

Big Data and Data Science: Big Data Analytics, Business intelligence vs. Big data, big data frameworks, Current landscape of analytics, data visualization techniques, visualization software.

Module 2: Exploratory Data Analysis (EDA) [6L]

Exploratory Data Analysis (EDA), statistical measures, Basic tools (plots, graphs and summary statistics) of EDA, Data Analytics Lifecycle, Discovery.

Module 3: Basic Statistical Inference [5L]

Developing Initial Hypotheses, Identifying Potential Data Sources, EDA case study, testing hypotheses on means, proportions and variances.

Module 4: Regression models [5L]

Regression models: Simple linear regression, least-squares principle, MLR, logistic regression, Multiple correlation, Partial correlation.

Module 5: Linear Algebra Basics [4L]

Matrices to represent relations between data, Linear algebraic operations on matrices –Matrix decomposition: Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

Module 6: Data Pre-processing and Feature Selection **[6L]**

Data cleaning, Data integration, Data Reduction, Data Transformation and Data Discretization, Feature Generation and Feature Selection, Feature Selection algorithms: Filters, Wrappers, Decision Trees, Random Forests.

Module 7: Basic Machine Learning Algorithms **[6L]**

Classifiers: Decision tree, Naive Bayes classifier, k-Nearest Neighbors (k-NN), k-means, Support Vector Machine. Association Rule mining – Ensemble methods.

Text/Reference Books:

1. J. Leskovek, A. Rajaraman and J. Ullman, "Mining of Massive Datasets. v2.1", Cambridge University Press.
2. S. Acharya and S. Chellappan, "Big Data Analytics", Wiley.
3. J. Han, K. Kamber and J. Pei, "Data Mining: Concepts and Techniques", Morgan Kaufmann.
4. J. Liebowitz, "Big Data and Business Analytics", CRC Press.
5. C. Rajan, "Data mining methods, 2nd edition", Narosa.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	2	2	2	-	-	2	-	1	3
CO2	1	2	2	2	2	2	-	-	1	-	1	3
CO3	1	2	2	2	1	2	-	-	2	-	1	3
CO4	2	1	1	1	1	2	-	-	1	-	1	1
CO5	2	1	1	1	1	2	-	-	2	-	1	3

Course Code	YCS5004
Course Title	Advanced Computer Architecture
Category	Professional Core
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Computer Organization and Architecture

Learning Objective:

In this course, the students will learn about the advanced features of computer architecture. The concept of quantitative principles of design, pipeline, multiprocessor systems will be taught in this course.

After the completion of this course, the student will better understand the architecture of modern day processors.

Course Outcome:

CO1: To analyze and measure quantitative principles in computer science.

CO2: To design and analyze pipelining system.

CO3: To explain and analyze instruction level parallelism.

CO4: To analyze and design memory systems for higher bandwidth.

CO5: To categorize multiprocessor systems and analyze their performance.

Course Content:

Module 1: Performance Evaluation and Pipeline Concept [10L]

Review of basic computer architecture, Quantitative principles in computer design, Measuring performance, Amdahl's law, Examples.
Concept of pipeline, Instruction pipeline, Arithmetic pipeline. Pipeline performance and optimization techniques (reservation table, minimum average latency).
Hazards: Data hazard, Structural hazard, Control hazard.
Techniques for handling hazard: data forwarding, delay slots, branch prediction, compiler optimization techniques.

Module 2: Instruction Level Parallelism [5L]

Instruction Level Parallelism (ILP), Techniques to increase ILP, Superscalar Architecture, Very Long Instruction Word (VLIW) Architecture.

Module 3: Memory System [7L]

Memory hierarchy, Inclusion, Coherence and locality properties, Cache optimization Techniques, Virtual memory concept, Translation Lookaside Buffer (TLB), Paging and segmentation, Memory replacement policies.

Module 4: Multiprocessor Systems **[10L]**

Taxonomy for parallel architectures, Centralized Shared memory architecture: synchronization and memory coherency, cache coherency problem, interconnection networks. Distributed shared memory architecture: Loosely couped systems, Uniform Memory Access (UMA) and Non- Uniform Memory Access (NUMA).

Module 5: Non-Conventional Architectures **[4L]**

Data flow computers, Systolic architectures, Domain specific architectures, GPUs, etc.

Text/Reference Books:

1. D. A. Patterson, and J. L. Hennessy, "Computer Organization and Design-The Hardware/-Software Interface", Morgan Kaufmann.
2. L. Hennessy and D. A. Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufmann.
3. M. J. Flynn, "Computer Architecture: Pipelined and Parallel Processor Design", Narosa Publishing House.
4. K. Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	1	-	-	2	-	-	-	-	2
CO2	2	2	3	-	1	-	1	-	-	-	-	2
CO3	2	1	2	2	-	-	1	-	-	-	-	2
CO4	2	-	2	2	2	-	1	-	-	-	2	2
CO5	2	-	1	2	1	1	2	-	-	-	2	2

Course Code	YCS5005
Course Title	Multimedia Technology
Category	Open Elective
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Design and Analysis of Algorithms

Learning Objective:

In this course, the students will learn to adopt factual knowledge and develop skills needed for independent development of multimedia systems and applications using available theory and different applications.

Course Outcome:

CO1: To explain the basic concept of multimedia and its applications.

CO2: To learn and analyze various multimedia Technologies.

CO3: To explain and analyze various multimedia creations.

CO4: To apply the basic understanding of concepts in real-world applications.

Course Content:

Module 1: Introduction to Multimedia **[7L]**

Introduction to multimedia: graphics, image and video representations, fundamental concepts of video, digital audio. Storage requirements of multimedia applications, need for compression, taxonomy of compression algorithms. Elements of information theory, error free compression, lossy compression.

Module 2: Text Compression **[4L]**

Huffman coding, adaptive Huffman coding, arithmetic coding, Shannon-Fano coding, Dictionary techniques – LZW family algorithms.

Module 3: Image Compression **[6L]**

Image Compression: Fundamentals, compression standards, JPEG Standard, sub-band coding, wavelet based compression.

Implementation using Filters – EZW, SPIHT coders, JPEG 2000 standard, JBIG and JBIG2 standards.

Module 4: Video Compression **[6L]**

Video compression techniques and standards – MPEG video coding: MPEG-1 and MPEG- 2 video coding, MPEG-3 and MPEG-4 motion estimation and compensation techniques, H.261 standard, DVI technology, DVI real time compression. Current trends in compression standards.

Module 5: Audio Compression **[5L]**

Audio compression Techniques, A-Law companding, frequency domain and filtering, basic sub-band coding, application o speech coding – G.722, MPEG audio, progressive encoding, silence compression, speech compression – Formant and CELP vocoders.

Module 6: Animation **[8L]**

Overview of Animation Techniques – Key framing. Computer animation: Motion capture and editing, forward/inverse kinematics, deformation models, facial animation. Raster methods, design of animation sequences, animation techniques, key-frame systems, motion specification – direct, dynamics, – rigid body animation, collision detection. Graphics file format – OpenGl animation procedures.

Text/Reference Books:

1. D. Hankerson, G. A. Harris and P. D. Johnson, "Introduction to Information Theory and Data Compression", CRC press.
2. D. Solomon, "Data Compression – The Complete Reference", Springer, New York.
3. M. S. Drew and Z. Li, "Fundamentals of Multimedia", Prentice-Hall of India.
4. P. Symes, "Digital Video Compression", McGraw Hill.
5. Y. Q. Shi and H. Sun, "Image and Video Compression for Multimedia Engineering: Algorithms and Fundamentals", CRC Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	2	2	-	2	-	-	3
CO2	1	2	2	-	2	-	1	-	2	-	-	3
CO3	3	1	2	-	2	-	1	-	2	-	-	3
CO4	1	2	3	2	1	-	2	-	2	-	-	3

Course Code	YCS5006			
Course Title	Operations Research			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Mathematics I & II b) Fundamentals of Programming			

Learning Objective:

In this course the students will learn about the basic knowledge of LPP, duality, transportation problem, assignment problem, game theory, queueing and inventory models. At the end of the course, the students will get knowledge about various decision making through operations research models.

Course Outcome:

CO1: To explain linear programming problems and appreciate their limitations.

CO2: To analyze and solve linear programming problems using appropriate techniques and optimization solvers.

CO3: To conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship.

CO4: To develop mathematical skills to analyze and solve transportation, assignment problem and network models arising from a wide range of applications.

CO5: To share and communicate ideas, explain procedures and interpret results and solutions in written and electronic forms to different audiences.

Course Content:

Module 1: Linear Programming Problem [10L]

Linear Programming Problem(LPP): Basics of LPP and its applications. General mathematical formulation of LPP. Definitions: Convex set, Solution, Feasible Solution, Basic and Non-Basic Variables, Basic Feasible Solution, Degenerate and Non-Degenerate solution, Optimum/Optimal Solution; Solution of LPP by Graphical Analysis/Method, Simplex Method, Charnes' Big M-Method; Duality Theory.

Module 2: Transportation Problem and Assignment Problem [6L]

Transportation Problem, Assignment Problem – problem solving.

Module 3: Game Theory [5L]

Game Theory: Introduction; Two person Zero Sum game, Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

Module 4: Network Optimization Models **[5L]**

Network Optimization Models: CPM, PERT, Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and stack. Critical path, Probability of meeting scheduled date of completion of project. Calculation of CPM network. Various floats for activities.

Module 5: Sequencing **[2L]**

Sequencing: Johnson's Algorithm (1957) For n Jobs and two machines, n Jobs and three machines.

Module 6: Queuing Theory **[5L]**

Queuing Theory: introduction and basic structure; Birth-and-Death Model (Poisson / Exponential distribution); Poisson Queue Models: (M/M/1):(∞/FIFO) and (M/M/1):(N/FIFO) and Problems.

Module 7: Inventory **[3L]**

Introduction to EOQ Models of Deterministic and Probabilistic, Safety Stock, Buffer Stock.

Text/Reference Books:

1. K. Swaroop and P. K. Manmohan, "Operations Research", Sultan Chand and Sons.
2. J. G. Chakraborty and P. R. Ghosh, "Linear Programming and Game Theory", Central Book Agency.
3. P. M. Karak, "Linear Programming and Theory of Games", ABS Publishing House.
4. D. K. Jana and T. K. Roy, "Operations Research", Chhaya Prakashani Pvt. Ltd.
5. H. A. Taha, "Operations Research", Pearson.
6. J. K. Sharma, "Operations Research Theory and Applications", Macmillan India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	1	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	1	1
CO5	3	3	2	-	-	-	-	-	-	-	1	1

Course Code	YCS5007			
Course Title	Communication Engineering			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Basic Electronics			

Learning Objective:

In this course, the students will be taught about the fundamental concepts of modern communication systems. This will include various kinds of modulation techniques, information theory and coding techniques, and multiple access techniques.

The course will be very helpful for the students in understanding next level courses like Computer Networks.

Course Outcome:

CO1: To explain and compare the fundamental concepts of analog, pulse and digital modulation techniques.

CO2: To compare and contrast the essential concepts of information theory and coding techniques.

CO3: To explain and classify the various spread spectrum and multiple access techniques in data communication.

Course Content:

Module 1: Analog Modulation [5L]

Amplitude Modulation: AM, double sideband full carrier system (DSBSC), single sideband suppressed carrier system (SSBSC), Vestigial sideband system (VSB), power spectral density (PSD).

Modulators and demodulators, angle modulation, frequency and phase modulation. Superheterodyne receivers.

Module 2: Pulse Modulation [7L]

Low-pass sampling theorem, Quantization, pulse amplitude modulation (PAM).

Line coding: pulse code modulation (PCM), differential pulse code modulation (DPCM), delta modulation (DM), and adaptive differential pulse code modulation (ADPCM).

Time Division Multiplexing, Frequency Division Multiplexing.

Module 3: Digital Modulation and Transmission [8L]

Phase shift keying: binary phase shift keying (BPSK), differential phase shift keying (DPSK), quadrature phase shift keying (QPSK). Principles of M-ary signaling, M-ary PSK quadrature amplitude modulation (QAM). Pulse shaping, Duo binary encoding, Cosine filters, equalizers.

Module 4: Information Theory and Coding **[8L]**

Measure of information: entropy, source coding theorem, Shannon–Fano coding, Huffman coding, LZ coding. Channel capacity, Shannon-Hartley law, Shannon's limit.

Error control codes: cyclic codes, syndrome calculation, convolution coding, sequential and Viterbi decoding.

Module 5: Spread Spectrum and Multiple Access **[8L]**

Pseudo-Noise (PN) sequences: properties, m-sequence, direct sequence spread spectrum (DSSS). Processing gain, jamming, frequency hopping spread spectrum (FHSS). Synchronization and tracking, Multiple Access: frequency division multiple access (FDMA), time division multiple access (TDMA), code division multiple access (CDMA).

Text/Reference Books:

1. J. G. Proakis and M. Salehi, "Fundamentals of Communication Systems", Pearson Education.
2. S. Haykin, "Communication Systems", John Wiley and Sons.
3. B. Carlson, P. B. Crilly, and J. C. Ruteledge, "Communication Systems", McGraw-Hill.
4. R. E. Ziemer and W. H. Tranter, "Principle of Communication", John Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	2	2	-	-	-	1	-	3
CO2	1	1	2	1	2	2	-	-	-	2	-	3
CO3	1	1	1	1	2	2	-	-	-	1	-	3

Course Code	YCS5101			
Course Title	Operating Systems Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Data Structures and Algorithms b) Computer Organization and Architecture			

Learning Objective:

In this laboratory course, the students will be carrying out various software assignments on Unix/Linux shell programming and system calls. Also, assignments for simulating important OS modules like CPU scheduling, file system, etc. shall be carried out.

Course Outcome:

CO1: To learn how to write shell scripts.

CO2: To learn how to use Unix/Linux system calls and to design a shell program.

CO3: To analyze the performance of CPU scheduling algorithms through

simulation. **CO4:** To learn how to use multi-threaded programming.

CO5: To design and implement one OS module like memory management, file system, etc.

Suggestive List of Experiments:

1. Write shell scripts using "bash" shell scripting language for simple system administration tasks, text search and replacement, directory and file manipulation, simple numeric computations, etc. **[2 days]**

2. Write programs in C for familiarization with the Unix/Linux system calls fork, exec, wait, exit, dup, pipe, shared memory, etc. **[2 days]**

3. Write a command line interpreter (shell) program using the Unix/Linux system calls with the facilities for: (a) running executable programs, (b) running a program in the background, (c) input and output redirection, (d) command piping. **[2 days]**

4. Implementation of various CPU scheduling algorithms in C, and compare their performances. **[2 days]**

5. Write programs using "pthread" library with multiple threads, and use semaphores for mutual exclusion. **[1 day]**

6. Design and implement a Unix-like memory-resident file system using the concept of inodes.

OR

Implementation of memory management system supporting virtual memory, and analyze the performance. **[3 day(s)]**

Text/Reference Books:

1. A. Silberschatz, P. B. Galvin and G. Gagne, "Operating System Concepts", Wiley Asia.
2. D. M. Dhamdhere, "Operating Systems: A Concept-Based Approach", Tata McGraw-Hill.
3. M. Bach, "Design of the Unix Operating System", Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	-	1	2	1	-	1	-	-	2
CO2	2	-	2	-	2	1	-	-	1	-	-	2
CO3	2	1	2	1	2	2	1	-	1	-	-	2
CO4	2	-	1	-	3	1	-	-	2	-	-	2
CO5	2	1	2	3	2	2	1	-	2	-	-	2

Course Code	YCS5102				
Course Title	Embedded Systems Laboratory				
Category	Professional Core				
LTP & Credits	L	T	P	Credits	
	0	0	3	1.5	
Total Contact Hours	36				
Pre-requisites	a) Computer Organization and Architecture b) Digital Circuits and Logic Design				

Learning Objective:

In this laboratory course, the students will be conducting hands-on sessions with various microprocessor and microcontroller development boards for a better understanding of the design of embedded systems. The sessions shall also involve interfacing of various sensors and actuators.

Course Outcome:

CO1: To learn programming on the 8085 development board, and interfacing simple peripherals.

CO2: To design programming and interfacing experiments on the Arduino UNO board. **CO3:** To design programming and interfacing experiments on ARM development board. **CO4:** To learn how to interface various sensors and actuators.

Suggestive List of Experiments:

1. Programming assignments based on 8085 microprocessor board – simple programs, looping, bit manipulation, subroutines. **[2 days]**
2. Interfacing switches, LEDs and 7-segment displays to the microprocessor kit, writing delay routines. **[2 days]**
3. Programming and interfacing experiments based on the Arduino UNO microcontroller board . **[3 days]**
4. Programming and interfacing experiments based on ARM development board. **[2 days]**
5. Design a home automation systems with multiple sensors and actuators, using some microcontroller board. **[3 days]**

Text/Reference Books:

1. R. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publisher.
2. W. Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufmann.
3. M. A. Mazidi, J. G. Mazidi et al., "The 8051 Microcontroller and Embedded Systems", Prentice-Hall of India.

4. M. Sloss, D. Symes, and C. Wright, “ARM System Developers Guide: Designing and Optimizing System Software”, (Online Resource).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	2	1	2	-	1	-	-	3
CO2	2	1	2	2	1	1	2	-	2	-	-	3
CO3	2	1	2	2	1	-	2	-	1	-	-	3
CO4	2	1	2	1	1	2	2	-	2	-	-	3

Course Code	YCS5103			
Course Title	Data Science Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Programming Practices II			

Learning Objective:

In this course, the students will learn to manipulate data objects, produce graphics, analyze data using common statistical methods and generate reproducible statistical reports with programming in Python and R.

After the completion of this course, the students will be in a better position to solve the analytical problems of data science using Python and R.

Course Outcome:

CO1: To be able to solve analytical problems using Python and R.

CO2: To develop competency in Python and Python libraries such as Pandas, Numpy, and Scipy.

CO3: To explain and analyze results effectively using visualizations in Python and R.

CO4: To demonstrate how to import, export and manipulate data and produce statistical summaries of continuous and categorical data in Python and R.

CO5: To be able to perform exploratory data analysis using Python and R.

Suggestive List of Experiments:

1. Experiments on basic Python programming.
   Expressions, operators, matrices, decision statements, control flow and functions.
   Classes, objects, packages and files.
   Tuples, lists, sequences, dictionaries, comprehensions. **[2 days]**

2. Experiments based on additional features of Python.
   Numpy arrays objects, creating arrays, basic operations, indexing, slicing and iterating, copying arrays, shape manipulation, identity array, eye function, universal function.
   Linear algebra with Numpy, eigenvalues and eigenvectors with Numpy. **[2 days]**

3. Experiments based on Aggregation, Joining and Pandas
   Object. Aggregation and joining.
   Pandas Object: concatenating and appending data frames, index objects.
   Handling time series data using Pandas, handling missing values using Pandas. **[3 days]**

4. Experiments based on advanced features and statistical
   techniques. Reading and writing the data including JSON data.
   Web scraping using python, combining and merging Datasets, Data transformations, Basic

matplotlib plots, common plots used in statistical analysis in python.
Common plots used in statistical analysis in python Data types in R. Sequence generation, Vector and subscript, Random number generation in R. Data frames and R functions, Data manipulation and Data Reshaping using plyr, dplyr, reshape. Parametric statistics and Non-parametric statistics. Continuous and Discrete Probability distribution using R.
Correlation and covariance, contingency tables, Overview of Sampling, different sampling techniques, R and data base connectivity.
Web application development with R using Shiny, Approaches to dealing with missing data in R, Exploratory data analysis with simple visualizations using R, Feature or Attribute selection using R, Dimensionality Reduction with R, Time series data analysis with R. **[5 days]**

Text/Reference Books:

1. J. Payne, "Beginning Python: Using Python 2.6 and Python 3.1", Wrox.
2. M. T. Goodrich, R. Tamassia and M. H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons.
3. I. Idris, "Python Data Analysis", Pact Publishing Limited.
4. C. Beeley, "Web Application Development with R Using Shiny", Pact Publishing.
5. M. J. Crawley, "The R Book", Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	-	2	-	1	-	-	3
CO2	2	1	3	2	3	1	2	-	2	-	-	3
CO3	1	1	1	1	1	-	2	-	1	-	-	3
CO4	2	1	2	2	3	-	2	-	2	-	-	3
CO5	1	2	1	1	1	-	2	-	1	-	-	3

Course Code	YCS5501			
Course Title	Environmental Science			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Students will be able to understand the natural environment and its relationships with human activities and able to apply the fundamental knowledge of science and engineering to assess environmental and health risk, to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues and to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome:

CO1: To understand the natural environment and its relationships with human activities.

CO2: To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

CO3: To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

CO4: Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course Content:

Module 1: General Natural Resources **[11L]**

Forest Resource, water resource, mineral resource, energy resources: alternative source of energy Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography Disaster Management: Types of disasters (Natural & Manmade), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control) Ecology & Ecosystem: Elements of ecology, definition of ecosystem-components types and function, Food chain & Food web, Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

Module 2: Air pollution and control Sources of Pollutants **[10L]**

Point sources, nonpoint sources and manmade sources primary & secondary pollutant Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog), Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion control of air pollution (ESP,

cyclone separator, bag house, catalytic converter, scrubber (ventury).

Module 3: Pollution **[9L]**

Water Pollution Classification of water (Ground & surface water) Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds. Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control) Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride Layout of waste water treatment plant (scheme only).

Module 4: Land Pollution types of Solid Waste **[3L]**

Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (biomedical), E-waste Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages). Waste management: waste classification, waste segregation, treatment & disposal

Module 5: Noise Pollution **[3L]**

Definition of noise, effect of noise pollution on human health, Average Noise level of some common noise sources Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18 hr Index) . Noise pollution control.

Text/Reference Books:

1. Shashi Chawla, “A Textbook of Environmental Studies”, Tata McGraw Hill Education Private Ltd.
2. Dr. J P Sharma, “Environmental Studies”, University Science Press.
3. J K Das Mohapatra, “Environmental Engineering”, Vikas Publication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	1	2	2	2	-	-	-	2
CO2	3	2	2	-	-	2	2	2	-	-	-	3
CO3	2	2	2	-	1	2	-	2	-	-	-	2
CO4	2	2	2	-	-	-	2	2	-	-	-	2

Semester 6 Curriculum and Syllabus

SEMESTER-6							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	PC	YCS6001	Computer Networks	3	0	0	3
2	PC	YCS6002	Software Engineering	3	0	0	3
3	PC	YCS6003	Compiler Design	3	0	0	3
4	PC	YCS6004	Cryptography and Network Security	3	0	0	3
5	OE		Elective II	3	0	0	3
		YCS6005	Internet Technology				
		YCS6006	E-Commerce and ERP				
		YCS6007	Cloud Computing				
		YCS6008	Java Programming				
PRACTICAL							
6	PC	YCS6101	Computer Networks Laboratory	0	0	3	1.5
7	PC	YCS6102	Software Engineering Laboratory	0	0	3	1.5
BLENDED (MOOC + INTERNAL ASSESSMENT)							
8	OE	YCS6401	MOOCS Elective I	3	0	0	3
MANDATORY NON-CGPA COURSE							
9	MC	YCS6501	Technical Report Writing and Presentation Skills	0	0	3	0
SESSIONAL(ONLY INTERNAL EVALUATION)							
10	PROJ	YCS6201	Innovative Project IV	0	0	3	1.5
TOTAL				**18**	**0**	**12**	**22.5**

Course Code	YCS6001
Course Title	Computer Networks
Category	Professional Core
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Computer Organization and Architecture b) Operating Systems

Learning Objective:

In this course, the students will learn about the fundamental concepts of computer networking, with detailed understanding about the TCP/IP protocol suite that drives the Internet. In addition, various important network applications shall be discussed.The course will be very helpful for the students in understanding how data flows through a real network and the various issues involved therein.

Course Outcome:

CO1: To explain the fundamental concepts of data communication

CO2: To illustrate how the various protocols at the data link layer level work

CO3: To explain the functionalities of the various protocols at the network and transport layer level

CO4: To demonstrate how various internetworking devices can be used to connect several different networks together

CO5: To learn about various network applications with particular emphasis on security

Course Content:

Module 1: Introduction to Data Communication Techniques [5L]

Data communication concepts, analog and digital signal transmission. Layered network architecture – the OSI model. Transmission media (guided and unguided) and data transmission techniques (analog and digital). Signal encoding techniques – NRZ, NRZI, AMI, Manchester, Differential Manchester, etc. Circuit switching and packet switching, virtual circuits and datagrams.

Module 2: Data Link Layer [7L]

Framing and flow-control techniques, stop-and wait and sliding-window protocols for frame transmission, performance analysis. Error control techniques – checksum and CRC, stop-and-wait ARQ, Go-back-N, selective reject protocols.

Multiple-access protocols: ALOHA, CSMA and CSMA/CD. IEEE 802.x Ethernet standards, switched Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LAN protocols and standards.

Module 3: Network Layer [8L]

TCP/IP protocol suite, internetworking concepts.

Internet Protocol (IP), IP addressing and routing, IP fragmentation and reassembly. IP subnets and masks – variable length subnet masks, classless inter-domain routing. Miscellaneous protocols – ARP and RARP, ICMP, BOOTP and DHCP. IPv6 – basic differences from IPv4.

Module 4: Transport Layer **[4L]**

Process-to-process delivery, TCP and UDP, TCP connection establishment and termination. Flow and congestion control in TCP – window advertisement, leaky-bucket and token-bucket algorithms.

Module 5: Internetworking Concepts **[6L]**

Internetworking devices – repeaters, hubs, bridges and routers.
Interconnecting LANs using bridges, frame forwarding and address learning.
Routing algorithms – shortest-path algorithm, distance vector algorithm, link state algorithm. RIP, OSPF and BGP algorithms.

Module 6: Network Applications **[6L]**

Client-server concept. Introduction to DNS, SMTP, SNMP, FTP, TELNET and HTTP.
Firewalls, Network Address Translator (NAT), Proxy Server, etc.
Basic concepts of cryptography – symmetric and asymmetric key cryptosystems, cryptographic hash functions. Digital signature, PGP, HTTPS.

Text/Reference Books:

1. W. Stallings, "Data and Computer Communication (5th Ed.)", PHI / Pearson Education.
2. B. A. Forouzan, "Data Communication and Networking (3rd Ed.)", Tata-McGraw Hill.
3. W. R. Stevens, "UNIX Network Programming (3rd Ed.), Prectice-Hall, Addision-Wesley.
4. A. Tanenbaum, "Computer Networks (4th Ed.), PHI / Pearson Education.
5. W. Stallings, "Cryptography and Network Security: Principles and Practice (4th Ed.)", PHI / Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	2	-	2	-	-	2
CO2	2	2	1	1	-	-	2	-	2	-	-	2
CO3	-	2	1	1	2	-		-	2	-	-	2
CO4	2	-	2	2	-	3	-	2	2	-	-	2
CO5	2	-	1	2	-	3	-	2	2	-	-	2

Course Code	YCS6002			
Course Title	Software Engineering			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Object Oriented Programming			

Learning Objective:

In this course, the students will learn about concepts in software engineering and its applications. They will learn about the layered architecture and the process framework, and analyze software process models like waterfall, spiral, evolutionary models.
After completing the course the students will be able to design software requirements and specifications of documents, understand project planning, scheduling, cost estimation, risk management and also describe data models, object models, context models and behavioural models and about the quality checking mechanism for software process and product.

Course Outcome:

CO1: To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

CO2: To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns

CO3: To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice

CO4: To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning

Course Content:

Module 1: Introduction [6L]

Characteristics, Components, Application, Definitions, Software Process models, Waterfall Model, Prototype model, RAD, Evolutionary Models, Incremental, Spiral, Software Project Planning, Feasibility Analysis, Technical Feasibility.

Module 2: Software Engineering Models [8L]

System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, Data Dictionary, Data Modelling, Software Requirements Specification

Software Design Aspects: Objectives, Principles, Concepts, HLD and LLD, Top-Down and Bottom- Up design, Decision tree, decision table and structured English, Structure chart, Transform analysis Functional Vs. Object- Oriented approach.

Module 3: Methodologies [7L]

Introduction to Agile Methodology, Agile Testing, Quality in agile software development, Unified Modelling Language: Class diagram, interaction diagram, Collaboration diagram, sequence diagram, State chart diagram, activity diagram, Implementation diagram, Use-Case diagram.

Module 4: Project Documentation **[4L]**

Coding and Documentation: Structured Programming, Modular Programming, Module Relationship- Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation. Testing–Levels of Testing, Integration Testing, System Testing, Test Cases-White Box and Black Box testing, Software Quality, Quality Assurance, Software Maintenance

Software Quality, Quality Assurance, Software Maintenance

Software Configuration Management, Software Architecture, Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management, Reactive vs. Proactive Risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Project Monitoring.

Module 5: Software Quality Assurance **[6L]**

Refinements and minimization of Risk in Software Engineering, Cost-Benefit Analysis, Basics of estimation: COCOMO (Basic, intermediate, Complete) model, SEI –CMM, CMM Levels and Industry Standard, New Strategies in Industry Based software Engineering, Containerization.

Text/Reference Books:

1. R. S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
2. P. Jalote, "Software Engineering", Wiley India.
3. R. Mall, "Software Engineering", Prentice-Hall of India.
4. M. L. Shooman, "Software Engineering", Tata McGraw Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	-	2	3	2	-	2	-	-	3
CO2	2	3	2	3	-	1	2	-	2	-	-	3
CO3	3	2	1	2	2	1	2	-	2	-	-	3
CO4	2	1	3	-	1	1	2	-	2	-	-	3

Course Code	YCS6003			
Course Title	Compiler Design			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Formal Language and Automata Theory b) Computer Organization and Architecture c) Programming and Data Structure			

Learning Objective:

In this course the students will learn about the fundamental principles in compiler design, the algorithms and data structures involved in the construction of a compiler, automation tools like lex and yacc for translating high level language. At the end of the course student will be able to build different phases of compilers.

Course Outcome:

CO1: Understand the lexical, syntactic and semantic structures of a language.

CO2: Recall various techniques to modify grammar of a given language.

CO3: Understand intermediate representations including symbol table, parse/syntax tree and data structure required for such representations.

CO4: Understand different techniques for intermediate code and machine code optimization.

Course Content:

Module 1: Lexical Analysis **[8L]**

History of Compiler Design, Analysis of the Source Program, The Phases of a Compiler, Cousins of the Compiler, The Grouping of Phases, Compiler Construction Tools, Need and role of lexical analyzer, Lexical errors, Input Buffering, Specification of Tokens, Recognition of Tokens, Design of a Lexical Analyzer Generator, Use of Lex tool.

Module 2: Syntax Analysis **[9L]**

Need and role of the parser, Context Free Grammars, Top Down parsing, Recursive Descent Parser, Predictive Parser, LL (1) Parser, Shift Reduce Parser, LR Parser, LR (0) item, Construction of SLR Parsing table, Introduction to LALR Parser, Use of YACC/Bison tool, Design of a syntax analyzer for a sample language.

Module 3: Syntax Directed Translation **[7L]**

Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, Translation of assignment statements, Boolean expressions, Statements that alter the flow of control, postfix translation, Translation with a top down parser, Translation: Array references in arithmetic expressions, procedures call, declarations and case statements.

Module 4: Code Generation **[6L]**

Data structure for symbols tables, representing scope information, Three address code, quadruple & triples, Issues in the design of code generator, The target machine, Runtime Storage management, Basic Blocks and Flow Graphs, Next-use Information, A simple Code generator, DAG representation of Basic Blocks.

Module 5: Code Optimization **[6L]**

Sources of Optimization, Peephole Optimization, Optimization of basic Blocks, Introduction to Global Data Flow Analysis, Runtime Environments, Source Language issues, Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter Passing.

Text/Reference Books:

1. A. Aho, V. R. Sethi and D. J. Ullman, "Compilers Principles, Techniques and Tools", Pearson Education.
2. M. L. Scott, "Programming Language Pragmatics", Morgan Kaufmann Publishers.
3. C. N. Fischer, R. K. Cytron, and R. J. LeBlanc, "Crafting a Compiler", Addison-Wesley.
4. S. Chattopadhyay, "Compiler Design", Prentice-Hall of India.
5. A. W. Appel, "Modern Compiler Implementation in C", Cambridge University Press.
6. R. Mark, "Writing Compilers and Interpreters: A Modern Software Engineering Approach Using Java", Wiley Publishing.
7. K. D. Cooper and L. Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers.
8. A. I. Holub, "Compiler Design in C", Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	1	-	2	-	-	1
CO2	3	2	2	1	2	1	2	-	1	-	-	1
CO3	3	2	2	1	2	2	1	-	2	-	-	1
CO4	3	2	2	1	2	1	2	-	1	-	-	1

Course Code	YCS6004				
Course Title	Cryptography and Network Security				
Category	Professional Core				
LTP & Credits	L	T	P	Credits	
	3	0	0	3	
Total Contact Hours	36				
Pre-requisites	a) Data Structures and Algorithms b) Operating Systems c) Discrete Structures				

Learning Objective:

In this course, the students will learn about the various cryptographic techniques that are essential to understand how secure information systems can be built. In particular, various security applications shall be discussed as case studies.
The course will be very helpful for the students in strengthening their basic knowledge in cyber security.

Course Outcome:

CO1: To explain the basic concept of cryptography and its applications in network security

CO2: To learn and analyze various private-key cryptography algorithms

CO3: To learn and analyze various public-key cryptography algorithms

CO4: To explain various cryptographic hash functions and their applications in network security

CO5: To demonstrate how the basic concepts of cryptography can be used to develop practical security applications

Course Content:

Module 1: Introduction to Cryptography and Block Ciphers [4L]

Introduction to security attacks, services and mechanisms. Conventional encryption models – private-key and public-key cryptography. Classical encryption techniques –substitution and transposition ciphers.

Module 2: Private-key Cryptography [7L]

Block Cipher – Feistel structure, Shannon's theory of confusion and diffusion, DES, triple-DES, AES.
Linear and differential cryptanalysis – basic concepts. Key distribution problem.
Stream Cipher – basic concept, realization based on linear feedback shift register.

Module 3: Mathematical Background [8L]

Modular arithmetic, Fermat's and Euler's theorem, gcd, primality testing. Euclid's algorithm, Chinese remainder theorem.
Intractable problems – integer factorization problem, modular square root problem, discrete logarithm problem

Module 4: Public-key Cryptography **[6L]**

RSA algorithm, security of RSA, key management. Diffie-Hellman key exchange algorithm.
Elliptic curve cryptography – basic concepts.

Module 5: Cryptographic Hash Functions and Authentication **[5L]**

Properties of hash functions – MD5 message digest algorithm, secure hash algorithm (SHA-1).
Digital signatures – authentication protocols, various approaches, digital signature standard (DSS).

Module 6: Network Security **[8L]**

Authentication applications – Kerberos, X.509 directory authentication service.
Electronic mail security – pretty good privacy (PGP), S/MIME.
Certification – public-key infrastructure. Secure socket layer (SSL), transport layer security, secure HTTP (HTTPS), and other secure protocols on the Internet.
System security – viruses, worms and malware, firewall systems.

Text/Reference Books:

1. W. Stallings, "Cryptography and Network Security: Principles and Practices", Prentice-Hall of India.
2. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, "Handbook of Applied Cryptography", CRC Press.
3. D. Stinson, "Cryptography: Theory and Practice", CRC Press.
4. C. Kaufman, R. Perlman, and M. Speciner, "Network Security", Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	-	1	1	-	-	2	2
CO2	1	1	2	-	2	-	2	1	-	-	1	3
CO3	1	1	2	-	2	-	1	1	-	-	2	3
CO4	1	1	3	2	1	-	2	1	-	-	1	3
CO5	1	2	2	-	3	2	1	1	-	-	2	3

Course Code	YCS6005
Course Title	Internet Technology
Category	Open Elective
LTP & Credits	L / T / P / Credits: 3 / 0 / 0 / 3
Total Contact Hours	36
Pre-requisites	a) Computer Networks

Learning Objective:

In this course, the students will learn about the technology and protocols that drive the Internet. In addition, they will be taught about the various software technologies that are used in developing web pages and web-based applications. The course will be very helpful for the students as it will provide them with the background for developing web-enabled applications.

Course Outcome:

CO1: To explain the technology and protocols that drive the Internet

CO2: To appraise the software technologies required to develop web

pages **CO3:** To demonstrate how interactive web pages can be created

CO4: To explain the security technologies that are used to make Internet secure

Course Content:

Module 1: Introduction to Internet [6L]

Overview: Intranet, Extranet and Internet, world-wide web.
TCP/IP protocol suite. IP protocol – IP datagram format, IP addressing and routing, IP packet fragmentation, classful and classless addressing, IPv4 and IPv6. TCP and UDP protocols – header fields, TCP connection establishment, flow control and congestion control.
Routing algorithms – Intra- and inter-domain routing, RIP, OSPF and BGP protocols. Packet forwarding in routers with examples.

Module 2: Internet Applications [6L]

Client-server model, Berkeley socket interface.
Common protocols in TCP/IP suite – ARP and RARP, ICMP, BOOTP and DHCP, FTP, TELNET.
Domain Name System (DNS) – iterative versus recursive name resolution.
Simple Mail Transfer Protocol (SMTP) – command and response formats, POP3 and IMAP.
Hyper-Text Transport Protocol (HTTP) – request and response formats, HTTP server.

Module 3: Hyper-Text Markup Language (HTML) [6L]

HTML tags and attributes – Heading, Paragraph, Formatting, Ordered and Bulleted Lists, Hyperlinks, Table, Block, CSS. Advanced features – HTML forms, HTML frames, image maps.
Extensible Markup Language (XML) – Syntax, Tree, Elements, Attributes, Validation, Viewing. Introduction to XHTML.

Common Gateway Interface (CGI) Scripts – principle of operation, environment variables, GET and POST methods, server-side scripting.

Module 4: Internet Scripting Languages **[6L]**

PERL – variable, condition, loop, array. Implementing data structures – Hash, String, Regular Expression, File handling, I/O handling.

JavaScript – statements, variable, comparison, condition, switch, loop, break. Object -string, array, regular expressions.

Cookies – basic concept, creation and storing cookies with example.

Java Applets – container class, components, Applet life cycle, update method. Embedding Applets within HTML page, parameter passing.

Module 5: Security and Privacy **[6L]**

Network Security – fundamental concepts, symmetric-key and asymmetric-key algorithms, cryptographic hash functions.

Common Security Protocols – Digital Signature, Pretty Good Privacy (PGP), HTTPS.

Network Security – Common vulnerabilities, Proxy Server and Network Address Translation (NAT), Packet-level and application-level firewalls, Secure transactions in ecommerce applications.

Module 6: Miscellaneous Topics **[6L]**

Internet Telephony – principle of operation, voice over IP (VoiP).

Multimedia Applications – multimedia over IP, RSVP, RTP, RTCP and RTSP protocols.

Streaming media, Codec and Plugins.

Search Engine and Web Crawler – principle of operation.

Introduction AJAX – AJAX Internals, XML HTTP request object, AJAX UI tags.

Text/Reference Books:

1. N. P. Gopalan and J. Akilandeswari, “Web Teclmology: A Developer’s Perspective”, PHI Learning.
2. R. Banerjee, “Intemetworking Technologies, An Engineering Perspective”, PHI Learning.
3. S. Holzner, ”HTML Black Book”, Dremtech Press.
4. P. J. Deitel and H. M. Deitel, “Internet and World Wide Web: How to program?”, Pearson Education.
5. B. A. Forouzan, “Data Communication and Networking (3rd Ed.)”, Tata-McGraw Hill.
6. W. Stallings, “Cryptography and Network Security: Principles and Practice (4th Ed.)”, PHI / Pearson Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	1	-	-	-	-	-	2
CO2	2	2	2	2	1	-	-	-	-	-	-	3
CO3	2	2	-	-	1	2	-	-	-	-	-	3
CO4	2	1	1		2	3	-	-	-	-	-	3

Course Code	YCS6006			
Course Title	E-Commerce and ERP			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Software Engineering b) Computer Organization and Architecture			

Learning Objective:

In this course, the students will learn about e-marketplaces, the major types of electronic markets, and also know about different types of intermediaries in e-commerce.
This subject also give the idea on electronic catalogs, shopping carts, search engines, and describe the various types of auctions and list their characteristics.

Course Outcome:

CO1: To explain the basic concept of E-Commerce and its applications

CO2: To learn and analyze various ERP Tools

CO3: To learn and analyze various E-Commerce concepts

CO4: To apply the basic understanding of ERP in business environment

Course Content:

Module 1: Introduction to E-Commerce [10L]

Introduction What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of E-Commerce, Inter Organizational E-Commerce Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework Network Infrastructure for E-Commerce Network Infrastructure for E-Commerce, Market forces behind I Way, Component of I way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

Module 2: Mobile Commerce and ERP [7L]

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices, Web Security Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, firewalls & Network Security.

Module 3: E-Commerce Payment and Gateways [8L]

Electronic Payments Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card I Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

Module 4: E-Commerce and EDA [5L]

Net Commerce EDA, EDI Application in Business, Legal requirement in E - Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

Module 5: Internet and E-Commerce **[6L]**

Internet and Electronic commerce, internet, extranet and enterprise solutions, information system for business operations, information system for managerial decision support, information system for strategic advantage.

Text/Reference Books:

1. T.P. Liang, "Electronic Commerce, A Managerial Perspective", Prentice Hall
2. R. Kalakota and A. Whinston, "Frontiers of Electronic Commerce", Addision Wesley.
3. D. Amor, "The E-Business Revolution", Addision Wesley.
4. M. Greenstein, "Electronic Commerce", McGraw-Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	1	1	-	-	2	-	-	2
CO2	1	2	1	-	1	-	1	-	-	-	-	2
CO3	1	1	2	-	2	-	-	-	-	-	-	2
CO4	1	1	3	1	1	-	-	-	-	2	-	2

Course Code	YCS6007			
Course Title	Cloud Computing			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Computer Networks b) Operating Systems			

Learning Objective:

To provide students a sound foundation of the cloud computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios. To enable students exploring some important cloud computing driven commercial systems and applications.

Course Outcome:

CO1: To explain the Cloud architecture, different services and deployment models.

CO2: To learn the concepts of abstraction and different types of virtualization.

CO3: To identify and explain different cloud offerings with their usage namely Azure, Google Apps, Amazon web service

CO4: To explain the underlying concepts of cloud management and security and illustrate the use of Service Oriented Architecture (SOA)

Course Content:

Module 1: Definition of Cloud Computing and its Basics [10L]

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing. Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients. Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service(CaaS).

Module 2: Use of Platforms in Cloud Computing [9L]

Concepts of Abstraction and Virtualization Virtualization technologies:Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of

Open	Virtualization	Format

– OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance.

Module 3:Use of various Web Services **[5L]**

Concepts of Platform as a Service: Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks Use of Google Web Services: Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.Use of Amazon Web Services: Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service Use of Microsoft Cloud Services: Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 4: Cloud Infrastructure **[6L]**

Types of services required in implementation – Consulting, Configuration, Customization and Support, Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle), Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)

Module 5: Concepts of Services and Applications **[6L]**

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition

– Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.

Text/Reference Books:

1. B. Sosinsky, "Cloud Computing Bible (1st Ed.)", Wiley.
2. R. Buyya, C. Vecchiola, S. T. Selvi, "Mastering Cloud Computing (2nd Ed.)", McGraw Hill Education.
3. A. T. Velte, "Cloud computing: A practical approach (3rd Ed.)", Tata McGraw Hill.
4. C. Miller, "Cloud Computing (4th Ed.)", PHI / Pearson Education.
5. K. Saurabh, "Cloud Computing (2nd Ed.)", Wiley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	1	-	-	-	-	-	-	2
CO2	2	2	2	-	1	-	-	1	1	-	-	2
CO3	3	1	2	-	1	2	-	-	2	-	-	1
CO4	3	3	3	-	1	2	-	1	1	-	-	2

Course Code	YCS6008			
Course Title	Java Programming			
Category	Open Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Fundamentals of Programming b) Object Oriented Programming			

Learning Objective:

The course objective is to understand various properties of object oriented programming. The course focuses on basics of OOP such as: abstraction, encapsulation, polymorphism and inheritance. This course gives a detailed discourse on Java programming language. This course thereafter focuses on platform independence of Java, implementation of various OOP paradigm, special properties such as exception handling and GUI usage.

Course Outcome:

CO1: To explain the process of interaction between objects, classes & methods

CO2: To acquire a basic knowledge of Object Orientation with different properties

CO3: To analyze various different string handling functions with various I/O

operations **CO4:** To discuss basic code reusability feature w.r.t. Inheritance,

package and Interface.

CO5: To implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Content:

Module 1: JAVA Basics **[8L]**

Fundamentals of Java: JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes.

Module 2: Object Oriented Programming **[7L]**

Encapsulation, Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & initialization code block, Access Control, Modifiers, Nested methods, Inner & Anonymous Classes, Abstract Class & Interfaces Defining Methods, Argument Passing Mechanism , Method Overloading, Recursion.

Module 3: Inheritances and Polymorphism **[9L]**

Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword.
Packages and Interfaces: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces.
I/O Streams: Concepts of streams, Stream classes- Byte and Character stream, Reading

console Input and Writing Console output, File Handling.

Module 4: Exception Handling **[6L]**

Exception types, Usage of Try, Catch, Throw, Throws and Finally

Thread: Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads, Critical Factor in Thread, DeadLock.

Module 5: JAVA Applet **[6L]**

Applet vs. Application, Applet class, Advantages of Applet, Applet Lifecycle My First Applet, Applet tag, How to run applet?

GUI Programming: Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package).

Collection Framework Collections of Objects, Collection Types, Sets, Sequence, Map, Understanding Hashing, Use of ArrayList & Vector.

Text/Reference Books:

1. H. Schildt and C. Dann, "Java: the Complete Reference", McGraw-Hill Education.
2. E. Balagurusamy, "Programming With Java: A Primer", Tata McGraw-Hill.
3. B. Eckel, "Thinking in JAVA", Prentice Hall.
4. G. Reese, "Database Programming with JDBC and JAVA", O'Reilly Media, Inc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	1	-	-	2	-	2	-	-	3
CO4	-	-	2	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	-	2	2	2	3

Course Code	YCS6101			
Course Title	Computer Networks Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a. Operating Systems Laboratory b. Computer Organization and Architecture Laboratory			

Learning Objective:

In this laboratory course, the students will be learning network programming using the socket API system calls, and also analyze packets flowing over the network. Also, a number of algorithms at the datalink and network layers shall be simulated and the results analyzed.

Course Outcome:

CO1: To learn how to use socket API system calls for network programming

CO2: To learn how to capture network packets and analyze them

CO3: To analyze various algorithms at the datalink and network layers through simulation

Suggestive List of Experiments:

1. Familiarization with Berkeley socket interface system calls in C, and writing programs to communicate between two machines using both connection-oriented (TCP) and connection-less (UDP) protocols. **[3 days]**
2. Write programs in C to simulate the stop-and-wait and sliding-window protocols, and carry out performance analyses both in the absence of errors and also in presence of errors. **[2 days]**
3. Familiarization with a packet capturing and analysis tool (like Wireshark), and analyze packets as captured under various data transfer scenarios over the network. **[2 days]**
4. Write a program in C to simulate a router for filtering IP packets (make the specification of the problem as realistic as possible).. **[3 days]**
5. Write programs to implement the distance vector algorithm for building up the routing tables in a network of routers.. **[2 days]**

Text/Reference Books:

1. W. Stallings, “Data and Computer Communication (5th Ed.)”, PHI / Pearson Education.

2. B. A. Forouzan, “Data Communication and Networking (3rd Ed.)”, Tata-McGraw Hill.

3. W. R. Stevens, “UNIX Network Programming (3rd Ed.), Prectice-Hall, Addision-Wesley.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	-	3	-	-	-	2	-	-	3
CO2	1	2	2	2	-	-	-	-	2	-	-	3
CO3	2	2	1	-	2	2	2	-	2	-	-	3

Course Code	YCS6102			
Course Title	Software Engineering Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Object Oriented Programming Laboratory			

Learning Objective:

In this course students can build a fully functional, interactive, layered, distributed, database-backed software system from the ground-up as part of a small, agile, development team in a laboratory setting, become acquainted with historical and modern software methodologies. I also help to understand the phases of software projects and practice the activities of each phase, Practice clean coding, taking part in project management and become adept at such skills as distributed version control, unit testing, integration testing, build management, and deployment.

Course Outcome:

CO1: To construct, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

CO2: To design applicable solutions in one or more application domains using software engineering approaches with case studies

CO3: To develop the test cases from the design and effectively apply relevant standards and perform testing, and quality management and practice

CO4: To construct modern engineering architecture for software project management, time management and software reuse, and an ability to engage in life-long learning

Suggestive List of Experiments:

1. Write down the problem statement for a suggested system of relevance. **[1 day]**
2. Do Feasibility study along with requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system. **[1 day]**
3. To perform the function oriented diagram: Data Flow Diagram (DFD) and Structured chart. **[1 day]**
4. To perform the user's view analysis for the suggested system: Use case diagram. **[1 day]**
5. To draw the structural view diagram for the system: Class diagram, object diagram. **[1 day]**
6. To draw the behavioral view diagram: State-chart diagram, Activity diagram. **[1 day]**
7. To perform the behavioral view diagram for the suggested system: Sequence diagram, Collaboration diagram, timing diagram, component diagram, State diagram. **[1 day]**
8. To perform the implementation view diagram: Component diagram for the system. **[1 day]**
9. To perform the environmental view diagram: Deployment diagram for the system. **[1 day]**

10. To perform various testing using the testing tool unit testing, integration testing for a sample code of the suggested system. **[1 day]**

11. Perform Estimation of effort using FP Estimation for chosen system with other matrices. **[1 day]**

12. To prepare time line chart/Gantt Chart/PERT Chart for selected software project. **[1 day]**

Software required: MS Project, MS Visio, Docker

Text/Reference Books:

1. R. S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
2. P. Jalote, "Software Engineering", Wiley India.
3. R. Mall, "Software Engineering", Prentice-Hall of India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	2	3	2	-	1	-	-	2
CO2	2	1	2	1	-	1	1	-	2	-	-	2
CO3	3	2	1	2	1	1	2	-	1	-	-	2
CO4	2	1	3	-	1	1	1	-	2	-	-	2

<table>
<tr><td>Course Code</td><td colspan="4">YCS6501</td></tr>
<tr><td>Course Title</td><td colspan="4">Technical Report Writing and Presentation Skills</td></tr>
<tr><td>Category</td><td colspan="4">Mandatory Non-CGPA Course</td></tr>
<tr><td rowspan="2">LTP & Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>0</td></tr>
<tr><td>Total Contact Hours</td><td colspan="4">36</td></tr>
<tr><td>Pre-requisites</td><td colspan="4">None</td></tr>
</table>

Learning Objective:

This course introduces students to the discipline of technical communication. Preparation of visuals to supplement text, workplace communication, descriptions of mechanisms, explanations of processes, and writing reports are the major topics included. This course is designed for students enrolled in technical degree programs.

Course Outcome:

CO1: To explain and demonstrate how to typeset documents using LaTeX

CO2: To explain and demonstrate how to write technical reports and research papers

CO3: To explain and demonstrate how to prepare and deliver presentations, and participate in group discussions

Suggestive List of Experiments:

1. Document preparation and typesetting using LATEX. **[3 days]**
2. Writing technical reports, styles and guidelines, data collection. **[2 days]**
3. Writing research papers, structure and guidelines, styles and formatting. **[3 days]**
4. Speaking skills, delivering seminars, group discussions. **[2 days]**
5. Guidelines for presentations, preparing presentations using Powerpoint or any other similar software tools. **[2 days]**

Text/Reference Books:

1. L. Lamport, "LaTeX: A Document Preparation System", Addison-Wesley.
2. S. Kumar and P. Lata,"Communication Skills", Oxford University Press.
3. A.J. Rutherfoord, "Basic Communication Skills for Technology", Pearson.
4. M.A. Rizvi, "Effective Technical Communication", McGraw Hill.
5. A. Leigh and M. Maynard, "The Perfect Presentation", Random House.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	2	1	1	2	-	2	-	1
CO2	1	3	3	-	1	1	2	2	2	-	-	1
CO3	1	2	2	-	3	1	1	2	-	-	-	1

Semester 7 Curriculum and Syllabus

SEMESTER-7							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG7001	Value and Ethics in Profession	2	0	0	2
2	PE		Elective III	3	0	0	3
		YCS7021	Architecture for Embedded Systems				
		YCS7022	Sensor Networks and IoT				
		YCS7023	Robotics				
3	PE		Elective IV	3	0	0	3
		YCS7021	Architecture for Embedded Systems				
		YCS7022	Sensor Networks and IoT				
		YCS7023	Robotics				
PRACTICAL							
4	PE	YCS7102	Stream Lab 1: Embedded Systems and Robotics	0	0	4	2
BLENDED(MOOC + INTERNAL ASSESSMENT)							
5	OE	YCS7401	MOOCS Elective II	3	0	0	3
SESSIONAL(ONLY INTERNAL EVALUATION)							
6	PROJ	YCS7204	Project I	0	0	6	3
MANDATORY NON-CGPA COURSE							
7	MC	YCS7501	Social Awareness	3	0	0	0
		YCS7502	History of Science and Technology				
		YCS7503	Indian Liberal Arts				
TOTAL				**14**	**0**	**10**	**16**

Course Code	YMG7001			
Course Title	Values and Ethics in Profession			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn to be awareness on professional ethics and human values.

Course Outcome:

CO1: To explain the core values that shape the ethical behavior of an engineer

CO2: To understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories

CO3: To analyze various social issues, industrial standards, code of ethics, and role of professional ethics in engineering field

CO4: To explain the responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer

CO5: To acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

Course Content:

Module 1: Introduction **[2L]**

Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

Module 2: Psycho-social theories of moral development **[4L]**

View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

Module 3: Ethical Concerns **[4L]**

Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society.
Nature of values: Value Spectrum of a good life.

Module 4: Ethics of Profession **[4L]**

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.
Social and ethical responsibilities of Technologists. Codes of professional ethics.
Whistle blowing and beyond, Case studies.

Module 5: Self Development **[4L]**

Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module 6: Effects of Technological Growth **[6L]**

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics.

Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text/Reference Books:

1. S. H. Unger, "Controlling Technology: Ethics and the Responsible Engineers", John Wiley & Sons.
2. D. Johnson, "Ethical Issues in Engineering", Prentice Hall.
3. A. N. Tripathi, "Human Values in the Engineering Profession", Monograph published by IIM, Calcutta, 1996.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	1	1	2	-	1
CO2	-	-	-	-	-	1	1	3	1	2	-	1
CO3	-	-	-	-	-	3	2	3		1	-	1
CO4	-	-	-	-	-	3	2	1	-	-	-	1
CO5	-	-	-	-	-	3	2	2		1	3	1

Course Code	YCS7021			
Course Title	Architecture for Embedded Systems			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	Embedded Systems			

Learning Objective:

In this course, the students will learn about the architecture for embedded systems, with emphasis on both hardware and software requirements. Various case studies and the issue of testing such systems will also be covered.

The course will be helpful for students who want to apply the knowledge to develop real-life applications that involve embedded systems.

Course Outcome:

CO1: To understand and classify the architecture of an embedded system and the software requirements

CO2: To explain the purpose of various embedded hardware building blocks and to analyze various real-life applications

CO3: To understand and analyze the implementation and testing aspects of embedded system design

Course Content:

Module 1: : Introduction to Embedded Systems Architecture [8L]

Embedded system design, embedded system architecture, life cycle of embedded system, embedded system model.
Overview of programming languages for embedded systems, assembly language, embedded high-level languages, scripting languages. Case study.

Module 2: Embedded Hardware Building Blocks [12L]

Embedded system development boards and the von Neumann model, general architecture.
Embedded processors, case studies. ISA architecture models, application-specific ISA models, Java Virtual Machine model, CISC and RISC, Instruction level parallelism, superscalar model.
Memory technologies for embedded system design. Bus standards in embedded system design – PCI, USB, etc.
Interrupt system, vectored interrupt. Device driver architecture, interrupt handling.
Board I/O driver examples.

Module 3: Application Case Studies [8L]

Processor architectures, sensors and actuators, user interface design. Illustration with a number of real-life case studies.
Stages of creating an embedded system architecture, architecture business cycle and its effect on architecture, documentation and reverse engineering.

Module 4: Implementation and Testing **[8L]**

Quality assurance and testing of a design.
Basic concepts of digital circuit testing: fault modeling, test generation, fault simulation, design for testability, built-in self-test. Testing of system-on-chip.

Text/Reference Books:

1. T. Noergaard, "Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers", Elsevier.
2. J. J. Labrosse, "Embedded System Building Blocks: Complete and Ready-to-Use Modules in C", The publisher, Paul Temme.
3. W. Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufmann.
4. P. Marwedel, "Embedded System Design", Kluwer.
5. M. Bushnell and V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Springer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	2	-	-	-	1	-	-	-	-	3
CO2	1	1	1	2	2	-	2	-	-	-	-	3
CO3	1	1	-	2	-	1	1	-	-	-	-	3

Course Code	YCS7022
Course Title	Sensor Networks and IoT
Category	Professional Elective
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	a) Computer Networks b) Embedded Systems

Learning Objective:

In this course, the students will learn about the architecture and software requirements for IoT systems, along with the various standards and protocols. They will also learn about wireless sensor networks and communication protocols, which are essential in developing integrated IoT-based systems.

Course Outcome:

CO1: To explain the basic concepts of IoT, their architecture and design principles

CO2: To understand and apply prototyping platforms and software development for IoT systems

CO3: To explain and analyze WSN architectures and communication protocols

Course Content:

Module 1: : Overview of Internet of Things [8L]

IoT conceptual framework, IoT architectural view, technology behind IoT, examples of IoT: smart cities, smart energy, smart health, cyber-physical systems.

Modified OSI model for the IoT/M2M systems, data enrichment, data consolidation and device management at IoT/M2M gateway, web communication protocols used by connected IoT/M2M devices, message communication protocols (CoAP-SMS, CoAP-MQ, MQTT, XMPP) for IoT/M2M devices

Module 2: Architecture and Design Principles of IoT [8L]

Internet connectivity, Internet-based communication, IPv4, IPv6, 6LoWPAN protocol, IP addressing in the IoT. Application layer protocols: HTTP, HTTPS, FTP, TELNET and ports.
Cloud computing paradigm for data collection, storage and computing, cloud service models, IoT cloud-based collection, storage and computing services using Nimbits.

Module 3: Prototyping and Software for Embedded Systems [8L]

Prototyping Embedded device software, programming embedded device on Arduino platform using IDE, reading data from sensors and devices. Gateways, Internet and web/cloud services software development.
Programming MQTT clients and MQTT server. Introduction to IoT privacy and security. vulnerabilities, security requirements and threat analysis, tomography and layered attacker model.

Module 4: Overview of Wireless Sensor Network (WSN) **[6L]**

Wireless sensor networks: basic concept, challenges, design principles, enabling technologies, case studies.

Single-node architecture: hardware components, energy consumption model, operating system and execution environments. Network architecture: sensor network scenarios, optimization goals and figures of merit, service interfaces of WSNs, gateway concept.

Module 5: Communication Protocols **[6L]**

Physical layer and MAC Protocols for WSNs, low duty-cycle protocols and wakeup concepts: S-MAC, mediation device protocol, wakeup radio concepts, contention based protocols (CSMA, PAMAS), schedule based protocols (LEACH, SMACS, TRAMA).

Address and name management in WSNs: assignment of MAC addresses, routing protocols: energy-efficient routing, geographic routing, hierarchical networks by clustering.

Text/Reference Books:

1. B. Mandler, J. Barja, et al., "Internet of Things: IoT Infrastructure", Springer.
2. R. Kamal, "Internet of Things: Architecture and Design Principles", McGraw-Hill Education.
3. H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley.
4. A. Bahga and V. Madisetti, "Internet of Things: A Hands-on Approach", Orient Blackswan Pvt. Ltd.
5. H. David, S. Gonzalo, G. Patrick and B. Rob, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things", Pearson.
6. F. Zhao and L. J. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Elsevier.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	-	2	-	-	-	-	3
CO2	2	1	1	2	2	2	1	-	-	-	-	3
CO3	1	1	1	2	2	1	1	-	-	-	-	3

Course Code	YCS7023			
Course Title	Robotics			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Computer Networks b) Embedded Systems			

Learning Objective:

In this course, the students will learn about the various functions of a robot, the various drive mechanism, sensors and image processing techniques used for robot navigation, and robot programming.

Course Outcome:

CO1: To understand and remember the fundamentals of robotics and classify the various drive systems that can be used for control

CO2: To explain the principle of operation of various sensors and the image processing techniques that are typically used in robots

CO3: To explain and assess the applications of robots in practical applications

Course Content:

Module 1: : Fundamental concepts in Robotics **[4L]**

Robot: definition, robot anatomy, co-ordinate systems, work envelope types and classification. Specifications: pitch, yaw and roll, joint notations, speed of motion, payload analysis.

Module 2: Robot Drive Systems **[8L]**

Types of Robot Drives: pneumatic drives, hydraulic drives, mechanical drives, electrical drives, D.C. servo motors, stepper motors, A.C. servo motors. End Effectors: grippers, mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers.

Vacuum grippers, two-fingered and three-fingered grippers, internal and external grippers, selection and design issues.

Module 3: Sensors and Machine Vision **[10L]**

Position sensors: piezo-electric sensor, LVDT, resolvers, optical encoders, pneumatic position sensors, range Sensors. Triangulation Principle, structured, lighting approach, time of flight, range finders, laser range meters, touch sensors, analog sensors, wrist sensors, slip sensors. Camera: frame grabber, sensing and digitizing image, data-signal conversion, image storage, lighting techniques, image processing and analysis, data reduction, segmentation, feature extraction, object recognition.
Applications: inspection, identification, visual serving and navigation.

Module 4: Robot Kinematics and Robot Programming **[10L]**

Forward kinematics, reverse kinematics – difference. Forward kinematics and reverse kinematics of manipulators with two, three degrees of freedom (in 2 dimension), four degrees of freedom (in 3 dimension).
Jacobians, velocity and forces: manipulator dynamics, trajectory generator, manipulator mechanism design: derivations and problems.
Lead through Programming, robot-programming languages: VAL Programming, motion commands, sensor commands, end effector commands. simple programs.

Module 5: Implementation and Robot Economies [4L]

Rail guided vehicle (RGV), automatic guided vehicle (AGV). Implementation of robots in industries: various steps, safety considerations for robot operations, economy analysis of robots.

Text/Reference Books:

1. R. D. Klafter, T. A. Chmielewski and M. Negin, "Robotic Engineering: An Integrated Approach", Prentice-Hall.
2. M. P. Groover, "Industrial Robotics: Technology, Programming and Applications", McGraw-Hill.
3. J. J. Craig, "Introduction to Robotics Mechanics and Control", Pearson Education.
4. Y. Koren, "Robotics for Engineers", McGraw-Hill.
5. P. A. Janakiraman, "Robotics and Image Processing, Protocols and Use Cases for the Internet of Things", Tata McGraw-Hill.
6. R. K. Rajput, "Robotics and Industrial Automation", S. Chand and Company.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	-	-	-	-	-	-	-	3
CO2	1	1	2	2	2	-	2	-	-	-	-	3
CO3	-	-	1	2	2	2	2	-	-	-	-	3

Course Code	YCS7102			
Course Title	Stream Laboratory 1 (Embedded Systems and Robotics)			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	0	0	4	2
Total Contact Hours	48			
Pre-requisites	a) Embedded Systems Laboratory			

Learning Objective:

In this course, the students will learn about the design requirements of practical embedded systems that are used in various important applications like smart home, smart cities, smart transportation, etc.

Course Outcome:

CO1: To explain the design requirements of embedded systems

CO2: To analyze the design tradeoffs in practical embedded system design

CO3: To demonstrate design and implementation of complex embedded systems

Suggestive List of Experiments:

1. Design and implementation of a home automation system with multi-faceted features (web-based interface, control multiple gadgets, multiple sensors, surveillance system, etc.) **[3 days]**

2. Design and implementation of a smart transportation system with useful features (web-based / app-based interface, real-time location tracking with GPS, parameter sensing, statistics of historical data, etc.). **[3 days]**

3. Design and implementation of a security system with useful features (motion tracking, fire detection and alarm system, intrusion detection using touch sensor / camera, etc.). **[3 days]**

4. Study of a robot arm based control system, and program it to carry out specified tasks. **[3 days]**

Text/Reference Books:

1. W. Wolf, “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufmann.

2. M. Sloss, D. Symes, and C. Wright, “ARM System Developers Guide: Designing and Optimizing System Software”, (Online Resource).

3. P. Marwedel, “Embedded System Design”, Kluwer.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	-	-	2	-	1	-	-	2
CO2	2	2	2	1	1	2	1	-	2	-	-	2
CO3	2	3	2	-	2	2	1	-	2	-	-	2

Course Code	YCS7501			
Course Title	Social Awareness			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn about the fundamental concepts of Social Awareness, with detailed understanding about the Human Rights. In addition, major social issues, religion-problems of the minorities, role of youth as a social agent shall be discussed. The course will be very helpful for the students in understand the society in different angles and form a holistic view.

Course Outcome:

CO1: To understand the agents of social change

CO2: To identify the tools to analyse the divided society scientifically through right-based approach

CO3: To identify and discuss the issues and problems prevalent in the society

Course Content:

Module 1: Basic concept and elements of Social Awareness [6L]

Understanding the Concept, need, basic guidelines for Social Awareness, The basic elements of Social Awareness: Respectfulness, Cleanliness, Thriftiness, Reason for the Weakening Social Responsibility, Education as the Core Method to Strengthen Stu-dent's Social Responsibility, Indianness Indian social ethos: Indian society, characteristics of Indian society, The concept of social problems, characteristics of social problem, types of social problem, social problem and social change in India.

Module 2: World trends & contemporary India [6L]

World trends today: Some basic data-Globalization- World Social Forum vs. World Economic Forum-the North South divide, Emerging challenges in contemporary India-(social, political, economic and cultural issues).

Module 3: Contemporary India: Social perspective [6L]

India: A land of cultural and religious diversity - secularism-communalism-fundamentalism, Indian politics and religion-problems of the minority and women empowerment.

Module 4: Major social problems and Mind set in India [6L]

Indian resources and Poverty; Manifestation and Measurement; Incidence and Magnitude; Causes, problems of poor and pains of poverty, Ignorance in Governance and corruption- The Concept; Causes and Impact of Corruption; Combating Corruption-Right to information act, Indian education system and illiteracy Illiteracy-Magnitude, Causes and Consequences -Functional illiteracy, Caste Discrimination – caste discrimination and process of exclusion, untouchability, caste and politics, Reservation policy, Child abuse, child labour -Child Population and the Working Children; Effects of Abuse on Children; Violence against woman- Women's Harassment; Nature, Extent and Char-

acteristics of Violence Against Women; Trans Gender issue.

Module 5: Role of the youth in social agent **[6L]**

Concept of Youth Unrest; Youth Protests, Agitations and Movements; Important Youth Agitations in India; Youth Leadership, Social Demands and Terrorism- The Concept; Characteristics, Causes and Consequences, Alcoholism, Drug Abuse, Drug Addiction and other social deviations- Aberrant Behaviour; Basic Concepts; Nature and Impact of Abusable Drugs; Extent and Nature of Drug Abuse; Role of Family & Peer Group in Drug in Abuse; Control over Drug Abuse, Youth and politics effective intervention by youth, Effective intervention by youth.

Module 6: Emerging alternatives **[6L]**

Participation in governance and Social Activism - Discovering social roles of individuals and groups, Human rights: Know your rights: Human rights (Universal Declaration of Human Rights- Concepts in human rights- Human rights violations.)and Economic, Social, Cultural rights, Educating the community - Influencing key decision makers, Changing local and national politics - Making our world a better place.

Text/Reference Books/Journals:

1. J. Berry, J. Trimble and E. Olmedo, "Assessment of acculturation: Field methods in cross-cultural research (pp. 291–324) (W. J. Lonner & J. W. Berry (Eds.))", Sage Publications, Inc.

2. C. Bichta, "Corporate Social Responsibility A Role in Government Policy and Regulation", CRI Publisher.

3. D. Jamali and R. Mirshak, "Corporate Social Responsibility (CSR): Theory and Practice in a Developing Country Context", Journal of Business Ethics, Vol-72, pp. 243-262, 2007

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	3	2	-	2	-	2
CO2	-	-	-	-	-	3	2	2	-	1	-	2
CO3	-	-	-	-	-	2	2	3	-	2	-	1

Course Code	YCS7502			
Course Title	History of Science and Technology			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Ancient Indian science and technology have contributed significantly to the foundations and growth of modern sciences. Yet there is little genuine material accessible to younger generations to help them understand and appreciate the extent of these contributions. Furthermore, History of Science and Technology acts as a natural bridge between humanities and sciences. This course will provide an overview of some of the chief landmarks in the development of science in India especially in the fields of mathematics, physics, astronomy, chemistry, medicine, etc. The modules will include not only specific advances or breakthroughs, but also discuss the epistemological and cultural contexts behind them. The course promises to be an eye-opener to students from a variety of disciplines.

Course Outcome:

CO1: To understand the evolution of science and technology in India.

CO2: To explain the origin of astronomy and mathematics in ancient India.

CO3: To assess the developments in various branches of science and technology.

Course Content:

Module 1: Understanding Science from the Ancient Indian Perspective [4L]

Ontology.
Epistemology
.
Methodology
.

Module 2: Developments in Science and Technology [6L]

Science and scientists: chronological development and evolution.
Development of science and technology in specific areas: space technology, nuclear technology, bio-technology renewable energy, etc.

Module 3: Astronomy [5L]

Ritual origins of classical Indian Astronomy.
Knowledge revealed in the *Samhitas*, *Brahmanas*, and *Sutras*.
Pre-*Siddhantic* and *Siddhantic* developments.

Module 4: Mathematics [6L]

Knowledge revealed in Vedic and Post-Vedic texts.

Contributions by eminent mathematicians: Aryabhata, Brahmagupta, Bhaskaracharya. The Kerala School of Mathematics.
Traditions of Computational Techniques.

Module 5: Medicine and Health Sciences **[5L]**

Ayurveda.
Yoga.
Contributions by Charaka and Sushruta.

Module 6: Allied Sciences and Technology **[10L]**

Contributions in the field of Architecture.
Developments and practices in Civil Engineering.
Advances in Metallurgy.
Findings and applications of Chemistry.

Text/Reference Books:

1. D.M. Bose, S.N. Sen and B.V. Subbarayappa, “A Concise History of Science in India”, 1989.
2. H. Selin and R. Narasimha (eds.), “Encyclopaedia of Classical Indian Sciences”, 2007.
3. A. Ghosh, “History of Science in India – Astronomy”, 2014.
4. D.P. Chattopadhyaya, “History of Science and Technology in Ancient India”, 1986.
5. S. Balachandra Rao, “Indian Astronomy – A Primer”, 2008.
6. B.S. Yadav et al. (eds.), “Ancient Indian Leaps into Mathematics”, 2011.
7. T. Padmanabhan (ed.), “Astronomy in India: A Historical Perspective”, 2010.
8. B.V. Subbarayappa (ed.), “Chemistry and Chemical Techniques in India”, 1999.
9. T.R.N. Rao and S. Kak (eds.), “Computing Science in Ancient India”, 2000.
10. G. Ifrah, “The Universal History of Numbers: From Prehistory to the Invention of the Computer, 2005.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	1	3	-	2	-	3
CO2	-	-	-	-	-	1	3	2	-	2	-	2
CO3	-	-	-	-	-	1	2	3	-	1	-	2

Course Code	YCS7503			
Course Title	Indian Liberal Arts			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, the students will learn about the fundamental concepts of Indian Liberal Arts. Liberal Arts courses are rather new in India. They fulfill an important gap in the Indian education system. The course will be very helpful for the students to enhance their understanding of liberal arts.

Course Outcome:

CO1: To learn about the liberal Arts and how they are changing India

CO2: To remember and make the students aware of Indian constitution

CO3: To explain Globalization and the impact of Globalization India

CO4: To learn about Indian Economy and various concepts related to

that **CO5:** To illustrate various aspects of Culture Studies

CO5: To demonstrate Public Speaking and Dramatization as Performing Arts

Course Content:

Module 1: Principles of Liberal Arts [7L]

Definitions of Liberal Arts Greek centers of learning like Athens, Sparta and Gurukul in Ancient India. Changing Profiles of Liberal Arts education. Benefits of Liberal Arts education. Future trends and challenges of Liberal Arts. The via media between science, technology and culture. Fostering human values in the age of science and technology.

Module 2: Introduction to the Constitution of India [5L]

The Constituent Assembly and the Indian Constitution. Preamble to the Constitution of India. Rights and Fundamental Duties, Directive Principles. Concept of Welfare State and its different Constitutional Safeguards.

Module 3: Globalization, Sociology and Psychology of Social Change [6L]

Globalization- Nature and Concept. Impact of Globalization in general and in India. Dynamics of Globalization and Economic growth. Cultural dynamics of globalization. Implication of globalization on media, environment and folk arts.

Module 4: Indian Economics [5L]

Per Capita Income, National Income and its composition. Poverty, Inequality and Unemployment. Human Development Index. Foreign Direct Investment in India.

Module 5: Culture and Literary Studies **[8L]**

Concept of Culture: Meaning and Definition. Introduction to Cultural Studies: definition, aim, scope, methodology. Popular Culture: Meaning, Nature and definition. Rise of popular culture. Mass culture, popular culture and high culture. Popular culture in India. Reading Culture: Interdisciplinary perspectives. Digital culture and ethics,

Module 6: Dramatics Performing Arts and Public Speaking **[5L]**

Concept of performing arts. Definition, nature, scope and significance of dramatics. Role of director in the development of play. Acting as an art and science. Relationship between Indian theatre and new electronic media such as radio, TV and Cinema. Changing nature of Indian Dramatics and its presentation techniques. Public speaking as an art and its preparation.

Text/Reference Books/Journals:

1. "The Philosophy Book: Big Ideas Simply Explained", D. K. Publishers.
2. D. Pattanaik, "Indian Culture, Art and Heritage", Pearson Education India.
3. S. Nitin, "Art and Culture", McGraw-Hill Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	1	-	2	-	-
CO2	-	-	-	-	-	-	2	1	-	2	-	-
CO3	-	-	-	-	-	-	1	2	-	2	-	-
CO4	-	-	-	-	-	-	1	1	-	1	-	-
CO5	-	-	-	-	-	-	1	2	-	1	-	-

Semester 8 Curriculum and Syllabus

SEMESTER-8							
Sl. No.	**Type**	**Course No.**	**Course Name**	**L**	**T**	**P**	**Credits**
THEORY							
1	HS	YMG8001	Principles of Management	2	0	0	2
2	PE		Elective V	3	0	0	3
		YCS8021	Embedded Control Systems				
		YCS8022	Computer Vision				
		YCS8023	Software for Embedded System				
3	PE		Elective VI	3	0	0	3
		YCS8021	Embedded Control Systems				
		YCS8022	Computer Vision				
		YCS8023	Software for Embedded System				
PRACTICAL							
4	PE	YCS8102	Stream Lab 2: Embedded System and Robotics	0	0	4	2
SESSIONAL(ONLY INTERNAL EVALUATION)							
5	PROJ	YCS7204	Project II	0	0	6	3
MANDATORY NON-CGPA COURSE							
6	MC	YCS8501	Indian Culture and Tradition	3	0	0	0
TOTAL				**11**	**0**	**10**	**13**

Course Code	YMG8001			
Course Title	Principles of Management			
Category	Humanities			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this course the students will learn about the fundamental principles of management used in the industry and the different organizations. They will learn of the various field of study of management and the theories related to them and will be able to practically apply these theories in their management skills as well. At the end of the course, the students will be able to understand and interpret the proper knowledge and skills necessary to work as a proper manager in the field.

Course Outcome:

CO1: To familiarize the students with the origins of management principles and compare them with the modern trends in management theories

CO2: To understand the essential functions of management along with the theories framed by management experts in the business field

CO3: To explain the managerial process and the functions related to them which help them bring about change

CO4: To understand the proper relationship between the various levels of management in a business Organisation and the process by which to achieve the objectives

CO5: To explain the importance of feedback controlling of the management process along with the relevant theories, and to properly understand the process by which to apply proper management principles in modern day practices in the business Organisation and solve problems based on them

Course Content:

Module 1: Management [4L]

Management (Definition, Nature, Importance, Evolution), Contribution of Fayol, Taylor, Hawthorne, Maslow, Management- Art or Science?, Functions of Manager (Duties and responsibilities), Ethics in Management, Functions of Management

Module 2: Planning and Control [4L]

Planning (Steps, types and barriers), Mckinsey Approach, SWOT, Operational and Strategic Planning, Controlling (Concept, Relationship with Planning, Process, Dimensions), MBO

Module 3: Decision Making and Organizing [4L]

Decision Making Process, Certainty and Uncertainty of Decisions, Brainstorming, Process of Organizing, Authority and Responsibility, Delegation and Empowerment, Centralization and Decentralization, Departmentation

Module 4: Staffing **[4L]**
Manpower Planning, Job Design, Selection and Recruitment, Training and Development, Performance Appraisal

Module 5: Leadership and Communication **[3L]**
Role of leadership, theories of leadership, qualities of a good leader, Development of leadership, Communication process and types, Electronic Media

Module 6: Group Dynamics **[2L]**
Group- Concept, Stages of Group formation, types of groups

Module 7: Recent Trends in Management **[3L]**
Social Responsibility in management, Changes in management, TQM, Stress Management, International and Global Management, Crisis Management

Text/Reference Books:

1. H. Cortes, D. S. Bright and E. Hartman, "Principles of Management".
2. R. B. Rudani, "Principles of Management".
3. M. Gupta, "Principles of Management".
4. L. M. Prasad, "Principles and Practice of Management".

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	1	2	1	1	-	3	-	3
CO2	2	3	1	-	2	1	1	-	2	3	2	2
CO3	1	-	1	1	2	1	-	1	1	1	3	2
CO4	3	1	2	1	-	1	-	-	-		1	1
CO5	2	1	1	3	-	-	1	1	-	1	3	2

Course Code	YCS8021
Course Title	Embedded Control Systems
Category	Professional Elective
LTP & Credits	L T P Credits 3 0 0 3
Total Contact Hours	36
Pre-requisites	Embedded Systems

Learning Objective:

In this course, the students will learn about the control feature of embedded systems, which is a vital part of embedded system design. Various concepts like open loop, closed loop, and various control algorithms will be discussed in this course. The students will develop the knowledge of how embedded systems are actually controlled.

Course Outcome:

CO1: To explain the fundamentals of control system design and classify the various algorithms for implementation

CO2: To explain how control systems can be modeled as finite-state machines

CO3: To explain the validation techniques for embedded systems and examine real-life case studies

Course Content:

Module 1: Review of Control System Design **[8L]**

Open-loop and closed-loop control systems, analysis of control loops, time and frequency domain specifications, stability. Control system design approaches: proportional, integral, derivative, PID controllers. Practical realization of a control loop. Control system design examples.

Module 2: Controller Implementation **[7L]**

Architecture of embedded controllers and description of various components. Desig n and implementation of control loops, choice of embedded computing platforms: real-time operating systems, tiny operating system, input-output and communication, scheduling algorithms and their performance analysis, real-time issues in co-design implementation.

Module 3: Model Based Control System Design **[8L]**

Discrete systems, finite-state machines: notion of state, extended state machines, model-based design, code generation, verification and validation, HIL, MIL, SIL, PIL. Performance assessment of control algorithms on target implementation architectures.

Module 4: Validation and Case Studies **[8L]**

Validation techniques for embedded control systems. Case studies: cyber-physical systems, process control applications from various domains like home automation, automotive, aerospace, smart cities, process control, etc.

Text/Reference Books:

1. E. A. Lee and S. A. Seshia, "Introduction toEmbeddedSystems:A Cyber-Physical Systems Approach", MIT Press.
2. K. J. Astrom and B. Wittenmark, "Computer Controlled Systems", Dover Publications.
3. D. Hristu-Varsakelis, W. S. Levine, "Handbook of Networked and Embedded Control Systems",Birkh¨auser Boston.
4. W. Wolf, "Computers as Components: Principles of Embedded Computing Systems Design", Academic Press.
5. J. Ledin, "Embedded Control Systems in C/C++", CMP Books.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	1	-	2	-	-	-	-	3
CO2	2	2	2	1	-	-	1	-	-	-	-	3
CO3	-	1	1	2	3	3	1	-	-	-	-	3

<table>
<tr><td>Course Code</td><td colspan="4">YCS8022</td></tr>
<tr><td>Course Title</td><td colspan="4">Computer Vision</td></tr>
<tr><td>Category</td><td colspan="4">Professional Elective</td></tr>
<tr><td rowspan="2">LTP & Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Total Contact Hours</td><td colspan="4">36</td></tr>
<tr><td>Pre-requisites</td><td colspan="4">a) Mathematics-II
b) Data Structures and Algorithms</td></tr>
</table>

Learning Objective:

In this course, the students will learn about computer vision algorithm, methods and concepts; which will enable the students to implement computer vision systems with emphasis on applications and problem solving. After the completion of this course, the students will be in a better position to understand the techniques, mathematical concepts and algorithms used in computer vision to facilitate further study in this area.

Course Outcome:

CO1: To explain image formation and representation

CO2: To categorize the different techniques for local feature extraction

CO3: To classify the different category of calibration methods

CO4: To learn motion analysis and motion tracking

CO5: To learn the recognition of objects and the representation of shapes

Course Content:

Module 1: Image Formation and Low-level Processing **[7L]**

Overview and state-of-the-art.Fundamentals of image formation, Transformation: orthogonal, Euclidean, affine, projective, etc.

Fourier transform, convolution and filtering, image enhancement, restoration, histogram processing.

Module 2: Feature extraction **[6L]**

Edge detection, line and curve detection (Hough transform), corners – Harris and Hessian affine, oriental histogram, SIFT, SURF, HOG.

Scale-space analysis: image pyramids and Gaussian derivative filters, Gabor filters and DWT.

Module 3: Model Fitting and Reconstruction **[5L]**

Hough transform, line fitting, ellipse and conic sections fitting, algebraic and Euclidean distance measures.

Reconstruction by triangulation; Euclidean reconstruction; affine and projective reconstruction.

Module 4: Image Segmentation and Pattern Analysis **[6L]**

Region growing, edge-based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation. Object detection.

Clustering: K-means, K-medoids, mixture of Gaussians.

Classification: discriminant function, supervised, unsupervised, semi-supervised. Classifiers: Bayes, KNN, ANN models. Dimensionality reduction: PCA, LDA, ICA.

Module 5: Depth Estimation and Multi-camera Views [6L]

Camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models.
Introduction to projective geometry; epipolar constraints; the essential and fundamental matrices; estimation of the essential/fundamental matrix.

Module 6: Motion analysis and Motion tracking [6L]

The motion field of rigid objects; motion parallax; optical flow, the image brightness constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust estimation; motion segmentation through EM.
Statistical filtering; iterated estimation; observability and linear systems; the Kalman filter; the extended Kalman filter.

Text/Reference Books:

1. D. A. Forsyth and J. Ponce, “Computer Vision – A Modern Approach”, Second Edition, Prentice Hal.
2. E. Trucco and A.Verri, “Introductory Techniques for 3-D Computer Vision”, Prentice Hall.
3. O.Faugeras, “Three Dimensional Computer Vision”, MIT Press.
4. R.Szeliski, “Computer Vision: Algorithms and Applications”, Springer.
5. J.M. Sonka, V. Hlavac and R. Boyle, “Image Processing, Analysis and MachineVision”, Third Edition, CL Engineering,.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	3	2	3	2	-	-	-	-	3
CO2	1	1	1	1	2	3	1	-	-	-	-	2
CO3	3	1	1	1	2	3	2	-	-	-	-	3
CO4	2	2	2	3	1	1	1	-	-	-	-	1
CO5	2	3	2	2	1	3	1	-	-	-	-	1

Course Code	YCS8023			
Course Title	Software for Embedded Systems			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Embedded Systems a) Data Structures and Algorithms			

Learning Objective:

In this course the students will learn about the various software that are required for designing embedded systems. In particular, the students will become familiar with various programming environments like embedC, etc., and also learn how to apply object oriented programming features in the implementation. The course will be very helpful for students who want to apply the knowledge to develop real-life applications involving embedded systems.

Course Outcome:

CO1: To explain and classify the architecture of embedded systems and the software requirements

CO2: To explain the purpose of various embedded hardware building blocks and to analyze various real-life applications

CO3: To explain the implementation and testing aspects of embedded system design

Course Content:

Module 1: Assembly Language Programming [6L]

ARM instruction set architecture: registers and instruction set, programming model, assembly language programming.

Module 2: Introduction to Embed-C Programming [12L]

The Embed-C programming environment: Data types and variables, data type modifiers, storage class modifiers, operators, functions, creating libraries, linking of libraries. Example programs with peripheral devices like LED, LCD, switches, and other sensors & actuators.

Module 3: Unified Modeling Language [8L]

Object model and use case model, UML basics, object state behavior, UML state charts, role of scenarios in the definition of behavior, sequence diagrams, event, architectural design in UML concurrency design, threads in UML.

Module 4: Real-Time Operating System [10L]

Real-time operating system: characteristics, why essential for embedded systems, embedded Linux. Resource analysis, real-time service utility, scheduling classes. Task scheduling: periodic, aperiodic, sporadic. Scheduling algorithms: preemptive-fixed priority, feasibility, rate monotonic least upper bound, deadline-based scheduling, priority-based scheduling.

Text/Reference Books:

1. D. W. Lewis, “Fundamentals of Embedded Software where C and Assembly Meet”, Pearson Education.
2. B. P. Douglas, “Real time UML, second edition: Developing Efficient Objects for Embedded Systems”, Pearson Education.
3. M. Barr and A. Massa, “Programming Embedded Systems”, O’Reilly.
4. R. Mall, “Real-Time Systems: Theory and Practice”, Pearson Education.
5. K. Zurell, “C Programming for Embedded Systesm”, R&D Books.
6. J. W. S. Liu, “Real-time Systems”, Prentice-Hall.
7. D. Abbott, “Linux for Embedded and Real-time Applications”, Newnes.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	-	-	1	-	-	-	2	3
CO2	-	2	2	1	2	1	2	-	-	-	1	3
CO3	-	2	2	2	1	-	2	-	-	-	1	3

Course Code	YCS8102				
Course Title	Stream Laboratory 2 (Embedded Systems and Robotics)				
Category	Professional Elective				
LTP & Credits	L	T	P	Credits	
	0	0	4	2	
Total Contact Hours	48				
Pre-requisites	a) Embedded Systems Laboratory b) Stream Laboratory 1 (Embedded Systems and Robotics)				

Learning Objective:

In this laboratory course, the students will carry out various hands-on sessions with the design and implementations of complex embedded systems, and useful robot control experiments.

Course Outcome:

CO1: To design and analyze embedded system design for practical examples

CO2: To learn and study the control system of robots

CO3: To design and analyze various useful applications using robots

Suggestive List of Experiments:

1. To program and control the behavior of a robotic vehicle. **[2 days]**
2. Automated system for vehicle parking with RFID-based identification. **[3 days]**
3. Object tracking of a mobile robot using various sensors and camera. **[3 days]**
4. Stick balancing robot/Inverted pendulum (2D-preliminary or 3D-advanced) Advanced robotics optimization and control design problem.

Preliminary case:

(a) A movable platform in two directions and a stick attached to the platform with a pivot joint allowing the stick to fall along the movable direction only

(b) Control the movable platform (only in x-direction) such that the stick stays perpendicular to the surface instead of falling to either direction

Advanced case:

(a) Replace movable platform from preliminary case with an omnidirectional platform or robotic car with a flat surface on top

(b) A stick is attacked to the surface of the robot using a ball and socket joint that allows the stick to fall in any direction on the surface

The control program should be able to move the robotic platform on x-y plane with the stick pointed in the z direction perpendicular on the x-y plane. **[4 days]**

Text/Reference Books:

1. W. Wolf, “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufmann.

2. M. Sloss, D. Symes, and C. Wright, "ARM System Developers Guide: Designing and Optimizing System Software", (Online Resource).

3. M. Quigley, B. Gerkey and B. Smart, "Programming Robots with ROS", O'Reilly.

4. P. Corke, "Robotics, Vision and Control: Fundamental Algorithms in MATLAB", Springer.

5. P. McKinnon, "Robotics: Everything You Need to Know about Robotics from Beginner to Expert", Createspace Independent Publishing.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	2	2	1	-	-	-	-	2
CO2	1	1	1	1	1	3	2	-	-	-	-	3
CO3	1	1	2	1	1	3	1	-	2	-	-	3

Course Code	YCS8501			
Course Title	Indian Culture and Tradition			
Category	Mandatory Non-CGPA Course			
LTP & Credits	L	T	P	Credits
	3	0	0	0
Total Contact Hours	36			
Pre-requisites				

Learning Objective:

India has a diverse and distinct culture that has been developing for thousands of years and varies from region to region.

The main objectives of this course are to familiarize students with various aspects of the culture and heritage of India, to develop among students a feeling of love and a sense of belonging towards the nation, to promote an integral and holistic growth of young minds, to develop the expressive and communicative power of logical reasoning, and to develop student sensibility with regard to issues of gender in contemporary India.

Course Outcome:

CO1: To understand the main features of Indian culture, civilization and Heritage.

CO2: To connect up and explain basics of Indian Traditional knowledge.

CO3: To explain the important issues related to gender in contemporary India.

CO4: To describe the socio-cultural insecurities caused by globalization.

CO5: To appreciate the ancient aesthetics and knowledge of construction, and also stimulate interest to know the subject in detail.

Course Content:

Module 1: Culture - An Introduction **[6L]**

Traditional and Modern concepts of Culture.
Notions of Culture in textual tradition, anthropological, archaeological and sociological understanding of the term culture.
Elements of Culture, concept of Indian culture and value system. Relation between culture and civilization.

Module 2: Indian Religion, Philosophy, and Practices **[6L]**

Pre-Vedic and Vedic Religion.
Buddhism, Jainism, Six System Indian Philosophy.
Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement.
Socio religious reform movement of 19^{th} century, Modern religious practices.

Module 3: Indian Culture Studies **[8L]**

Indian Society and Culture in historical and contemporary perspectives.
Moments and Milestones in the history of India's freedom Movement, Historiography.
Multiculturalism, Ethnicity, New Social Thoughts and movements (including environmental movement), Diaspora.

Indian Polity, Impact of Globalization on Indian society, Post Modernism, World Politics and terrorism.
Feminism (including eco-feminism), Women's Empowerment, Gender discrimination &
Gender Violence.

Module 4: Cultural Heritage and Performing Arts **[6L]**
Cultural Heritage: its significance and its constituents.
Importance of Built Heritage at the level of Locality, Region, Nation and World.
Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals.
Current developments in Arts and Cultural.
Indian's Cultural Contribution to the World.

Module 5: Socio-Cultural Issues in Contemporary India **[5L]**
Caste System
Issues related to woman: Gender Discrimination, Dowry System
Communalism
Issues related to the Elderly
Issues of poverty and
Unemployment Problems of
Children

Module 6: Student Activism and Youth Culture **[5L]**
History of Youth Movement in India.
Nature of Students Activism in India.
Indian students' Unrest in Global Perspective.
Causes of student Activism.
Youth Culture and Future Development

Text/Reference Books:

1. N. Singhania, Indian Art and Culture, McGraw-Hill.
2. Y. Singh, Modernization of Indian Tradition, Publisher-Rawat.
3. V. Pandey, Indian Society And Culture, Publisher - Rawat.
4. N. Hasnain, Indian Society And Social Issues, McGraw-Hill.
5. D. Pattanaik, Indian Culture, Art and Heritage, Pearson Education India.
6. Dr. P. K. Agrawal, Indian Culture, Art and Heritage, Prabhat Prakashan.
7. Dr. S. S. Mathur, A Sociological Approach to Indian Education, Vinod Pustak Mandir Agra.
8. K. A. Jacobsen, Modern Indian Culture and Society, Routledge (1st edition).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	1	-	-	-	1
CO2	-	-	-	-	-	-	1	2	-	-	-	1
CO3	-	-	-	-	-	-	2	1	-	-	-	1
CO4	-	-	-	-	-	-	1	2	-	-	-	1
CO5	-	-	-	-	-	-	2	1	-	-	-	1