Curriculum & Syllabus
Under Autonomy

B.Tech Computer Science Engineering
(Effective from 2023-24 admission batch)

Department: CSE

Curriculum Structure & Syllabus
(Effective from2023-24 admission batch)

		1stYear1stSemester							
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A.THEORY									
1	SCI	Multidisciplinary	YCS 1001	Basic Electronics	3	0	0	3	3
2	SCI	Minor	YMT1001	Engineering Mathematics–I	3	1	0	4	4
3	ENGG	Major	YCS 1002	Programming for Problem Solving	3	1	0	4	4
4	HUM	Ability Enhancement Course	YED1001	Professional Communication	2	0	0	2	2
5	HUM	Common value added course	YBT1010	Environmental Science	1	1	0	2	1
B.PRACTICAL									
6	ENGG	Skill Enhancement	YCS1101	Basic Electronics Laboratory	0	0	3	3	1.5
7	ENGG	Skill Enhancement	YCS1103	Workshop & Manufacturing Practices Laboratory	0	0	3	3	1.5
8	ENGG	Major	YCS 1102	Programming for Problem Solving Laboratory	0	0	3	3	1.5
9	HUM	Ability Enhancement Course	YED1101	Professional Communication Laboratory	0	0	2	2	1.5
C.MANDATORYACTIVITIES/COURSES(Non CGPA)									
11	MC	Mandatory Course	YCS1502	Seminar/Group Discussion	0	0	0	0	1
12.	MC	Mandatory Course	YCS1501	Universal Human Value	0	0	0	0	1
13.	MC	Mandatory Course	YCS1503	SkillX	0	0	0	0	1
Total of Theory, Practical and Mandatory Activities /Courses								26	20

***HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project; MC:* Mandatory Activities/Courses**

1st Year 2nd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	YCS 2001	Data Structures	3	1	0	3	4
2	SCI	Multidisciplinary	YPH 2001	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	YMT2001	Engineering Mathematics –II	3	0	0	3	3
4	ENGG	Minor	YCS2002	Basic Electrical Engineering	3	0	0	3	3
5	HUM	Common value added course	YED2001	Indian Knowledge System	1	1	0	2	1
B.PRACTICAL									
6	ENGG	Major	YCS2101	Data Structures Laboratory	0	0	3	3	1.5
7	SCI	Skill Enhancement	YPH2101	Engineering Physics Laboratory	0	0	3	3	1.5
8	ENGG	Minor	YCS2102	Basic Electrical Engineering Laboratory	0	0	3	3	1.5
9	ENGG	Skill Enhancement	YCS2301	Engineering Graphics & Design Laboratory	1	0	2	3	1.5
10	SCI	Ability Enhancement	YCS2503/ JSC2503	Life Skills / Communicative English Proficiency	0	0	1	1	1
C.MANDATORYACTIVITIES/COURSES(Non-CGPA)									
11	HUM	Ability Enhancement Course	YCS2502	Group Discussion	1	0	0	1	1
12	MC	Mandatory Course	YCS2501	NSS/Physical Activities /Meditation &Yoga/Photography	0	0	3	2	1
13	MC	Mandatory Course	YCS2504	SkillX	0	0	0	0	1
Total of Theory, Practical and Mandatory Activities / Courses								30	21

2nd Year 3rd Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A.THEORY									
1	SCI	Minor	YMT 3001	Discrete Mathematics	3	0	0	3	3
2	ENGG	Minor	YCS 3001	Digital Logic and Electronics	3	0	0	3	3
3	ENGG	Major	YCS 3002	Computer Organization and Architecture	3	0	0	3	3
4	ENGG	Major	YCS 3003	Design and Analysis of Algorithms	3	0	0	3	3
B.PRACTICAL									
5	ENGG	Minor	YCS 3101	Digital Logic and Electronics Laboratory	0	0	3	3	1.5
6	ENGG	Skill Enhancement Course	YCS 3104	IT Workshop Laboratory (SciLab/MATLAB/C++)	0	1	3	3	3
7	ENGG	Major	YCS 3102	Computer Organization and Architecture Laboratory	0	0	3	3	1.5
8	ENGG	Major	YCS 3103	Design and Analysis of Algorithms Laboratory	0	0	3	3	1.5
C.MANDATORYACTIVITIES/COURSES(Non-CGPA)									
10	HUM	Ability Enhancement Course	YCS3501	Technical Seminar Presentation	1	0	0	1	1
10	MC	Mandatory Course	YBB3501	Disaster management	0	0	3	3	1
11	MC	Mandatory Course	YCS3502	SkillX	0	0	0	0	1
Total of Theory, Practical and Mandatory Activities / Courses								28	19.5

2ndYear4th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A.THEORY									
1	SCI	Minor	YMT 4001	Probability and Statistics	3	0	0	3	3
2	ENGG	Major	YCS 4001	Operating Systems	3	0	0	3	3
3	ENGG	Major	YCS 4002	Formal Language and Automata Theory	3	0	0	3	3
4	ENGG	Minor	YCS 4003	Object Oriented Programming using Java	3	0	0	3	3
5	HUM	Ability Enhancement Course	YBB4001	Principles of Management	2	0	0	2	2
B.PRACTICAL									
6	ENGG	Major	YCS 4101	Operating Systems Laboratory	0	0	3	3	1.5
7	ENGG	Minor	YCS 4102	Numerical Methods Laboratory	0	0	3	3	1.5
8	ENGG	Major	YCS 4103	Object Oriented Programming using Java Laboratory	0	0	3	3	1.5
9	ENGG	Major	YCS 4104	Programming Using Python Laboratory	0	0	3	3	1.5
C.MANDATORYACTIVITIES/COURSES (Non-CGPA)									
10	HUM	Ability Enhancement Course	YCS4501	Soft Skill & Aptitude	1	0	0	1	1
11	MC	Mandatory Course	YED4501	Foreign Language	0	0	0	3	1
12	MC	Mandatory Course	YCS4502	SkillX	0	0	0	0	1
Total of Theory, Practical and Mandatory Activities /Courses								30	20

3rdYear5thSemester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	YCS5001	Artificial Intelligence	3	1	0	4	4
2	ENGG	Major	YCS5002	Database Management Systems	3	0	0	3	3
3	ENGG	Major	YCS5003	Computer Networks	3	0	0	3	3
4	ENGG	Major	YCS5004A YCS5004B YCS5004C	Compiler Design Cryptography and Network Security Computer Graphics	3	0	0	3	3
5	HUM	Minor	YED5001	Economics for Engineers	2	0	0	2	2
B.PRACTICAL									
6	ENGG	Major	YCS5101	Artificial Intelligence Laboratory	0	0	3	3	1.5
7	ENGG	Major	YCS5102	Database Management Systems Laboratory	0	0	3	3	1.5
8	ENGG	Major	YCS5103	Computer Networks Laboratory	0	0	3	3	1.5
9	PRJ	Skill Enhancement	YCS5201	Internship	0	0	2	2	1.5
C.MANDATORYACTIVITIES/COURSES(Non-CGPA)									
10	MC	Mandatory Course	YCS5501	Behavioral and Interpersonal skills	3	0	0	3	1
11	MC	Mandatory Course	YCS5502	SkillX	0	0	0	0	1
Total of Theory, Practical and Mandatory Activities /Courses								28	20

3rdYear6thSemester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A.THEORY									
1	ENGG	Major	YCS 6013	Web and Internet Technology	3	0	0	3	3
2	ENGG	Major	YCS 6014	Machine Learning	3	0	0	3	3
3	ENGG	Major	YCS 6015	Software Engineering	3	0	0	3	3
4	ENGG	Major	YCS 6004A YCS6003 YCS6004C	Mobile Computing Natural Language Processing Cloud Computing	3	0	0	3	3
5	ENGG	Minor	YLB6001	Cyber Law and Ethics	3	0	0	0	3
B.PRACTICA L									
6	ENGG	Major	YCS 6113	Web and Internet Technology Laboratory	0	0	3	3	1.5
7	ENGG	Major	YCS 6114	Machine Learning Laboratory	0	0	3	3	1.5
8	ENGG	Major	YCS 6115	Software Engineering Laboratory	0	0	3	3	1.5
C.MANDATORYACTIVITIES/COURSES(Non-CGPA)									
10	MC	Mandatory Course	YCS6501	Innovation, Entrepreneurship & IPR	3	0	0	3	1
11	MC	Mandatory Course	YCS6502	SkillX	0	0	0	0	1
Total of Theory, Practical and Mandatory Activities /Courses								24	19.5

4th Year 7th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A.THEORY									
1	ENGG	Major	YCS 7001	Neural Networks and Deep Learning	3	0	0	3	3
2	ENGG	Major	YCS 7002 I YCS 7002 J YCS 7002 K	Advanced Algorithms High Performance Computing Advanced Operating Systems	3	0	0	3	3
3	ENGG	Major	YCS 7004B YCS 7003 H YCS 7003 J	Information and Coding Theory Ad-Hoc and Sensor Networks Data Mining and Data Warehouse	3	0	0	3	3
4	ENGG	Major	YCS 7002A YCS 7002B YCS 7004F	Computer Vision Parallel Computing Learning Optimization Techniques	3	0	0	3	3
5	HUM	Minor	YBB7001	Human Resource Development and Organizational Behavior	2	0	0	2	2
B.PRACTICAL									
5	ENGG	Major	YCS 7101	Neural Networks and Deep Learning Laboratory	0	0	3	3	1.5
6	ENGG	Major	YCS 7102 I YCS 7102 J YCS 7102 K	Advanced Algorithms Laboratory High Performance Computing Laboratory Advanced Operating Systems Laboratory	0	0	3	3	1.5
7	ENGG	Major	YCS 7201	Project I	0	0	3	3	3
C.MANDATORY ACTIVITIES/COURSES(Non-CGPA)									
8	MC	Mandatory Course	YCS7501	Constitution of India	3	0	0	3	1
9	MC	Mandatory Course	YCS7502	SkillX	0	0	0	0	1
Total of Theory, Practical and Mandatory Activities/Courses								29	20

4thYear8thSemester									
Sl.No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A.THEORY									
1	ENGG	Major	YCS 8001J YCS 8001H YCS 8001I	Real Time Systems Data Analytics Soft Computing	3	1	0	3	4
2	ENGG	Major	YCS 8002 J YCS 8002 K YCS 8002 L	VLSI Bio-informatics Robotics	3	1	0	3	4
3	ENGG	Minor	YCS 8003 A YCS 8003 B YCS 8003 C	Introduction to IoT Image Processing Optimization Techniques	3	0	0	3	3
B.PRACTICAL									
4	PRJ	Skill Enhancement	YCS 8201	Major Project-II	0	0	12	12	6
5	PRJ	Internship	YCS 8202	Grand Viva	0	0	3	3	3
C.MANDATORYACTIVITIES/COURSES(Non-CGPA)									
6	MC	Mandatory Course	YED 8501	Essence of Indian Knowledge Tradition	0	0	3	3	1
7	MC	Mandatory Course	YCS 8502	SkillX	0	0	0	0	1
Total of Theory, Practical and Mandatory Activities/Courses								33	20

Total Credit = 160

Semester1Curriculum and Syllabus

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

Learning Objective:

In this course, students will learn about the fundamental behavior and principle of operations of various electronic devices and circuits. At the end of the course, students will be able to design useful electronic subsystems like rectifiers, amplifiers, 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 diodes, bipolar and field-effect transistors, and solve design problems.
CO3: To understand and remember the principle of working of operational amplifiers and demonstrate its various applications.
CO4: Design and analyze electronic circuits incorporating semiconductor devices and operational amplifiers to meet specified requirements.
CO5: Troubleshoot and optimize electronic circuits using diagnostic tools and techniques.

Course Content:

Module 1: Fundamentals of Semiconductor [6L]

- Conductors, Insulators, and Semiconductors
- Energy band diagrams
- Fermi Dirac function, Fermi level
- Intrinsic and Extrinsic (p-type and n-type) semiconductors
- Drift and Diffusion current
- Mass action law
- Conductivity 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 equation, V-I characteristics
- P-N junction breakdown: conditions, avalanche, and zener breakdown
- Zener diode and characteristics
- Diode half-wave and full-wave rectifiers (centre tapped and bridge) circuits and operation, ripple factor, efficiency, reduction of ac ripples using filter circuit (Qualitative analysis)
- Design of diode clipper and clamper circuit

- 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
- BJT biasing, BJT as an amplifier
- 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
- 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
- Operational Amplifier: Ideal characteristics, Non-ideal characteristics of op-amp – offset voltages, bias current, offset current, slew rate, CMRR, and bandwidth
- Inverting and Non-inverting amplifier
- Concept of virtual ground and virtual short
- Applications of op-amp: Adder, Differential Amplifier, Differentiator, Integrator
- Numerical problems

Module 6: Electronic Instruments and Measurements [2L]

- Basics of measurement
- Cathode-Ray Oscilloscope and Digital-Storage Oscilloscope
- Measurement of voltage, frequency, and phase
- Signal generators and analytical instruments

Text/Reference Books:

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

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

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

Learning Objectives :

In this course the students will learn about the basic knowledge of matrix algebra, function of several variable sand Improper integral. At the end of the course, the students will be able to solve engineeringproblems.

Course Outcome:

CO1: Recall the distinctive characteristics of matrix algebra and calculus.

CO2: Understand the theoretical concept of vector space and apply to address problems.

CO3: Understand concept of definite and improper integral and apply to address problems in theirdisciplines

CO4: Understand the concept of functions of several variables and apply to address problems in their disciplines

CO5: Apply matrix algebra, vector spaces, definite and improper integrals, and functions of several variables to solve engineering problems, demonstrating a comprehensive understanding of the mathematical concepts and their practical applications.

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]

Definite and Improper Integral: 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: 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 Ed)", John Wiley & Sons, 2006.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. T. Veerarajan, "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
4. B. S. Grewal, "Higher Engineering Mathematics (36th Ed)", Khanna Publishers, 2010.
5. N. P. Bali and M. Goyal, "A textbook of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

PO-CO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 1002			
Course Title	Programming for Problem Solving			
Category	ENGG Major			
LTP & Credits	L	T	P	Credit
	3	1	0	4
Total Contact Hours	48			
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, and solve problems
CO3: Design and implement algorithms for a given problem
CO4: Implement algorithms using a high-level programming language
CO5: Analyze and evaluate algorithms for efficiency and correctness

Course Content:

Module 1: Introduction to Computation **[12L]**
Model of computation, stored-program concept, hardware and software. Number representation: basic concepts, decimal and binary.

Module 2: Problem Solving and Algorithmic Thinking **[10L]**
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 **[16L]**
Constituents of Algorithms-Sequence, Selection and Repetition, input-output. Computation - expressions, logic. Problem Understanding and Analysis -problem definition, input-output, variables, name binding. Types of Functions- user defined functions, Standard Functions, Parameter Passing techniques, Recursive functions, Data organization: lists, arrays, etc.,
algorithms to programs.

Module 4: Problem Solving with Algorithms **[10L]**
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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YED 1001				
Course Title	Professional Communication				
Category	HUM , Ability Enhancement Course				
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
CO5: To enhance listening skills for effective communication.

Course Content:
Module 1: Communication in a Globalized World [4L]
Introduction; meaning of communication; five stages of communication; formal and informal communication; verbal and non-verbal communication; role of body language in communication; barriers to effective communication; prejudice and lack of sensitivity in communication; gender/culture neutrality.

Module 2: Functional Grammar [8L]
Articles and prepositions. Direct and indirect verbs, subject-verb agreement. Tense and voice, sentences: simple, complex and compound; 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 making.

1. "Where the Mind is without Fear" by Rabindranath Tagore
2. "Out of Business" by R.K. Narayan

Module 4: Writing Skills **[6L]**

Paragraph, formal letters, emails, job applications, order and complaint letter, 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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YBT1010			
Course Tittle	Environmental Science			
Category	HUM Common value added course			
LTP & Credits	L	T	P	Credits
	1	1	0	1
Total Contact Hours	24			
Pre-requisites	None/ If Any			

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.

CO5: Demonstrate an understanding of the ethical and societal implications of environmental issues and propose sustainable solutions to mitigate environmental degradation, emphasizing the importance of conservation and preservation of natural resources.

Course Content:

Module1: Introduction [5L]

Introduction to environment and ecology. Components of the environment, environmental degradation, natural cycles of environment.

Module2: Ecology [2L]

Elements of Ecology, Ecological balance, Cause & Effects of afforestation and deforestation.

Module 3: Air Pollution and Control [5L]

Atmospheric composition, Segments of atmosphere climate, weather. Atmospheric Stability, Sources and effect so fair pollutants, primary and secondary pollutants. Criteria Pollutants:PM10, Source, Effect, Control.5 CO, NOx, Source, Effect, Control. Sox, Source, Effect, Control. Lead, Ozone, Source, Effect, Control. Greenhouse effect, Control Measures. Depletion of ozone layer, Effects of UV exposer, ControlMeasures.

Module 4: Water Pollution and Control [7L]

Hydrosphere, natural water resources and reserves. Pollutants: their origin and effects. COD and BOD test, NBOD and CBOD. River / lake / ground water pollution. Control Measures of water pollution. Drinking water and waste water treatment.

Module 5: Land Pollution [3L]

Lithosphere, pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes) their origin and effects. Collection and disposal of solid waste, recycling and treatment methods.

Module 6: Noise Pollution [2L]

Sources, effects, standards and control converters, Gray code to binary converters, Encoder.

Text/Reference Books:

1. A. K. Dey, “Environmental Chemistry”, New Ageinternational

2. G.M. Masters, “Environmental Engineering”, Prentice HallIndia

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS1101			
Course Title	Basic Electronics Laboratory			
Category	ENGG Skill Enhancement			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

1. To prepare the students to have a basic knowledge of active and passive components.
2. To develop the ability to measure signals using a multimeter, CRO.
3. To understand the characteristics of proper biasing for BJT and FET.
4. To encourage the development of circuits using diodes, transistors, FETs, and OPAMPs.

Course Outcome:

CO1: To study and evaluate the characteristics of basic electronic components (Diode, BJT, FET).
CO2: To demonstrate the working of CRO, Function Generator, Digital Multimeter, and D.C. power supply.
CO3: To sketch the V-I characteristics of p-n junction diode, Zener diode, BJT.
CO4: To construct the rectifier circuit using diode and Inverting, Non-inverting amplifiers Circuit using Op-Amp.

CO5: To determine the characteristics parameters of Op-Amp.

Course Content:

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT). [3 days]
2. Familiarization with measuring and testing equipment like Digital Multimeter, CRO, Signal generator, and Power Supply. [2 days]
3. Study of V-I characteristics of Junction diode. [1 day]
4. Study of V-I characteristics of Zener diode. [1 day]
5. Study of Half wave and Full wave rectifier. [2 days]
6. Study of V-I characteristics of BJT. [1 day]
7. Study of an operational amplifier chip and analyze its functionality. [2 days]
8. Design of non-inverting and inverting amplifier using operational amplifier. [2 days]
9. Design of adder, differential amplifier using operational amplifier. [2 days]
10. Verification of the truth table of basic logic gates using IC. [1 day]
11. Innovative Experiment. [1 day]

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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	1	2	2	1	2	2	-	2
CO2	3	2	1	2	2	-	-	1	2	2	1	2	3	3	3
CO3	3	3	1	1	2	-	-	1	2	1	1	2	3	3	3
CO4	3	3	3	2	2	1	1	1	3	2	2	3	3	3	3
CO5	3	2	1	1	-	-	-	-	1	1	1	2	2	-	2

Course Code	YCS 1103			
Course Title	Workshop/Manufacturing Practices Laboratory			
Category	ENGG Skill Enhancement			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	Physics & Mathematics (10+2 Level)			

Course Outcomes:

After successful completion of this course, learners will be able to:

CO1: Identify and operate various hand tools related to a variety of manufacturing operations.
CO2: Safely fabricate simple components with their own hands.
CO3: Gain practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.
CO4: Produce small devices of their interest for project or research purposes.
CO5: Apply safety standards and regulations in workshop environments to ensure the well-being of oneself and others.

Course Content:

(i) Theoretical discussion & videos: 3P

1. Manufacturing Methods - casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic molding & Glass Cutting

(ii) Workshop Practice:

Module 1 - Machine shop 6P Typical jobs that may be made in this practice module: i. To make a pin from a mild steel rod in a lathe. ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop 6P Typical jobs that may be made in this practice module: i. To make a Gauge from MS plate.

Module 3 - Carpentry 6P Typical jobs that may be made in this practice module: i. To make wooden joints and/or a pattern or like.

Module 4 - Welding shop (Arc welding 3P + gas welding 3P) 3P Typical jobs that may be made in this practice module: i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metal arc welding. ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Module 5 - Electrical & Electronics 3P House wiring, soft soldering

Module 6 – Smithy 3P Typical jobs that may be made in this practice module: R21 B. Tech (ME) i. A simple job of making a square rod from a round bar or similar. For further study (Optional)

Module 7 - Casting 3P Typical jobs that may be made in this practice module: i. One/ two green sand molds to prepare, and a casting be demonstrated.

Module 8 - Plastic molding & Glass Cutting 3P Typical jobs that may be made in this practice module: i. For plastic molding, making at least one simple plastic component should be made. ii. At least one sample shape on glass should be made using laser cutting machine. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K., and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Reference Books:

1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A. Ghosh and A.K. Mallick, Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C. Sen and A. Bhattacharya, New Central Book Agency, Kolkata.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course code	YCS1102			
Course Title	Programming for Problem solving Laboratory			
Category	ENGG Major			
LTP & Credits	L	T	P	Credit
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	Basic Understanding of Computer			

Learning Objective:

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

Course Outcomes:

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 analyse 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.

Course Content:

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.

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YED 1101			
Course Title	Professional communication Laboratory			
Category	HUM, Ability Enhancement Course			
LTP & Credits	L	T	P	Credits
	0	0	2	1.5
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

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

Course Outcome:

CO1: Apply different skills of technical communication in English.

CO2: Use correct pronunciation when speaking English.

CO3: Use appropriate techniques for effective and active listening.

CO4: Learn to express ideas clearly and coherently in professional settings.

CO5: Demonstrate effective verbal and non-verbal communication skills in various professional scenarios, including presentations, meetings, and interviews

Course Content:

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/unvoiced, 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 a picture, group discussions, and personal interviews). [6 Days]
4. Laboratory project work (Making a 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 Tools to Hone your Communication Skills", Rockridge Press.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Semester 2 Curriculum and Syllabus

Course Code	YCS2001			
Course Title	Data Structures			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Basic Programming			

Learning Objective:

In this course, 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 a program.
CO2: To solve problems based on different data structures and also write programs.
CO3: To identify appropriate data structure and algorithmic methods in solving a problem.
CO4: To discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.
CO5: To compare and contrast the benefits of dynamic and static data structures implementations.

Course Content:

Module 1: Introduction of Data Structure [12L]

- 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.

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).
- Queues, 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 [8L]

- Sorting Algorithms: Bubble sort, Insertion sort, Selection sort – with the 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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YPH2001			
Course Title	Engineering Physics			
Category	SCI, Multidisciplinary			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The objective of the course is to provide students with a sufficient understanding of physics' foundational ideas and their potential applications. Understanding the fundamentals of physics will enable engineers to better comprehend the instruments and methods employed in the field and lay the groundwork for introducing novel ideas. It can also raise awareness of the crucial part that engineering and science play in the creation of new technologies. Additionally, it provides the required exposure to the practical aspects, which is a vital component of studying the sciences.

Course Outcome:

CO1: To understand and remember the basic principles of Classical Mechanics, Relativistic Mechanics, Quantum Mechanics, Statistical Mechanics, and microscopic phenomena.

CO2: To understand the working principles of laser, optical fiber, and holography amplifier and analyze their various applications to enhance knowledge in modern optics.

CO3: To learn the basic principles of electromagnetic induction, dielectric properties, and magnetic properties of materials.

CO4: To understand and apply knowledge in new technologies.

CO5: To apply the principles of physics to solve engineering problems and analyze real-world phenomena.

Course Content:

Module 1: Mechanics [8L]

- 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 [8L]

- Blackbody 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, Fiber Optics [6L]

- Spontaneous and stimulated emission of radiation, Population inversion, Einstein's coefficients, Basic components of laser system, Construction and working of Ruby laser, He-Ne lasers, Laser Applications. Basic ideas of Fiber optics.

Module 4: Statistical Mechanics and Applications [6L]

- 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 [3L]

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

Module 6: Dielectrics [3L]

- Types of dielectric, relation between dielectric constant and electric susceptibility, polarizability, 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. Beiser, "Concepts of Modern Physics", McGraw Hill India.
2. D.K. Bhattacharya and P. Tandon, "Engineering Physics", Oxford India.
3. Lal and N. Subramanyam, "A Textbook Of Optics", S. Chand & Co.
4. Dominic I. and A. Nahari, "A TextBook 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. K. Pandey and S. Chathurvedi, "Engineering Physics", Cengage Learning.
9. J. Philip, "A textbook of Engineering Physics", Educational Publishers.
10. B. Premlet, "Engineering Physics", McGraw Hill India..

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YMT2001			
Course Title	Mathematics II			
Category	SCI, Multidisciplinary			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective(s):

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 Outcomes:

CO1: To use mathematical tools to evaluate multiple integrals and vector integrals.
CO2: To apply effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
CO3: To understand the properties of Laplace Transform to evaluate multiple integrals and their usage
CO4: To understand the concept of Laplace transform to solve ordinary differential equations.
CO5: Apply mathematical concepts and techniques to analyze and solve engineering problems involving double and triple integration, ordinary differential equations, and Laplace transforms, demonstrating proficiency in mathematical modeling and problem-solving skills.

Course Content:

Module 1: Multivariable Calculus (Integration): [8L]

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals,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: [8L]

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations,

Module 4: Laplace Transform: **[10L]**

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 LT, 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.

Text /Reference Books:

1. E. Kreyszig, "Advanced Engineering Mathematics(9th Ed)", John Wiley & Sons.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill New Delhi.
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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS2002			
Course Title	Basic Electrical Engineering			
Category	ENGG, Minor			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

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

Course Outcome:

CO1: Understand and remember the working principles of basic electrical circuits, power distribution, and safety measures.
CO2: Analyze the functioning of DC and AC circuits.
CO3: Understand and remember the basic principles of transformers and rotating machines.
CO4: Analyze and evaluate the performance of electrical circuits, transformers, and rotating machines through laboratory experiments and simulations.
CO5: Design basic electrical circuits and systems, considering safety, efficiency, and economic factors.

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.

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.
- Three-phase balanced circuits, Concept of three-phase power measurement.

Module 3: Single-Phase Transformer [5L]

- Single-phase transformer: Idea on constructional parts, Classifications, Working principle. Numerical on EMF equation, Phasor diagram.

Module 4: Electrical Rotating Machines [8L]

- DC Machines: Constructional features, Classifications, Working principle of Generator and Motor. Simple Numerical 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).

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-McGrawHill.
2. V. Mittle and A. Mittal, "Basic Electrical Engineering", Tata-McGrawHill.
3. E. Hughes, "Electrical and Electronics Technology", PHI/Pearson Education.
4. C.L. Wadhwa, "Basic Electrical Engineering", Pearson Education.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YED2001			
Course Title	Indian Knowledge System			
Category	HUM, Common value added course			
LTP & Credits	L	T	P	Credits
	1	1	0	1
Total Contact Hours	24 hrs			
Pre-requisites	None			

Learning Objective(s):

To facilitate students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of the knowledge system. To make students understand traditional knowledge and analyze it and apply it to their day-to-day life.

Course Outcomes:

CO1: Provide an overview of the concept of the Indian Knowledge System and its importance.
CO2: Appreciate the need and importance of protecting traditional knowledge.
CO3: Recognize the relevance of Traditional knowledge in different domains.
CO4: Establish the significance of Indian Knowledge systems in the contemporary world.
CO5: Evaluate the impact of Indian Knowledge Systems on global perspectives.

Course Content:

Module 1: Introduction to Indian Knowledge Systems (IKS): [7L]

Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.

Module 2: Traditional Knowledge in Humanities and Sciences: [8L]

Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.

Module 3: Traditional Knowledge in Professional domain: [9L]

Town planning and architecture- Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

Text / Reference Books:

1. Introduction to Indian Knowledge System - concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-9391818-21-0
2. Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230
3. Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS2101			
Course Title	Data Structures Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	Fundamentals of Programming			

Learning Objective:

In this course, students will learn about implementing different algorithmic approaches in C programs using non-linear and linear data structures to solve problems in various engineering domains.

Course Outcome:

CO1: Choose appropriate data structures for specified problem definitions.
CO2: Compare operations such as searching, insertion, deletion, and traversing mechanisms on various data structures.
CO3: Explain practical applications of data structures.
CO4: Analyze how to store, manipulate, and arrange data efficiently.
CO5: Implement various data structures using arrays and linked lists.

Course Content:

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 lists
    - 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. R. Thareja, "Data Structures using C", Oxford University Press.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YPH2101			
Course Title	Engineering Physics Laboratory			
Category	SCI, Skill Enhancement			
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 a standard set of experiments to correlate them with the corresponding theory.

Course Outcomes:

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.
CO4: To analyze experimental data using appropriate statistical methods and tools to draw meaningful conclusions and make predictions.
CO5: To communicate experimental procedures, observations, and results effectively through written reports and oral presentations.

Course Content:

Suggestive List of Experiments:

1. General idea about Measurements and Errors: i) Error estimation using Slide calipers/Screw-gauge/traveling microscope for one experiment. ii) Proportional error calculation using Carey 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 bandgap 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 wavelength. [1 day]
10. Determination of wavelength 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.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS2102			
Course Title	Basic Electrical Engineering Laboratory			
Category	ENGG, Minor			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

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

Course Outcomes:

CO1: Identify and apply common electrical equipment and instruments.
CO2: Develop electric networks using various components and analyze the circuit behavior.

CO3: Apply and analyze the basic characteristics of transformers and electrical machines.
CO4: Demonstrate an understanding of the characteristics and operation of different types of electrical machines.
CO5: Analyze and interpret data from electrical experiments, draw conclusions, and make recommendations based on the findings.

Course Content:

List of Experiments:

1. Basic safety precautions – Earthing, Introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real-life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten, and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter methods.
7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of a single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing, and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on a single-phase Energy Meter.
13. Innovative experiments.

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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS2301			
Course Title	Engineering Graphics & Design Laboratory			
Category	ENGG, Skill Enhancement			
LTP & Credits	L	T	P	Credits
	1	0	2	1.5
Total Contact Hours	36			
Pre-requisites	None/IfAny			

Learning Objective:

The learning objectives of engineering graphics typically include developing skills and knowledge related to the visualization, interpretation, and communication of engineering designs.

Course Outcomes (COs):

After attending the course, students would:

CO1: Get introduced to Engineering Graphics and visual aspects of design.
CO2: Know and use common drafting tools with the knowledge of drafting standards.
CO3: Able to apply computer-aided drafting techniques to represent line, surface, or solid models in different engineering viewpoints.
CO4: Able to produce part models; carry out assembly operations and show the working procedure of a designed project work using animation.
CO5: Demonstrate proficiency in using computer-aided design (CAD) software to create and modify engineering drawings, including 2D and 3D models, with an understanding of industry standards and practices.

Course Content:

List of Drawings:

- **Traditional Engineering Graphics:** Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Modules:

Module 1: Introduction to Engineering Drawing

- Principles of Engineering Graphics and their significance.
- Usage of Drawing instruments.
- Lines, lettering, Dimensioning.
- Scales – Plain, Diagonal, and Vernier Scales.

Module 2: Geometrical Construction and Curves

- Construction of polygons, Parabola, Hyperbola, Ellipse, Cycloid, Archimedean Spiral, and Involute (square & circle).

Module 3: Projection of Points, Lines, Surfaces

- Orthographic projection - 1st and 3rd angle projection.
- Projection of lines and surfaces – Hexagon.

Module 4: Projection of Solids

- Cube, Pyramid, Prism, Cylinder, Cone.

Module 5: Drawing Isometric view from Orthogonal / Sectional views of Simple Solid Objects

- Principles of Orthographic Projections.
- Conventions.
- Projections of Points and lines inclined to both planes.
- Auxiliary Views.
- Isometric Views of lines, Planes, Simple, and compound Solids.
- Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 6: Sections and Sectional Views of Right Angular Solids

- Full and half-sectional views of solids.

Module 7: Development Of Surfaces

- Prism, Cylinder, Cone.

Module 8: Computer-Aided Drafting (Using AutoCAD and/or similar softwares)

- Introduction: Cartesian and Polar coordinate system, Absolute and Relative coordinates.
- Basic editing commands: Line, Point, Trace, Rectangle, Polygon, Circle, Arc, Ellipse, Polyline.
- Editing methods.
- Basic object selection methods, Window and crossing window, Erase, Move, Copy, Offset, Fillet, Chamfer, Trim, Extend, Mirror.
- Display commands: Zoom, Pan, Redraw, Regenerate.
- Simple dimensioning and text.

- Simple exercises.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House.
2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers.

Reference Books:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House.
2. Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
4. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publishers.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS2503			
Course Title	LIFE SKILLS			
Category				
LTP & Credits	L	T	P	Credits
	0	0	1	1
Total Contact Hours	30			
Pre-requisites	None			

Learning Objective:

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is

designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

Course Outcomes:

After the completion of the course, the student will be able to:

- **CO1:** Define and identify different life skills required in personal and professional life.
- **CO2:** Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.
- **CO3:** Explain the basic mechanics of effective communication and demonstrate these through presentations.
- **CO4:** Take part in group discussions for goal-setting, decision-making, and problem-solving, and work effectively in teams to achieve common goals.
- **CO5:** Use appropriate thinking and problem-solving techniques to solve new problems.

Course Content:

Module 1:[6L]

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, Problem solving, Effective communication, Interpersonal relationships, Coping with stress, Coping with emotion.
Life Skills for Professionals: Positive thinking, Right attitude, Attention to detail, Having the big picture, Learning skills, Research skills, Perseverance, Setting goals and achieving them, Helping others, Leadership, Motivation, Self-motivation, and motivating others, Personality development, IQ, EQ, and SQ.

Module 2:[7L]

Self-awareness: Definition, need for self-awareness; Coping with stress and emotions, Human values, tools and techniques of SA: Questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback.

Stress Management: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion-oriented, acceptance-oriented, resilience, Gratitude Training.

Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques.

Morals, Values, and Ethics: Integrity, Civic Virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Time management, Co-operation,

Commitment, Empathy, Self-confidence, Character, Spirituality, Avoiding procrastination, Sense of engineering ethics.

Module 3:[5L]

21st Century Skills: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right Brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Steps in Problem Solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections, Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.

Module 4:[6L]

Group and Team Dynamics: Introduction to Groups: Composition, formation, cycle, thinking, clarifying expectations, problem solving, consensus, dynamics techniques, Group vs Team, Team dynamics, Virtual teams. Managing team performance and managing conflicts, Entrepreneurship

Case Studies: Students analyze real-world case studies to apply life skills concepts to practical problems.

Module 5:[6L]

Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of leadership, traits, styles, VUCA leadership, levels of leadership, transactional vs. transformational leaders, leadership grid, effective leaders.

Self-Assessment Quizzes: Students complete self-assessment quizzes to reflect on their strengths, weaknesses, values, and goals.

. **Text Books**

1. BarunK.Mitra,“Personality Development & Soft Skills”, Oxford Publishers, Third impression,2017.

Reference Books:

1. ShivKhera,“You Can Win”, MacmillanBooks,NewYork,2003.
2. ICT Academy of Kerala,"Life Skills for Engineers ", McGraw-Hill Education (India) Private Ltd.,2016.
3. Caruso, D. R. and Salovey P, “The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership”,JohnWiley & Sons, 2004.
4. Kalyana, “Soft Skill for Managers”; First Edition;Wiley Publishing Ltd,2015.
5. Larry James,“The First Book of Life Skills”; FirstEdition,EmbassyBooks,2016.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	-	-	-	-	-	2	-	1	2	2	1	3	-	-	-
CO2	-	-	-	-		1	-	-	3	-	-	2	-	-	-
CO3	-	-	-	-	-	1	-	-	1	3	-		-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	1	-	-	-
CO5	-	3	2	1	-	-	-	-	-	-	-	-	-	-	-

Semester 3 Curriculum and Syllabus

Course Code	YMT3001			
Course Title	Discrete Mathematics			
Category	SCI, Minor			
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 a 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, Conjunc- tion, Disjunction, Negation.
- Conditional Connectives, Implication, Converse, Contra- positive, Inverse, Bi-conditional statements, Logical Equivalence, Tautology.
- Conjunctive and disjunctive normal forms.
- Universal and existential quantifiers and their negations.

Module 2: Proof Techniques [6L]

- Forward proof, proof by contradiction, contrapositive proofs, proof by mathematical induction, proof of necessity and sufficiency.
- Weak Induction and Strong Induction.

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

- Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations.
- Finite and infinite set, countable and uncountable sets.
- Algebraic structures with one binary operation: semigroups, monoids, and groups.
- Algebraic structures with two binary operations: rings and fields.
- Power Sets, Cardinality of Finite and Infinite Sets.

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.
- Pigeonhole principle.

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, cutset, cutvertices, adjacency and incidence matrices of a graph, isomorphism.
- Graph coloring problem, planar graphs, trees.
- Hamiltonian Graphs, Dijkstra's Algorithm.

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-POMapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS3001			
Course Title	Digital Logic and Electronics			
Category	ENGG, Minor			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, students will learn about the representation of numbers in a computer system and how digital circuits can be designed using logic gates and flip-flops. They will also learn about the process of digital-to-analog and analog-to-digital conversions. After completing this course, students will be in a better position to understand the basic operation of a computer system and how various

functional blocks can be implemented.

Course Outcome:

CO1: Explain the binary number system and its importance in digital circuit design.
CO2: Classify and analyze various ways of minimizing switching functions.
CO3: Understand the process of designing combinational logic circuits.
CO4: Understand the process of designing sequential logic circuit modules.
CO5: Understand and remember the process of analog-to-digital and digital-to-analog conversion.

Course Content:

Module 1: Number Systems and Binary Codes [5L]

- 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.
- Introduction to floating-point representation and its importance in representing real numbers in digital systems.

Module 2: Logic Families and Minimization of Switching Functions [6L]

- 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.
- Explanation of buffer and tri-state buffer operations and their applications in digital circuits.
- Introduction to HDL and its importance in describing digital circuits for synthesis and simulation.

Module 3: Combinational Logic Circuits [7L]

- 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.
- Adder-Subtractor Circuits: Detailed explanation of adder-subtractor circuits and their applications in arithmetic operations.
- Comparator Circuits: Introduction to comparator circuits and their use in comparing binary numbers.

Module 4: Sequential Logic Circuits [7L]

- 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 datapaths.

Module 6: D/A and A/D Conversion Techniques [5L]

- 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.

- Sigma-Delta ADCs: Introduction to sigma-delta analog-to-digital converters and their advantages in achieving high resolution.
- Successive Approximation Register (SAR) ADCs: Detailed explanation of successive approximation register ADCs and their operation principles.
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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-POMapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS3002			
Course Title	Computer Organization and Architecture			
Category	ENGG, Major			
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, students will learn about the evolution of computer systems and development in computer organization and architecture. Special emphasis will be placed on the various functional units of a computer system and how instructions are executed. By the end of the course, students will have a better understanding of how programs are executed in a computer system.

Course Outcomes:

CO1: Explain the process of instruction execution.

CO2: Analyze and design the control unit of a computer system.

CO3: Analyze and design adder, multiplier, and division units.

CO4: Analyze and design memory subsystems.

CO5: 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
- Pipelining: Basic concepts, pipeline hazards, techniques to overcome hazards (e.g., forwarding, stalling, branch prediction)
- Case study: Pipeline stages and operation in a modern processor (e.g., Intel or AMD processors)

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: Booth's algorithm, integer division, restoring and non-restoring division
- Floating-point representation: IEEE floating point format, floating-point arithmetic
- Superscalar and out-of-order execution: Concepts and advantages
- Speculative execution: Purpose and implementation in modern processors

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
- Virtual memory: Concepts, benefits, implementation (e.g., page tables, TLB)
- Memory management techniques: Fragmentation, compaction, techniques to reduce fragmentation (e.g., buddy system)

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-POMapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS3003			
Course Title	Design and Analysis of Algorithms			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			

Learning Objective: The course will cover topics such as algorithm complexity concepts and diverse algorithmic designs, including divide and conquer, dynamic programming, and greedy algorithms. It will also include important search and sorting algorithms, graphs, and basic approaches to optimization.

Course Outcome:

1. To understand the concepts of time and space complexity, worst case, average case, and best case complexities, and the big-O notation.
2. To apply design principles and concepts to algorithm design.
3. To understand and analyze the mathematical foundation in the analysis of algorithms.
4. To explain and classify different algorithmic design strategies.
5. To analyze the efficiency of algorithms using time and space complexity theory.

Course Content:

Module 1: Complexity Analysis [5L]

- Time and space complexity
- Different asymptotic notations and their mathematical significance
- Solving recurrences: substitution method, recurrence tree method, Master Theorem

Module 2: Divide and Conquer [7L]

- Basic concept
- Examples: binary search, merge sort, quick sort and their complexity (all three cases)
- Heap sort and its complexity
- Karatsuba algorithm
- Introduction to randomized algorithms and their application in divide and conquer
- Lower Bound Theory: Comparison trees, Oracle and adversary argument, State space method

Module 3: Dynamic Programming [8L]

- 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
- Traveling 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
- Advanced dynamic programming techniques (e.g., memoization, tabulation)
- 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
- Rabin-Karp algorithm for string matching with a rolling hash function
- Boyer-Moore algorithm for string searching with a heuristic to skip comparisons
- Amortized Analysis and Network Flow: Aggregate, Accounting, and Potential Method
- Ford Fulkerson algorithm
- Max-Flow Min-Cut

Module 5: Notion of NP-Completeness [6L]

- 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
- Additional small important topics in existing modules

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. Sahni, "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. D.E. Knuth, "The Art of Computer Programming (Vol.3)", Addison-Wesley.

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CO-POMapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS3101			
Course Title	Digital Logic and Electronics Laboratory			
Category	ENGG, Minor			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this laboratory course, students will conduct hands-on sessions for the design and implementation of combinational and sequential digital circuit modules, as well as 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.
CO5: To design a data path consisting of an ALU, registers, and multiplexers, and then design the control path to compute the Greatest Common Divisor (GCD) of two numbers.

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.
2. Given a Boolean function, minimize it and realize the function using NAND gates. Using a 555 timer, design a rectangular waveform generator of a given frequency.
3. Design a 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.
4. Verify the functionality of multiplexer and decoder chips. Implement a 4-variable Boolean function using an 8-to-1 multiplexer.
5. Implement RS and JK master-slave flip-flops using NAND gates and verify their functionalities. Verify the functionality of a J-K flip-flop chip.
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) a ring counter, (b) Johnson counter and verify the functionality.
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.
8. Design a 2-digit BCD counter and display the count value on 7-segment display units.
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.
10. Design a data path consisting of an ALU, registers, and multiplexers. Hence design the control path to compute the GCD of two numbers.

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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS3104			
Course Title	IT Workshop Lab(SciLab/MATLAB/C++)			
Category	ENGG, Skill Enhancement Course			
LTP & Credits	L	T	P	Credits
	0	0	3	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The purpose of this course is to learn and practice basic programming concepts, skills needed for basic problem solving, and applications—plots and built-in statistical and set operations, all using MATLAB as the vehicle. MATLAB is a powerful software package that has built-in functions to accomplish a diverse range of tasks, from mathematical operations to three-dimensional imaging. Additionally, MATLAB has a complete set of programming constructs that allow users to customize programs to their own specifications.

Course Outcome:

CO1: To impart knowledge to the students using MATLAB software that enhances programming knowledge in Research and Development.

CO2: To introduce the MATLAB technical computing environment for the analysis and visualization of data to understand and predict future scenarios.

CO3: To introduce students to the use of a high-level programming language, MATLAB, for solving scientific and engineering problems.

CO4: Reinforce a structured, top-down approach to formulate and solve problems.

CO5: Introduce common approaches, structures, and conventions for creating and evaluating computer programs, primarily in a procedural paradigm.

Course Content:

1. **Basic Commands:**
    - Clear Command: Removes all variables from the workspace.
    - Clc Command: Clears the command window and homes the cursor.
    - Help Command: Displays help about a topic if it exists.
    - Lookfor Command: Provides help by searching through all the first lines of MATLAB help topics and returning those that contain a keyword you specify.

- Edit Command: Enables you to edit (open) any M-file in the Editor Window. This command does not open built-in functions like sqrt. See also the type Command.
- More command: More on enables paging of the output in the MATLAB command window, and more off disables paging of the output in the MATLAB command window.

2. **Create/Initialize Matrix:**
    - Separate the elements of a row with blanks or commas, use semicolons to indicate the end of each row, and surround the entire list of elements with square brackets.
3. **Matrix Operations:**
    - Display the result of addition, subtraction, and multiplication operations on matrices.
4. **Colon Operator:**
    - Create and display vectors using the colon operator along with spacing, perform possible arithmetic operations, and validate the result.
5. **Zero and Unit Matrix:**
    - Create and display zero and unit matrices of the required size.
6. **Matrix Manipulations:**
    - Find and display the inverse and transpose of a given matrix, find the largest element in each vector of the matrix, and store it at n+1 positions of each row or vector. Also, find the maximum element of the matrix at n+1, m+1 positions, where n and m are the sizes of the given matrix.
7. **Display Results of Various Commands/Functions:**
    - Diag(), prod(), median(), sort(), det(), tril(), and triu().
8. **Built-in Functions:**
    - Write a program to display the result of various built-in functions like abs(), atan(), ceil(), log(), rem(), sqrt(), rand(), randn(), and mod().
9. **Plotting:**
    - Plot a graph of y versus x, where x values range from zero to 2*pi, and y values are the sine of x.
10. **Graph Labeling:**
    - Display the graph with proper labeling using xlabel, ylabel, and title commands.
11. **Plotting Sinc Function:**
    - Plot the Sinc function, where $\text{Sinc}(x) = \sin(x) / x$, and $-2\pi \leq x \leq 2\pi$.
12. **M-File Program:**
    - Write a program in an M-File to read a 3x3 Matrix, then display the diagonal of the matrix.
13. **String Manipulation:**
    - Write a program to read a string, then replace each character in the string with its following character in ASCII code.
14. **Control Structures:**

- Programs using control structure statements. For example, display all prime numbers between two given input values.

15. **Image Processing:**
    - Write a program to read an image and display the resulting image of the following commands: imresize() and imhist().

Text/Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing MATLAB, Pearson Education Inc., 2004.
2. Stormy Attaway, MATLAB: A Practical Introduction to Programming and Problem Solving, Butterworth-Heinemann Publisher, 2013.
3. MathWorks Book by Cleve Moler
4. MATLAB Getting Started Guide

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS3102			
Course Title	Computer Organization and Architecture Laboratory			
Category	ENGG, Major			
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, students will conduct 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 Verilog.

Course Outcome:

1. CO1: To understand how to write assembly language programs in MIPS.
2. CO2: To design various combinational and sequential circuits using Verilog.
3. CO3: To design and analyze various CPU functional units using Verilog.
4. CO4: To apply a pipelined processor using Verilog.
5. CO5: To implement and simulate the MIPS 5-stage pipeline in Verilog, utilizing a subset of 16 instructions, and validate the design by composing a comprehensive test bench with sample machine language programs stored in a memory module.

Course Content:

1. Familiarization with MIPS assembly language programming using an instruction set simulator like QtSPIM.
    - Reading and displaying an arbitrary string and an integer.
    - Storing numbers sequentially in memory and finding the minimum, maximum, and sum.
    - Sorting a set of numbers stored in memory. [2 days]
2. Familiarization of function calls with MIPS assembly language programming.
    - Writing a function to compute the factorial of a given number.
    - Writing a function to compute the GCD of two numbers.
    - Writing a function to compute the N-th Fibonacci number. [2 days]
3. Familiarization with a Verilog simulator like iVerilog and writing simple combinational and sequential modules using behavioral and structural modeling with Verilog.
    - Writing a module to implement an arbitrary Boolean function (e.g., F=A'BC+C'D).
    - Writing a module to implement a full adder and hence a 4-bit ripple carry adder.
    - Writing a module to implement a D flip-flop and hence a 4-bit shift register.
    - Writing a module to implement an 8-bit up-down counter with asynchronous clear. [2 days]
4. Writing Verilog modules to implement functional blocks used in computer organization.
    - Writing a module to implement a 16-bit arithmetic and logic unit with 8 functions.
    - Writing a module to implement read/write operations in a 1024x16 memory system. [2 days]
5. Implementing 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:

Course Outcome (CO)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO -1	PSO -2	PSO -3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS3103			
Course Title	Design and Analysis of Algorithms Laboratory			
Category	ENGG, Major			
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 programming, greedy method) to solve problems in computer science effectively. Using these paradigms, the course will demonstrate innovative and effective approaches to solving specific problems. Rigorous proof of algorithm validity will be emphasized.

Course Outcome:

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

CO2: To design algorithms using dynamic programming, greedy method, backtracking, branch and bound strategy, and to describe algorithms that employ these strategies.

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.

CO5:To apply algorithmic design techniques to solve real-world scheduling and routing problems, demonstrating proficiency in graph coloring, backtracking, and optimization approaches.

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 Duration: 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 Duration: 2 days
3. Experiments on Backtracking:
    - The n-Queens problem
    - Graph Coloring problem Duration: 2 days
4. Experiments on Greedy Methods:
    - Knapsack problem
    - Job sequencing with deadlines
    - Minimum cost spanning tree by Prim's and Kruskal's algorithm Duration: 2 days
5. Innovative Experiments:
    - Take the university timetable for all departments. Write a computer program to find all conflicts within the timetable using graph coloring 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. Duration: 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.

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CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Semester 4 Curriculum and Syllabus

Course Code	YMT4001			
Course Title	Probability and Statistics			
Category	SCI, Minor			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

In this course, 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.
CO5: Apply probability and statistical concepts to solve problems in artificial intelligence, data science, and other relevant fields.

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-McGrawHill.
4. R.GargandC.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.FreundandR.E.Walpole, “Mathematical Statistics”, Prentice Hall.

CO-POMapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3

Course Code	YCS4101			
Course Title	Operating Systems			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	Data Structures and Algorithms Computer Organization and Architecture			

Learning Objective:

In this course, students will learn about the role of an operating system as the interface between application programs and computer hardware. They will understand how the operating system manages various computer resources, which is essential for handling large software projects effectively.

Course Outcomes:

CO1: To explain the role of an operating system and how it acts as an 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 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 an 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 cooperating 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.
- Page table structure and its optimization techniques. Segmentation with paging (combined scheme). Memory protection and access control mechanisms. Shared memory and memory-mapped files.
- Case studies on memory management in modern operating systems (e.g., Windows, macOS, Linux).

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.
- Disk management optimizations (e.g., track skewing, clustering, buffering), RAID levels and their implications for performance and fault tolerance.
- File system reliability and recovery mechanisms (e.g., journaling, shadowing), Network file systems and distributed file systems (e.g., NFS, AFS, CIFS).

- Case studies on file systems used in cloud computing and distributed systems.

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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS4002			
Course Title	Formal Language and Automata Theory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	Discrete Mathematics Programming and Data Structures			

Learning Objective:

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

Course Outcome:

CO1: Explain the basic properties of formal languages and grammars.

CO2: Understand the tools for recognizing different formal languages.

CO3: Differentiate between regular, context-free, and recursively enumerable languages.

CO4: Apply the theory of computation and computational models, including decidability and intractability.

CO5: Analyze complex problems and automata to find solutions using 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)
- Nondeterministic Finite Automata (NFA)
- Equivalence of NFA and DFA
- Minimization of Finite Automata
- Myhill-Nerode Theorem
- FA with output: Moore and Mealy machine

Module 2: Properties of Regular Expression [7L]

- Operators of regular expression and their precedence
- Algebraic laws for Regular expressions
- Kleen's Theorem
- Regular expression to FA
- Non-Regular Languages
- Pumping Lemma for regular Languages

Module 3: Language & Grammar Formalism [9L]

- Grammars, Regular grammars
- Context-Free Grammar
- Derivation, Derivation trees
- Ambiguity in Grammar

- Simplification of CFGs
- Normal forms for CFGs - CNF and GNF

Module 4: PushDown Automata [4L]

- PDA Description and definition
- Acceptance by Final state, Acceptance by empty stack
- Deterministic PDA
- Equivalence of PDA and CFG

Module 5: Turing Machines and Decidability [6L]

- Basic model, Definition and representation
- Language acceptance by TM
- Church's Thesis
- Recursive and recursively enumerable languages
- Halting problem
- Introduction to Undecidability

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", Springer, 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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS4003			
Course Title	Object Oriented Programming using Java			
Category	ENGG, Minor			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	Fundamentals of Programming Object Oriented Programming			

Learning Objective:

The course aims to provide a comprehensive understanding of Java programming with a focus on object-oriented concepts. Students will learn the fundamentals of Java, including data types, variables, control statements, and arrays. They will also gain knowledge of OOP principles such as encapsulation, inheritance, polymorphism, and abstraction. Additionally, the course covers advanced topics like exception handling, multithreading, and GUI programming in Java.

Course Outcome:

CO1: Explain the process of interaction between objects, classes, and methods.

CO2: Acquire a basic knowledge of Object Orientation with different properties.

CO3: Analyze various string handling functions with various I/O operations.

CO4: Discuss basic code reusability features with respect to Inheritance, package, and Interface.

CO5: Implement Exception handling, Multithreading, and Applet (Web program in Java) programming concepts in Java.

Course Content:

Module 1: Java Basics **[8L]**

- JVM architecture
- Data types, variables, and operators
- Control statements
- Arrays
- Exception handling
- Java Collections Framework (List, Set, Map, ArrayList, LinkedList, HashSet, HashMap)

Module 2: Object-Oriented Programming **[7L]**

- Encapsulation
- Class fundamentals
- Object & Object reference
- Constructors
- Access control
- Nested methods
- Abstract Class & Interfaces
- Enumerations
- Packages
- Reflection

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

- Types of inheritance
- Member access rules
- Usage of this and Super keyword
- Method Overloading and Overriding
- Abstract classes
- Dynamic method dispatch
- Packages and Interfaces
- I/O Streams

Module 4: Exception Handling and Multithreading **[6L]**

- Exception types
- Try, Catch, Throw, Throws, Finally
- Thread basics
- Thread Life-Cycle
- Synchronizing Threads
- Inter Communication of Threads
- Critical Factor in Thread
- Deadlock

Module 5: GUI Programming and Applet **[6L]**

- Applet vs. Application
- Applet Lifecycle
- GUI Programming basics
- AWT Components
- Swing Components
- Java Utilities (java.util Package)

Text/Reference Books:

1. "Java: The Complete Reference" by H. Schildt and C. Dann
2. "Programming With Java: A Primer" by E. Balagurusamy
3. "Thinking in JAVA" by B. Eckel
4. "Database Programming with JDBC and JAVA" by G. Reese

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YBB4001			
Course Title	Principles of Management			
Category	HUM, Ability Enhancement Course			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this course, students will learn about the fundamental principles of management used in the industry and different organizations. They will study various fields of management and related theories, applying them practically to enhance their management skills. By the end of the course, students will understand and interpret the knowledge and skills necessary to work as effective managers.

Course Outcomes:

CO1: To familiarize students with the origins of management principles and compare them with modern trends in management theories.

CO2: To understand the essential functions of management along with theories framed by management experts in the business field.

CO3: To explain the managerial process and related functions that facilitate change.

CO4: To understand the relationship between various levels of management in a business organization and the process of achieving objectives.

CO5: To explain the importance of feedback control in the management process, along with relevant theories, and to apply proper management principles in modern business practices to solve problems.

Course Content:

Module 1: Management **[4L]**

- Definition, Nature, Importance, and Evolution of Management
- Contributions of Fayol, Taylor, Hawthorne, Maslow
- Management as an Art or Science?
- Functions of a Manager (Duties and Responsibilities)
- Ethics in Management

Module 2: Planning and Control **[4L]**

- Planning (Steps, Types, and Barriers)
- McKinsey Approach, SWOT Analysis
- Operational and Strategic Planning
- Controlling (Concept, Relationship with Planning, Process, Dimensions)
- Management by Objectives (MBO)

Module 3: Decision Making and Organizing **[4L]**

- Decision Making Process
- Certainty and Uncertainty in 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
- Total Quality 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-POMapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS4101			
Course Title	Operating Systems Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	Data Structures and Algorithms Computer Organization and Architecture			

Learning Objective:

In this laboratory course, students will carry out various software assignments on Unix/Linux shell programming and system calls. Additionally, 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.

Course Content:

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. Write programs in C for familiarization with the Unix/Linux system calls fork, exec, wait, exit, dup, pipe, shared memory, etc.
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.
4. Implementation of various CPU scheduling algorithms in C and compare their performances.
5. Write programs using the "pthread" library with multiple threads and use semaphores for mutual exclusion.
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.

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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS4102			
Course Title	Numerical Methods Laboratory			
Category	ENGG,Minor			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	C programming			

Learning Objective:

- To provide an overview of numerical techniques applicable to engineering problems.
- To offer insight into the implementation of these techniques.
- To build confidence in tackling numerical solutions.
- To understand the underlying physics behind numerical methods.
- To aid in method selection by understanding how methods work and their limitations.

Course Outcomes:

CO1: Demonstrate proficiency in using computer programming tools for engineering calculations.
CO2: Construct simple computer algorithms using a programming tool.
CO3: Apply simple numerical methods to solve engineering-related mathematical problems.
CO4: Appreciate the limitations and applicability of numerical methods.
CO5: Utilize computer-based numerical methods for solving engineering problems.

Course Content:

Module 1: Solution for Systems of Non-linear Equations
- Roots of non-linear equations using Bisection Method.
- Roots of non-linear equations using Regula Falsi or False Position Method.
- Roots of non-linear equations using Newton-Raphson Method.

Module 2: Solution for Systems of Linear Algebraic Equations
- System of linear equations using Gauss-Elimination Method.
- System of linear equations using Gauss-Seidal Iteration Method.
- System of linear equations using Gauss-Jordan Method.

Module 3: Numerical Integration
- Numerical integration using Trapezoidal Rule.
- Numerical integration using Simpson's Rules.

Module 4: Solution of Interpolation Polynomial
- Solution using Newton Forward Difference Interpolation Polynomial Function.
- Solution using Newton Backward Difference Interpolation Polynomial Function.
- Solution using Lagrange's Interpolation Polynomial Function.

Module 5: Numerical Solution of Ordinary Differential Equations
- Numerical solution of ordinary differential equations by Euler's Method.
- Numerical solution of ordinary differential equations by Runge-Kutta Method of 4th Order.
- Numerical solution of ordinary differential equations by Taylor Series Method.

Text/Reference Books:

1. "Introductory Methods of Numerical Analysis" by S.S. Sastry.
2. "Numerical Methods for Scientific and Engineering Computation" by Mahinder Kumar Jain.
3. "Numerical Methods for Engineers" by Steven C. Chapra and Raymond P. Canale.
4. "Numerical Recipes: Art of Scientific Computing" by W.H. Press, B.P. Flannery, et al.
5. "Numerical Methods" by E. Balagurusamy.
6. "Numerical Methods using MATLAB" by J. M. Mathews and K. Fink.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS4103			
Course Title	Object Oriented Programming using Java Laboratory			
Category	ENGG, Minor			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a)Programming Practices I			

Learning Objective:

The learning objective of this course is to provide students with practical experience in implementing object-oriented programming concepts using Java. Through hands-on exercises and projects, students will learn to design and develop Java applications using classes, inheritance, interfaces, packages, exception handling, file handling, multithreading, and event-driven programming. The course aims to enhance students' understanding and proficiency in Java programming, enabling them to solve real-world problems using object-oriented principles.

Course Outcome:

CO1: Implement and demonstrate an understanding of basic object-oriented programming principles such as classes, objects, inheritance, and polymorphism in Java.
CO2: Design and develop Java applications using interfaces, packages, exception handling, and file handling to solve programming problems.
CO3: Develop multithreaded Java applications to achieve concurrent execution of tasks and improve program efficiency.
CO4: Apply event-driven programming concepts in Java to create interactive graphical user interfaces (GUIs) for applications.
CO5: Work on a mini project that integrates various Java programming concepts learned throughout the course to solve a real-world problem.

Course Content:

1. Electricity Bill Generation using Classes [1 day]
2. Currency Converter, Distance Converter, and Time Converter Implementation using Packages [1 day]
3. Pay Slip Generation using Inheritance [1 day]
4. Stack ADT Implementation using Multiple Inheritance (Interface) [1 day]
5. String Operations using ArrayList [1 day]
6. Abstract Class Implementation [1 day]
7. User-Defined Exception Handling Implementation [1 day]
8. File Handling [1 day]
9. Multithreading Implementation [1 day]
10. Generic Function Implementation [1 day]
11. Calculator Design Using Event-Driven Programming [1 day]
12. Mini Project [1 day]

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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS4104			
Course Title	Programming Using Python Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	Fundamentals of Programming Basic Problem Solving			

Learning Objective:
In this practical course, students will learn Python programming basics and paradigms, including looping, control statements, and string manipulations. They will become familiar with various modules, packages, and Python libraries used for various applications, such as machine learning and deep learning.

Course Outcome:

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

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.

CO5: Apply Python programming concepts to develop a computer game for teaching data

structures like stacks and queues, enhancing visualization and understanding of abstract concepts through game-based learning.

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 the 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. 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 learned 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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Semester 5 Curriculum and Syllabus

Course Code	YCS 5001			
Course Title	Artificial Intelligence			
Category	ENGG, Major			
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, students will learn the basic concepts, theories, and techniques of artificial intelligence, enabling them to understand and apply AI algorithms in various fields of Computer Engineering.

Course Outcome:

CO1: Explain the basic concept of Artificial Intelligence and its applications.
CO2: Classify and analyze various AI tools and techniques.
CO3: Learn and evaluate various AI algorithms.
CO4: Apply the basic understanding of artificial intelligence in real-world applications.
CO5: Evaluate and assess the performance, effectiveness, and ethical implications of artificial intelligence systems in various 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*, AO*, min-max, 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, "The Handbook of Satisfiability," IOS Press.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS5002			
Course Title	Database Management System			
Category	ENGG, Major			
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, students will learn about data models, conceptualize and depict a database system, design systems using E-R diagrams, learn SQL and relational database design, understand internal storage structures using different file and indexing techniques, and grasp the concepts of transaction processing, concurrency control techniques, and recovery procedures.

Course Outcome:

CO1: Apply E-R diagrams for an application.
CO2: Explain the creation of the normalized relational database model.
CO3: Analyze real-world queries to generate reports.
CO4: Determine whether a transaction satisfies the ACID properties.
CO5: Create and maintain an organization's database.

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]

- Functional 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-based 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.
- Types 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, AddisonWesley.
3. J. D. Ullman, "Principles of Database Systems", Galgottia Publication.

4. G. Jim and R. Address, "Transaction Processing: Concepts and Techniques", Morgan Kaufmann.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 5003				
Course Title	Computer Networks				
Category	ENGG,Major				
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, students will learn about the fundamental concepts of computer networking, with a detailed understanding of the TCP/IP protocol suite that drives the Internet. Various important network applications shall be discussed, providing students with a comprehensive understanding of how data flows through a real network and the various issues involved.

Course Outcome:

CO1: Explain the fundamental concepts of data communication.

CO2: Illustrate how the various protocols at the data link layer level work.

CO3: Explain the functionalities of the various protocols at the network and transport layer level.

CO4: Demonstrate how various internetworking devices can be used to connect different networks together.

CO5: Learn about various network applications with a 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 standard, 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 crypto systems, Cryptographic hash functions.
- Digital signature, PGP, HTTPS.

Text/Reference Books:

1. W. Stallings, “Data and Computer Communication (5thEd.)”, PHI/Pearson Education.
2. B. A. Forouzan, “Data Communication and Networking (3rdEd.)”, Tata-McGraw-Hill.
3. W. R. Stevens, “UNIX Network Programming (3rdEd.), Prentice-Hall, Addision-Wesley.

4. A. Tanenbaum, “Computer Networks (4thEd.), PHI/ Pearson Education.
5. W. Stallings, “Cryptography and Network Security: Principles and Practice(4thEd.)”, PHI/Pearson Education.

CO-PO Mapping:

Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS5004A				
Course Title	Compiler Design				
Category	ENGG, Major				
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, students will learn about the fundamental principles in compiler design, the algorithms and data structures involved in the construction of a compiler, and automation tools like lex and yacc for translating high-level languages. At the end of the course, students 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 the grammar of a given language.

CO3: Understand intermediate representations including symbol table, parse/syntax tree, and data structures required for such representations.

CO4: Understand different techniques for intermediate code and machine code optimization.

CO5: Implement various optimization techniques in the compiler design process.

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 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, procedure call, declarations, and case statements

Module 4: Code Generation **[6L]**

- Data structure for symbol 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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS5004B			
Course Title	Cryptography and Network Security			
Category	ENGG, Major			
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, students will learn about various cryptographic techniques essential for understanding how secure information systems can be built. The course will discuss various security applications as case studies, helping students strengthen their basic knowledge in cybersecurity.

Course Outcome:

CO1: Explain the basic concept of cryptography and its applications in network security.

CO2: Learn and analyze various private-key cryptography algorithms.

CO3: Learn and analyze various public-key cryptography algorithms.

CO4: Explain various cryptographic hash functions and their applications in network security.

CO5: 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 [7L]

- 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 [7L]

- 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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS5004C			
Course Title	Computer Graphics			
Category	ENGG, Major			
LTP& Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a. Mathematical Foundation b. Programming Languages			

Learning Objectives:

This course provides an introduction to the principles of computer graphics. In particular, the course will consider methods for modeling 2-D objects and generating photorealistic renderings on color raster graphics devices. The emphasis will be on understanding how various elements like algebra, geometry, algorithms, and data structures interact in the design of graphics. Additionally, this course provides an idea of hardware system architecture for computer graphics, including graphics pipeline, frame buffers, and graphic coprocessors.

Course Outcome:

CO1: Students will describe fundamental algorithms used in computer graphics and compare and evaluate them to some extent.

CO2: Students will work and interact, through hands-on experiences, to design, develop, and modify electronically generated imagery using a wide range of sophisticated graphical tools and techniques.

CO3: Students will summarize different hidden surface elimination algorithms and shading techniques used in computer graphics and digital media production.

CO4: Students will explain the technology necessary for creating multimedia content for the web, video, DVD, 2D and 3D graphics, sound, and programming.

CO5: Students can apply knowledge, techniques, skills, and modern tools to become successful professionals in communication and media industries.

Course Content:

Module 1: Introduction [8L]

- Application areas of Computer Graphics
- Overview of graphics systems

- Video display devices
- Raster-scan systems
- Random scan systems
- Graphics monitors and workstations
- Input devices
- Output primitives: Points and lines
- Line drawing algorithms
- Mid-point circle and ellipse algorithms
- Filled area primitives: Scan line polygon fill algorithm, boundary-fill, and flood-fill algorithms.

Module 2: 2-D Geometrical Transforms [8L]

- Translation, scaling, rotation, reflection, and shear transformations
- Matrix representations and homogeneous coordinates
- Composite transforms
- Transformations between coordinate systems
- 2-D Viewing: The viewing pipeline
- Viewing coordinate reference frame
- Window to view-port coordinate transformation
- Viewing functions
- Cohen-Sutherland clipping algorithms
- Sutherland-Hodgeman polygon clipping algorithm.

Module 3: 3-D Object Representation [6L]

- Polygon surfaces
- Quadric surfaces
- Spline representation
- Hermite curve, Bezier curve, and B-spline curves
- Bezier and B-spline surfaces
- Basic illumination models
- Polygon rendering methods.

Module 4: Geometric Transformations [6L]

- 3-D Geometric transformations: Translation, rotation, scaling, reflection, and shear transformations
- Composite transformations
- 3-D viewing: Viewing pipeline
- Viewing coordinates
- View volume and general projection transforms and clipping.

Module 5: Computer Animation **[8L]**

- Design of animation sequence
- General computer animation functions
- Raster animation
- Computer animation languages
- Keyframe systems
- Motion specifications
- Visible-Surface Determination Techniques for efficient Visible-Surface Algorithms
- Categories of algorithms
- Back-face removal
- The z-Buffer Algorithm
- Scan-line method
- Painter's algorithms.

Text/Reference Books:

1. "Computer Graphics C version" by Donald Hearn and M. Pauline Baker, Pearson Education.
2. "Computer Graphics Second edition" by Zhigand Xiang, Roy Plastock, Schaum's Outlines, Tata McGraw Hill edition.
3. "Computer Graphics Principles & Practice" (Second edition in C) by Foley, Van Dam, Feiner, and Hughes, Pearson Education.
4. "Procedural Elements for Computer Graphics" (Second edition) by David F. Rogers, Tata McGraw Hill.

CO-PO Mapping:

Course Outcome (CO)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO-1**	**PSO-2**	**PSO-3**
CO1	-	-	2	-	-	-	0	0	3	0	0	0	1	0	0
CO2	2	2	-	-	-	-	0	0	0	0	0	0	1	2	0
CO3	2	-	1	-	3	-	0	0	1	0	0	0	2	0	0
CO4	2	2	-	2	-	1	0	0	1	0	0	0	0	0	0
CO5	1	2	-	-	-	-	0	0	2	0	0	0	1	0	0

Course Code	YED5001			
Course Title	Economics for Engineers			
Category	HUM, Minor			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	24			
Pre-requisites	None			

Learning Objective:

In this course, students will learn about managerial economics, basics of accounting, and financial management. By the end of the course, students will be able to make different managerial decisions in terms of economics, solve financial statements, and make different financing decisions for businesses and at a personal level.

Course Outcome:

CO1: Apply appropriate engineering economics analysis methods for problem-solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.

CO2: Evaluate the cost-effectiveness of individual engineering projects using the learned methods and draw inferences for investment decisions.

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

CO4: Evaluate the profit of a firm, carry out break-even analysis, and employ this tool to make production decisions.

CO5: 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, determinants, function, elasticity, forecasting
- Supply: Determinants, function, elasticity

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

- Elements of costs
- Marginal cost, Marginal Revenue
- Sunk cost, Opportunity cost

- Break-even analysis–PV ratio

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

- Inflation: Meaning, types, causes, measures to control
- National Income: Definition, Concepts, Method of measuring

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

- Concepts and Definition of Accounting
- Journal, Ledger, Trial Balance
- Trading A/C, Profit & Loss A /C, 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, Future worth, Annual worth, Internal rate of return, 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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS5101			
Course Title	Artificial Intelligence Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a) Data Structures and Algorithms b) Database Management System c) Programming Practices II			

Learning Objective:

In this course, students will learn the basic principles, techniques, and applications of Artificial Intelligence and Machine Learning for problem-solving, inference, perception, knowledge representation, and puzzles design.

Course Outcomes:

CO1: Explain the working principles of PROLOG/LISP and apply LIST structure of PROLOG.

CO2: Apply reasoning and inference principles to real-world problems and design programs to solve various puzzles.

CO3: Design simple algorithms for data classification in Python/R and test them with benchmark datasets.

CO4: Design simple algorithms for data clustering in Python/R and test them with benchmark datasets.

CO5: Analyze and evaluate algorithms for estimation/prediction using regression.

Course Content:

Suggestive List of Experiments:

In this laboratory, students will be familiarized with PROLOG/LISP language. The experiments are structured into four modules.

Module 1 (4 days):

- Introduction to PROLOG facts & rules using a simple family tree.
- Explanation of how goals are given in PROLOG and simple queries on the family tree.
- Formation of recursive definitions and how PROLOG executes goals.
- Implementation of Graph Search algorithms like DFS, BFS.
- Implementation of well-known puzzles like the 8-queens problem, Towers-of-Hanoi problem, etc.

Module 2 (4 days):

- Implementation of Classifiers: KNN, Naive Bayes Classifier, Decision Tree, SVM, Perceptron, Multi-Layer Perceptron, Random Forest, etc., on Python/R platform and test them on benchmark datasets.
- Familiarization with ML Tools: Excel, WEKA, R, Python for classification.

Module 3 (3 days):

- Implementation of data clustering algorithms: K-Means, DBSCAN, Hierarchical (AGNES/DIVISIVE), etc., on Python/R platform and test them on benchmark datasets.
- Familiarization with ML Tools: Excel, WEKA, R, Python for clustering.

Module 4 (1 day):

- Implementation of Regression (single and Multiple Variables) linear and non-linear, Logistic regression for prediction tasks.

Text/Reference Books:

1. I. Bratko, "Prolog programming for artificial intelligence", Pearson Education.
2. S. Kaushi, "Logic and Prolog Programming", New Age International Publishers.
3. B. Lantz, "Machine learning with R", PACKT Publishing.
4. C. M. Andreas and S. Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Media.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS5102			
Course Title	Database Management System Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	a)Digital Circuits Laboratory			

Learning Objective:

This course aims to enable students to learn about data models, conceptualize and depict a database system, understand the fundamental concepts of SQL queries, design a database with the necessary attributes, and learn the methodology of accessing, modifying, and updating data and information from relational databases. Additionally, students will learn database design, designing user interfaces, and how to connect with databases.

Course Outcome:

CO1: To understand the basic concepts regarding databases and 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 (Duration: 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 (Duration: 2 days)
3. Experiments on retrieving data from the 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 (Duration: 3 days)
4. Experiments on Miscellaneous Database Management:
    - Creating Views
    - Creating Column Aliases
    - Creating Database Users
    - Use of GRANT and REVOKE (Duration: 1 day)
5. Experiments on PL/SQL:
    - Use of decision-making statements
    - 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 (Duration: 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.) (Duration: 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 Kaufmann.
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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS5103			
Course Title	Computer Networks Laboratory			
Category	ENGG, Major			
LTP& Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	c. Operating Systems Laboratory d. Computer Organization and Architecture Laboratory			

Learning Objective:

In this laboratory course, students will learn network programming using the socket API system calls and analyze packets flowing over the network. Additionally, they will simulate several algorithms at the data link and network layers and analyze the results.

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 data link and network layers through simulation.

CO4: To understand and apply error detection and correction techniques in network communication.

CO5: To design and implement simple network protocols.

Course Content:

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 connectionless (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 the 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 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.)", Prentice-Hall, Addison-Wesley.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Semester 6 Curriculum and Syllabus

Course Code	YCS6013			
Course Title	Web and Internet Technology			
Category	ENGG, Major			
LTP & Credits	**L**	**T**	**P**	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites				

Learning Objective:

The primary professional objective of a web developer is to write code to make a website. They must employ various programming techniques and tools to deliver high-quality results. Web technology refers to the means by which computers communicate with each other using markup languages and multimedia packages. It gives us a way to interact with hosted information, like websites

Course Outcome:

CO1: Design and develop web applications.
CO2: Explain client and server-side scripting and their applicability.
CO3: Create scripts using JavaScript in a web page
CO4: Integrate JavaScript in a web page.
CO5: Design forms and check for data accuracy.

Course Content:

Module 1: **[7L]**

Web Basics and Overview: Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Toolbox. HTML Common tags: List, Tables, images, forms, frames, Cascading Style Sheets (CSS) & its Types. Introduction to Java Script, Declaring variables, functions, Event handlers (onclick, onsubmit, etc.,) and Form Validation.

Module 2: **[6L]**

Introduction to XML: Document type definition, XML Schemas, Presenting XML, Introduction to XHTML, Using XML Processors: DOM and SAX. PHP: Declaring Variables, Data types, Operators, Control structures, Functions.

Module 3: **[6L]**

Web Servers and Servlets: Introduction to Servlets, Lifecycle of a Servlet, JSDK, Deploying Servlet, The Servlet API, The javax. Servlet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servlet HTTP package, Handling Http Request & Responses, Cookies and Session Tracking..

Module 4: **[7L]**

Database Access: Database Programming using JDBC, JDBC drivers, Studying Javax.sql.* package, Connecting to database in PHP, Execute Simple Queries, Accessing a Database from a Servlet. Introduction to struts frameworks.

Module 4: **[10L]**

JSP Application Development: The Anatomy of a JSP Page, JSP Processing. JSP Application Design and JSP Environment, JSP Declarations, Directives, Expressions, Scripting Elements, implicit objects. Java Beans: Introduction to Beans, Deploying java Beans in a JSP page

Text/Reference Books:

1. Programming world wide web-Sebesta, Pearson Education,2007.
2. Internet and World Wide Web – How to program by Dietel and Nieto PHI/ Pearson EducationAsia.
3. Jakarta Struts Cookbook, Bill Siggelkow, S P D O' Reilly for chap8.
4. March's beginning JAVA JDK 5, Murach,SPD
5. An Introduction to WEB Design and Programming –Wang-Thomson
6. PHP: The Complete Reference Steven Holzner TataMcGraw-Hill.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS6014			
Course Title	Machine Learning			
Category	ENGG, Major			
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:

The course covers some of the important regression, classification, clustering, rule-based, and probabilistic models and algorithms. It includes themes like linear and logistic regression, regularization, decision trees, probabilistic models, SVMs, 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.
CO5: To design and implement machine learning models using popular machine learning libraries and frameworks such as scikit-learn, TensorFlow, or PyTorch.

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, regularized 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, naive 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, metalearning. What to measure, how to measure, how to interpret, interpretation of results over multiple datasets.

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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS6015			
Course Title	Software Engineering			
Category	Major ENGG			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites				

Learning Objective:

The students will be able to comprehend the various software process models. To understand the types of software requirements and SRS document. To know the different software design and architectural styles. To learn the software testing approaches and metrics used in software development. To know about quality control and risk management.

Course Outcome:

CO1: To compare and select a process model for a business system.
CO2: To identify and specify the requirements for the development of an application.
CO3: To develop and maintain efficient, reliable and cost effective software solutions.
CO4: To critically think and evaluate assumptions and arguments of the client.
CO5: To understand the importance of software maintenance and the techniques involved in maintaining software systems.

Course Content:

Module 1: **[9L]**

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths. A Generic view of process: Software engineering- A layered technology, a process framework, Process patterns, process assessment. Process models: The waterfall model, Incremental process models, Evolutionary process models, The Unified process, Agility and Agile Process model, Extreme Programming, Other process models of Agile Development and Tools

Module 2: **[8L]**

Software Requirements: Functional and non-functional requirements, User requirements, System

requirements, Interface specification, the software requirements document. Requirements Engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models: Context Models, Behavioral models, Data models, Object models, structured methods. UML Diagrams.

Module 3: **[7L]**

Design Engineering: Design process and Design quality, Design concepts, the design model. Creating an architectural design: Software architecture, Data design, Architectural styles and patterns, Architectural Design. Object-Oriented Design: Objects and object classes, An Object-Oriented design process, Design evolution. Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation

Module 4: **[6L]**

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging. Product metrics: Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance. Metrics for Process and Projects: Software Measurement, Metrics for software quality.

Module 5: **[6L]**

Risk management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan. Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software Quality Assurance, The Capability Maturity Model Integration (CMMI), Software reliability, The ISO 9000 quality standards.

Text/Reference Books:

1. Software Engineering A practitioner's Approach, Roger S Pressman, 6th edition. McGraw Hill International Edition.
2. Software Engineering, Ian Sommerville, 7th edition, Pearson education.
3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
4. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
5. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
6. Software Engineering1: Abstraction and modelling, Diner Bjorner, Springer International edition, 2006.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS6004A			
Course Title	Mobile computing			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	a) Computer Networks b) Operating Systems			

Learning Objective:

Mobile computing enables connecting portable devices to wireless networks to access data and use services while moving. Mobile communication involves the infrastructure that is used to wirelessly transmit and receive data between devices seamlessly and safely.

Course Outcome:

CO1: Understanding of Wireless Communication Fundamentals
CO2: Knowledge of Telecommunication Networks and Wireless LAN
CO3: Proficiency in Mobile Network and Transport Layer Protocols
CO4: Ability to Implement Mobile Application Layer Protocols
CO5: Understanding of Database Issues in Mobile Computing

Course Content:

Module 1: **[8L}**

Wireless Communication Fundamentals Cellular systems - Frequency Management and Channel Assignment - types of handoff and their characteristics, dropped call rates & their evaluation - MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

Module 2: **[8L]**

Telecommunication Networks & Wireless Lan Telecommunication systems – GSM – GPRS - Satellite Networks, Wireless LAN – IEEE 802.11 - Architecture – services – MAC – Physical layer – IEEE 802.11a-802.11b standards – HIPERLAN – BlueTooth.

Module 3: **[8L]**

Mobile Network Layer & Transport Layer Mobile IP – Dynamic Host Configuration Protocol - Routing – DSDV – DSR – Alternative Metrics. Traditional TCP, Mobile TCP.

Module 4: **[7L]**

Application Layer Wap Model - Mobile Location-based services - WAP Gateway – WAP protocols – WAP user agent profile- caching model-wireless bearers for WAP - WML – WML Scripts.

Module 5: **[5L]**

Database Issues Database Issues: Hoarding techniques, caching invalidation mechanisms, client-server

computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Text/Reference Books:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2003.
2. William Stallings, "Wireless Communications and Networks", Pearson Education, 2002.
3. Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", PHI/Pearson Education, 2003.
4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons, and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
5. Raj Kamal, "Mobile Computing", Oxford University Press, 2007.
6. Asoke K. Talukdar, "Mobile Computing", Tata McGraw-Hill Education, 2010.
7. Mohammad Ilyas, Imad Mahgoub, "Mobile Computing Handbook", AUERBACH, 2004.
8. Vilas S. Bagad, "Mobile Computing Introduction", Technical Publications, 2014.
9. DR SANJAY Sharma, "Mobile Computing", S.K. Kataria & Sons Publication, 2014.
10. Dr. Ashish N. Jani, Dr. N.N. Jani, Neeta Kanabar, "Mobile Computing-Technologies and Applications", 2010.
11. Pattnaik, Prasant Kumar, Mall, Rajib, "Fundamentals of Mobile Computing", Second Edition, PHI Learning Pvt. Ltd., 2015.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS6003				
Course Title	Natural Language Processing				
Category	ENGG, Major				
LTP & Credits	L	T	P	Credits	
	3	0	0	3	
Total Contact Hours	36				
Pre-requisites	a) Design and Analysis of Algorithms b) Compiler Design				

Learning Objective:

In this course, students will learn about various Natural Language Processing techniques essential for

understanding how to build Language Processing systems. Specifically, various security applications shall be discussed as case studies. The course will be very helpful for 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 environments.
CO5: To design and implement a natural language processing system for a specific application, demonstrating proficiency in using NLP techniques and tools.

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, multiword 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, and V. Chaitanya, "Natural Language Processing: a Paninian Perspective", Prentice-Hall of India.
4. T. Siddiqui and U. S. Tiwary, "Natural Language Processing and Information Retrieval", OUP.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS6004C			
Course Title	Cloud Computing			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	c) Computer Networks d) Operating Systems			

Learning Objective:

To provide students a sound foundation of 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 to explore 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 Services.

CO4: To explain the underlying concepts of cloud management and security and illustrate the use of Service-Oriented Architecture (SOA).

CO5: To analyze and compare different cloud computing providers and services, evaluating their performance, cost-effectiveness, and suitability for specific use cases.

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 to 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 platforms.
- 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 the 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:

ourse Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YLB6001				
Course Title	Cyber Law and Ethics				
Category	ENGG, Minor				
LTP & Credits	L	T	P	Credits	
	3	0	0	3	
Total Contact Hours	36				
Pre-requisites	None/if any				

Learning Objective:

Cyber law provides a framework for protecting individuals and organizations from cyber threats, ensuring the privacy and security of digital transactions, and establishing guidelines for ethical and legal conduct in cyberspace.

Course Outcome:

CO1: Understand the evolution of computer technology and the emergence of cyberspace, including the legal and technological significance of domain names and the Internet as a tool for global access.

CO2: Analyze the Information Technology Act, 2000, its amendments, limitations, and provisions related to digital signatures, cryptographic algorithms, electronic records, and certifying authorities.

CO3: Evaluate cyber laws and related legislation, including patent law, trademark law, copyright, and their implications for software, domain names, electronic databases, and civil and criminal procedures.

CO4: Examine electronic business and legal issues, including the evolution of e-commerce, paperless contracts, e-commerce models (B2B, B2C), e-security, taxation, electronic payments, supply chain, and emerging trends.

CO5: Discuss the importance of cyber ethics, the need for cyber regulations, and ethical issues in information society, artificial intelligence, and blockchain technologies.

Course Content:

Module 1: **[7L]**

Introduction to Cyber Law: Evolution of computer technology, emergence of cyberspace. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Webspace, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

Module 2: **[8L]**

Information Technology Act: Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private 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: **[9L]**

Cyber Law and Related Legislation: Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic DataBase and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).

Module 4: **[6L]**

Electronic Business and Legal Issues: Evolution and development in E-commerce, paper vs paperless contracts E-Commerce models-B2B, B2C, E-security. Business, taxation, electronic payments, supply chain, EDI, E-

markets, Emerging Trends.

Module 5: **[6L]**

Cyber Ethics: The Importance of Cyber Law, Significance of Cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Blockchain Ethics.

Text/Reference Books:

1. Cyber Laws: Intellectual property & E-Commerce, Security-Kumar K, Dominant Publisher
2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
3. Information Security policy & Implementation Issues, NIIT, PHI
4. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
5. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,
6. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS6113			
Course Title	Web and Internet Technology Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites				

Learning Objective:

This course is intended to teach the basics involved in publishing content on the World Wide Web. This includes the 'language of the Web'–HTML, the fundamentals of how the Internet and the Web function, a basic understanding of graphic production with a specific stress on creating graphics for the Web, and a general grounding introduction to more advanced topics such as programming and scripting. This will also expose students to the basic tools and applications used in Web publishing.

Course Outcome:

The students will be able to:

CO1: Analyze a web page and identify its elements and attributes.
CO2: Create web pages using XHTML and Cascading Style Sheets.
CO3: Build dynamic web pages using Java Script (Client side programming).
CO4: Create XML documents and Schemas.
CO5: Understand the basic concepts and principles of web security, including common vulnerabilities and best practices for securing web applications and data transmission.

Course Content:

List of Experiments:

1. HTML Table Creation:
    - Create an HTML table with the following details:
        - Book Name
        - Author
        - Operating Systems - Godbole
        - Data Communications and Networks - Godbole
        - Computer Networks - Rajkumar
        - OOPs - R.NageswaraRao
2. Form Creation with Input Attributes:
    - Create an HTML form with various attributes for input tags.
3. Multiple Stylesheets in a Single Page:
    - Create a web page that uses multiple types of stylesheets.
4. CGI Sample Program:
    - Write a CGI program to send output back to the user.
5. JavaScript Program with Variables:
    - Write a JavaScript program using variables.
6. JavaScript Program for Multiplication:
    - Write a JavaScript program to multiply two numbers and display the result in a separate text box.
7. JavaScript Program for Form Validation:
    - Write a JavaScript program for form validations.
8. AJAX Program for XML Http Request:
    - Write an AJAX program to check the presence of the XML Http Request object.
9. AJAX Program for Sales Report:
    - Write a program to create a sales report for books using AJAX.
10. XML Document Template for Student Results:
    - Create an XML document template to describe the results of students in an examination. Include the student's roll number, name, three subject names and marks, total marks, percentage, and results.
11. XSLT Code for Book Titles and Prices:
    - Write XSLT code to retrieve only the book titles and their prices.
12. Homepage Design:
    - Design basic elements of a homepage.

Text/Reference Books:

- Achyut Godbole, Atul Kahate, "Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing", Third Edition, McGraw-Hill Education.
- Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.
- Raj Kamal, “Internet and Web Technologies”, Tata McGraw-Hill.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS6114			
Course Title	Machine Learning Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None/if any			

Learning Objective:

The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python.

Course Outcomes:

After the completion of the course the student can able to:

CO1: Understand complexity of Machine Learning algorithms and their limitations;
CO2: Understand modern notions in data analysis-oriented computing;
CO3: Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
CO4: Be capable of performing experiments in Machine Learning using real-world data.
CO5: Gain hands-on experience in selecting, implementing, and tuning machine learning algorithms to solve real-world problems, developing a deeper understanding of the nuances involved in practical machine learning applications.

Course Contents:

List of Experiments

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is theprobability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)
2. Extract the data from database using python
3. Implement k-nearest neighbours classification using python
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k- means clustering with 3 means (i.e., 3 centroids)

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

Medium skiing design single twenties no->high Risk high golf trading married forties yes ->low Risk

low speed way transport married thirties yes->med Risk medium football banking single thirties yes ->low Risk high flying media married fifties yes ->high Risk

low football security single twenties no->med Risk medium golf media single thirties yes ->med Risk medium golf transport married forties yes ->low Risk high skiing banking single thirties yes ->high Risk low golf unemployed married forties yes->high Risk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset?

6. Implement linear regression using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS6115			
Course Title	Software Engineering Laboratory			
Category	ENGG Major			
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. It 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 a dept 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

CO5: To understand the importance of software maintenance and the techniques involved in maintaining software systems.

Suggestive List of Experiments:

1. Write down the problem statement for a suggested system of relevance. [1day]
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. [1day]
   To perform the user's view analysis for the suggested system: Use case diagram. [1day]
4. To draw the structural view diagram for the system: Class diagram, object diagram. [1day]
   To draw the behavioral view diagram: State-chart diagram, Activity diagram. [1day]
5. To perform the behavioral view diagram for the suggested system: Sequence diagram, Collaboration diagram, timing diagram, component diagram, State diagram. [1day]
   To perform the implementation view diagram: Component diagram for the system. [1day]
   To perform the environmental view diagram : Deployment diagram for the system. [1day]
6. To perform various testing using the testing tool unit testing, integration testing for a Sample code of the suggested system. [1day]
7. Perform Estimation of effort using FP Estimation for chosen system with other matrices. [1day]
8. To prepare time line chart/Gantt Chart/PERT Chart for selected software project. [1day]

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:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Semester 7 Curriculum and Syllabus

Course Code	YCS 7001			
Course Title	Neural Networks and Deep Learning			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Neural networks can help computers make intelligent decisions with limited human assistance. This is because they can learn and model the relationships between input and output data that are nonlinear and complex. Deep learning covers the theory and practice of a big family of very effective techniques today in the domain of machine learning. The objective of the course is to enable students to get familiarity with this area and to gain adequate knowledge to apply the techniques in solving real world problems.

Course Outcome:

CO1: Able to understand the mathematics behind functioning of artificial neural networks
CO2: Able to analyze the given dataset for designing a neural network based solution

CO3: Able to carry out design and implementation of deep learning models for signal/image processing applications

CO4: Able to design and deploy simple TensorFlow-based deep learning solutions to classification problems
CO5: Able to apply deep learning techniques to solve real-world problems, demonstrating an understanding of the practical applications of neural networks.

Course Content:

Module 1: **[6L]**

Introduction: Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.

Module2: **[6L]**

Feed forward neural network: Artificial Neural Network, activation function, multi-layer neural network. Cardinality, operations, and properties of fuzzy relations.

Module3: **[6L]**

Training Neural Network: Risk minimization, loss function, back propagation, regularization, model

selection, and optimization

Module4: **[7L]**

Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

Module5: **[7L]**

Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.

Module 6: **[4L]**

Deep Learning research: Object recognition, sparse coding, computer vision, natural language

Text/Reference Books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
6. Rajiv Chopra, Deep Learning, Khanna Publishing House, 2018.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7002 I			
Course Title	Advanced Algorithms			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Introduces the recurrence relations for analyzing the algorithms. Introduces the graphs and their traversals. Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate. Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis. Introduces string matching algorithms.

Course Outcome:

CO1: Ability to analyze the performance of algorithms

CO2: Ability to analyze string matching algorithms

CO3: Introduces linear programming.

CO4: Ability to choose appropriate data structures and algorithm design methods for a specified application

CO5: Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs

Course Content:

Module 1: **[8L]**

Introduction: Role of Algorithms in computing, Order Notation, Recurrences, Probabilistic Analysis and Randomized Algorithms. Sorting and Order Statistics: Heap sort, Quick sort and Sorting in Linear Time. Advanced Design and Analysis Techniques: Dynamic Programming- Matrix chain Multiplication, Longest common Subsequence and optimal binary Search trees.

Module 2: **[7L]**

Greedy Algorithms - Huffman Codes, Activity Selection Problem. Amortized Analysis. Graph Algorithms: Topological Sorting, Minimum Spanning trees, Single Source Shortest Paths, Maximum Flow algorithms

Module 3: **[8L]**

Sorting Networks: Comparison Networks, Zero-one principle, bitonic Sorting Networks, Merging Network, Sorting Network. Matrix Operations- Strassen's Matrix Multiplication, Inverting matrices,

Solving system of linear Equations

Module 4: **[7L]**

String Matching: Naive String Matching, Rabin-Karp algorithm, matching with finite Automata, KnuthMorris - Pratt algorithm

Module 5: **[6L]**

NP-Completeness and Approximation Algorithms: Polynomial time, polynomial time verification, NP-Completeness and reducibility, NP-Complete problems. Approximation Algorithms- Vertex cover Problem, Travelling Sales person problem

Text/Reference Books:

1. Introduction to Algorithms,'' T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, Third Edition, PHI.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd
3. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7002J			
Course Title	High Performance Computing			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The objective of this course is To Study various computing technology architecture. To know

Emerging trends in computing technology. To highlight the advantage of deploying computing technology

Course Outcome:

CO1: On successful completion of the course, the student will be having the basic knowledge of computing technology

CO2: Student will be able to understand architecture of computing technology.

CO3: Student will be able to know cloud computing service models

CO4: Know about emerging trends in computing technology

CO5: Student will be able to know big data and hadoop architecture

Course Content:

Module 1: **[9L]**

Cluster Computing and its Architecture:

Ease of Computing ,Scalable Parallel Computer Architecture, Towards Low Cost Parallel Computing,& Motivation Windows opportunity. A Cluster Computer And Its Architecture. Cluster Classification Commodity Components for Clusters. Network Services/Communication SW. Cluster Middleware and Single Systems Image. Resource management & Scheduling (RMS)

Module2: **[5L]**

Cluster Setup and Administration: Introduction. Setting up the cluster. Security System Monitoring,System Tuning

Module3: **[6L]**

Introduction to Grid and its Evolution: Introduction to Grid and its Evolution: Beginning of the Grid, Building blocks of Grid, Grid Application and Grid Middleware, Evolution of the Grid: First, Second & Third Generation

Module4: **[6L]**

Introduction to Cloud Computing: Defining Clouds, Cloud Providers, Consuming Cloud Services, Cloud Models – Iaas, Paas, SaaS, Inside the cloud, Administering cloud services, Technical interface, Cloud resources.

Module5: **[6L]**

Nature of Cloud: Tradition Data Center. Cost of Cloud Data Center. Scaling computer systems, Cloud work load, Managing data on clouds, Public, private and hybrid clouds.

Module 6: **[4L]**

Cloud Elements: Infrastructure as a service, Platform as a service, Software as a service.

Text/Reference Books:

1. High Performance Cluster Computing, Volume 1, Architecture and Systems, Rajkumar Buyya, Pearson Education.
2. Berman, Fox and Hey, Grid Computing – Making the Global Infrastructure a Reality, Wiley India.
3. Hurwitz, Bllor, Kaufman, Halper, Cloud Computing for Dummies, Wiley India.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
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CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7002 K			
Course Title	Advanced Operating Systems			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To study, learn, and understand the main concepts of advanced operating systems (parallel processing systems, distributed systems, real time systems, network operating systems, and open source operating systems) Hardware and software features that support these systems.

Course Outcome:

CO1: Understand the design approaches of advanced operating systems

CO2: Analyze the design issues of distributed operating systems.

CO3: Evaluate design issues of multi processor operating systems.

CO4: Identify the requirements Distributed File System and Distributed Shared Memory.

CO5: Formulate the solutions to schedule the real time applications

Course Content:

Module 1: **[8L]**

Architectures of Distributed Systems: System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Primitives. Theoretical Foundations: Inherent Limitations of a Distributed System, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Termination Detection.

Module 2: **[8L]**

Distributed Mutual Exclusion: The Classification of Mutual Exclusion Algorithms, Non-Token – Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm, Token-Based Algorithms: Suzuki-Kasami's Broadcast Algorithm, Singhal's Heurisric Algorithm, Raymond's Heuristic Algorithm.

Module 3: **[7L]**

Distributed Deadlock Detection: Preliminaries, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized- Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms

Module 4: **[7L]**

Multiprocessor System Architectures: Introduction, Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling. Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues

Module 5: **[6L]**

Distributed Scheduling: Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration
Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues

Text/Reference Books:

1. Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjan G. Shivaratri, Tata McGraw-Hill Edition 2001
2. 1. Distributed Systems: Andrew S. Tanenbaum, Maarten Van Steen, Pearson Prentice Hall, Edition – 2, 2007

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7004B			
Course Title	Information and Coding Theory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To develop an understanding of modern network architectures from a design and performance perspective. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs). To provide an opportunity to do network programming

Course Outcome:

CO1: To Perform information theoretic analysis of communication system.

CO2: To Design a data compression scheme using suitable source coding technique

CO3: To Design a channel coding scheme for a communication system.

CO4: To Understand and apply fundamental principles of data communication and networking.

CO5: To apply flow and error control techniques in communication networks

Course Content:

Module 1: **[5L]**

Source Coding Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes

Module2: **[6L]**

Channel Capacity And Coding [7L] Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit

Module3: **[6L]**

Linear And Block Codes For Error Correction [8L] Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes

Module4: **[5L]**

Cyclic Codes Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes

Module5: **[6L]**

BCH Codes Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Module 6: **[8L]**

Convolutional Codes Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding

Text/Reference Books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7003H			
Course Title	Ad-Hoc and Sensor Networks			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

An ad-hoc network is a local area network (LAN) that is built spontaneously with network devices connected; it is a communication mode that allows computers to directly communicate with each other without a router. A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. A WSN system also incorporates a gateway that provides wireless connectivity back to the wired world and distributed nodes. The architecture and routing algorithm for wireless network and challenges are discussed here

Course Outcome:

CO1: Construct an Ad hoc networks and Wireless Sensor Networks

CO2: Implement a suitable routing algorithm based on the network and user requirement
CO3: Identify appropriate physical and MAC layer protocols and its issues
CO4: Demonstrate the transport layer and security issues possible in Ad hoc and sensor networks.
CO5: Be familiar with the OS used in Wireless Sensor Networks and build basic modules

Course Content:

Module 1: **[8L]**

Introduction to ad hoc wireless networks: characteristics of MANETs , Application of MANETs, challenges Topology-based versus positions- based approaches, topology based routing protocols, positions based routing, other routing protocols

Module 2: **[6L]**

Data Transmission In Manets: The broadcast storm multicasting, geocasting Tcp Over Ad Hoc Networks: TCP protocol overview, TCP and MANETs, solutions for TCP over Ad Hoc.

Module 3: **[8L]**

Basics of wireless sensors and applications: The Mica Mote, Sensing and Communication Range, Design Issues, Energy consumption, Clustering of Sensors, Applications. Data retrieval in sensor networks: classification of WSNs, MAC layer routing layer , high level application layer support, adapting to the inherent dynamic nature of WSNs.

Module 4: **[8L]**

SECURITY: security in ad-hoc wireless networks, key management, secure routing cooperation in MANETs, instruction detection system. Sensor network platforms and tools: Sensor network hardware,sensor network programming challenges, Node-Level software Platforms.

Module 5: **[6L]**

Operating system-TinyOS Imperative language: nesC, Dataflow style language: TinyGALS, Node-level Simulators, ns-2 and its sensor networks extension, TOSSIM.

Text/Reference Books:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.
2. Holger Karl, Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley publication, Jan 2006..
3. Ad Hoc and sensor networks, Carlos Corderio Dharma P.Aggarwal, world scientific publication/ Cambridge university press, March 2006
4. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.
5. Wireless sensor networks: An information processing approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman publishers, 2005,rp2009

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7003 J			
Course Title	Data Mining and Data Warehouse			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

It presents methods for mining frequent patterns, associations, and correlations. It then describes

methods for data classification and prediction, and data–clustering approaches. It covers mining various types of data stores such as spatial, textual, multimedia, streams.

Course Outcome:

CO1: Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.

CO2: Apply preprocessing methods for any given raw data.

CO3: Extract interesting patterns from large amounts of data

CO4: Discover the role played by data mining in various fields.

CO5: Choose and employ suitable data mining algorithms to build analytical applications

Course Content:

Module 1: **[6L]**

Introduction to Data Warehousing and Data Mining: The modern Data warehouse, Data Warehouse roles and structure, need of Data warehouse, The cost of Warehousing Data, Foundation of Data mining, The roots of Data Mining, The Approach to Data Exploration and Data Mining.

Module2: **[6L]**

The Data Warehouse: Stores, Warehouses and Marts, the Data Warehouse Architecture, Metadata, Metadata Extraction, Implementing Data Warehouse, Data Warehouse technologies.

Module3: **[7L]**

Data Mining: Data–Types of Data–, Data Mining Functionalities– Interestingness Patterns– Classification of Data Mining systems– Data mining Task primitives –Integration of Data mining system with a Data warehouse–Major issues in Data Mining–Data Preprocessing.

Module4: **[7L]**

Association Rule Mining: Mining Frequent Patterns–Associations and correlations – Mining Methods– Mining Various kinds of Association Rules– Correlation Analysis– Constraint based Association mining. Graph Pattern Mining, SPM. Online Analytical Processing, Techniques used to mine the data, Market Basket Analysis, Limitations and challenges to DM.

Module5: **[4L]**

Classification: Classification and Prediction – Basic concepts–Decision tree induction–Bayesian classification, Rule–based classification, Lazy learner.

Module 6: **[6L]**

Data Analysis and Visualization: Data Analysis: Correlation, Covariance, Rank and Percentile, Histogram and Moving Average. Data Visualization with advance Charts: Stock Chart, Surface Chart, Donut Chart, Bubble Chart and Radar Chart

Text/Reference Books:

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.
3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7002A			
Course Title	Computer Vision			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To introduce students the fundamentals of image formation; To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; To develop an appreciation for various issues in the design of computer vision and object recognition systems; and To provide the student with programming experience from implementing computer vision and object recognition applications.

Course Outcome:

CO1: To identify basic concepts, terminology, theories, models and methods in the field of computer vision,

CO2: To describe known principles of human visual system

CO3: To describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,

CO4: To suggest a design of a computer vision system for a specific problem

CO5: To apply computer vision techniques to solve real-world problems, such as image classification, object detection, and image segmentation

Course Content:

Module 1: **[10L]**

Introduction, Image Formation – geometric primitives and transformations, photometric image formation, digital camera, Image Processing – point operators, linear filtering, neighborhood operators, Fourier transforms, and segmentation

.

Module 2: **[12L]**

Feature Detection and Matching – points and patches, edges, lines, Feature-based Alignment – 2D, 3D feature-based alignment, pose estimation, Image Stitching, Dense motion estimation – Optical flow – layered motion, parametric motion, Structure from Motion

Module 3: **[14L]**

. Recognition – object detection, face recognition, instance recognition, category recognition, Stereo Correspondence – Epipolar geometry, correspondence, 3D reconstruction

Text/Reference Books:

1. Zeliski R., "Computer Vision: Algorithms and Applications", Springer, 2010.
2. Shapiro L. G. and Stockman G., "Computer Vision", Prentice Hall, 2001.
3. Forsyth D. A. and Ponce J., "Computer Vision – A Modern Approach", Second Edition, Pearson Education, 2012.
4. Davies E. R., "Machine Vision: Theory, Algorithms, Practicalities", Morgan Kaufmann, 2004.
5. Jain R., Kasturi R. and Shunck B. G., "Machine Vision", McGraw Hill, 1995.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS7002B			
Course Title	Parallel computing			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To learn the advanced concepts of Parallel and Distributed Computing and its implementation for assessment of understanding the course by the students

Course Outcome:

CO1: Understand implicit and explicit parallel platform

CO2: Decompose given problem into many sub problems using different decomposition techniques

CO3: Use different performance metrics for analysis of parallel algorithms

CO4: Use message passing library for communication among process running on parallel platform

CO5: Develop parallel algorithms for shared address space platform using multithreading

Course Content:

Module 1: **[6L]**

Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.

Module 2: **[6L]**

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Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models

Module 3: **[8L]**

Basic Communication Operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, all to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations

Module 4: **[6L]**

Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, Effect of Granularity and Data Mapping on Performance, Amdahl's law, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics.

Module 5: **[10L]**

Programming Using the Message Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Collective Communication and Computation Operations, Groups and Communicators. Programming Shared Address Space Platforms Thread Basics: Why Threads? The POSIX Thread Application Programme Interface, Synchronization Primitives in POSIX, Controlling Thread and Synchronization Attributes, Thread Synchronization Constructs, OPEN MP . Applications: Cancellation, Composite Parallel algorithm development for Matrix multiplication, Sorting and Graph

Text/Reference Books:

1. A Grama, AGupra, G Karypis, V Kumar. Introduction to Parallel Computing (2nd ed.). Addison Wesley,2003.
2. C Lin, L Snyder. Principles of Parallel Programming. USA: Addison-Wesley Publishing Company,2008.
3. J Jeffers, J Reinders. Intel Xeon Phi Coprocessor High-Performance Programming.Morgan Kaufmann Publishing and Elsevier,2013.
4 T Mattson, B Sanders, B Massingill. Patterns for Parallel Programming. Addison-Wesley Professional

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS7004F			
Course Title	Optimization Technique			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Introduction to optimization techniques using both linear and non-linear programming. The focus of the course is on convex optimization though some techniques will be covered for non-convex function optimization too. After an adequate introduction to linear algebra and probability theory, students will learn to frame engineering minima maxima problems in the framework of optimization problems.

Course Outcome:

CO1: Understand the mathematical preliminaries required for optimization techniques, including linear algebra, matrices, vector spaces, eigen analysis, probability theory, and multivariable calculus

CO2: Apply linear programming techniques, including the simplex method, duality, and Karmarkar's method, to solve optimization problems..

CO3: Apply unconstrained optimization methods, such as conjugate direction and quasi-Newton methods, gradient-based methods, and one-dimensional search methods, to solve optimization problems

CO4: Apply constrained optimization techniques, including Lagrange theorem, FONC, SONC, and SOSC conditions, to solve optimization problems with constraints

CO5: Understand and apply projection methods, KKT conditions, and models for non-linear constrained optimization problems.

Course Content:

Module 1: Mathematical Preliminaries **[8L]**

Linear algebra and matrices

- Vector spaces
- Eigen analysis
- Elements of probability theory
- Elementary multivariable calculus

Module 2: : Linear Programming **[6L]**

- Simplex method
- Introduction to linear programming model
- Duality
- Karmarkar's method

Module 3: Unconstrained Optimization **[6L]**

- Conjugate direction and quasi-Newton methods
- Gradient-based methods

- One-dimensional search methods

Module 4: Constrained Optimization **[8L]**

- Lagrange theorem
- FONC, SONC, and SOSC conditions

Module 5: Non-linear Constrained Optimization **[8L]**

- Projection methods
- KKT conditions
- Non-linear constrained optimization models

  Non-linear problems

Text/Reference Books:

1. An Introduction to Optimization by Edwin P K Chong, Stainslaw Zak
2. Nonlinear Programming by Dimitri Bertsekas

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YBB7001			
Course Title	Human Resource Development and Organizational Behavior			
Category	HUM, Minor			
LTP & Credits	L	T	P	Credits
	2	0	0	2
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To provide an understanding of the basic principles of organizational behaviour so as to acquaint the students with managerial skills and the required inputs with reference to human resource management.

Course Outcome:

CO1: To define and explain the basic concepts of organizational behavior and motivation.
CO2: To explain the essential concepts of organizational conflicts, resolution of conflicts through negotiation, change management and organizational development.
CO3: To familiarize the various aspects of HR, to deal effectively with people resourcing and talent management and HR functions in an organization
CO4: To understand the concepts of HRD, its role and importance in the success of organization
CO5: To develop an understanding towards compensation management and industrial relations

Course Content:

Module 1: **[8L]**

Introduction to Organizational Behavior : Meaning and scope of organizational behavior - Challenges and Opportunities – Foundations of Individual behavior, Motivation - Theories (Maslow, ERG, Douglas McGregor two-factor theory), Group dynamics, Leaderships styles

Module2: **[7L]**

Organizational Conflict - causes and consequences - conflict and negotiation, Organizational change, change management process, resistance to change, flexibility and crisis management – Organisational Development – concept and significance

Module3: **[6L]**

HRM: Meaning, definition and functions. Job Analysis, Job Design, Human Resource Planning - Recruitment and Selection - Sources of Recruitment - Selection process, Placement and Induction

Module4: **[7L]**

Introduction to Human Resource Development: Concepts - Training and Development - methods of training, importance of Performance Appraisal, traditional and modern methods of performance appraisal, Job Evaluation - methods of Job Evaluation, Wage and Salary Administration

Module5: **[8L]**

Compensation – Concepts and Principles, Influencing Factors, Emerging Trends in Compensation – Methods of Payment – Incentives and Rewards, Managing Industrial Relations – Emerging trends

and practices in human resource management

Text/Reference Books:

1. K. Aswathappa, Organizational Behaviour, 12thedition, Himalaya, 2016
2. Edwin B. Flippo, Personnel Management, 6thedition, TMH, 2013
3. P. Subba Rao, Management & Organizational Behavior, 2ndedition, Himalaya, 2014
4. C.B. Mamoria& VSP Rao, Personnel Management, 20thedition, Himalaya, 2015
5. Stephen P. Robins, Organisational Behaviour, 11th edition, PHI Learning / Pearson Education, 2008

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7101			
Course Title	Neural Networks and Deep Learning Laboratory			
Category	ENGG,Major			
LTP & Credits	**L**	**T**	**P**	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

To build the Foundation of Deep Learning and understand how to build the neural network. Enable students to develop successful machine learning concepts.

Course Outcome:

CO1: To Understand basic neuron models and learning algorithms by using Matlab's neural network toolbox
CO2: To Describe about different activation function (transfer function).
CO3: To Analyze how weights & bias values affect the output of neuron
CO4: To Identify how weights & bias values are able to represent a decision boundary

in the feature space

CO5: To Conceptualize about perceptron learning rule works for linearly separable problems

Course Content:

List of Experiments:

1. To write a program to implement Perception.
2. To write a program to implement AND OR gates using Perception.
3. To implement Crab Classification using pattern net Objective.
4. To write a program to implement Wine Classification using Back propagation
5. Write a MatLab Script containing four functions Addition, Subtraction, Multiply and Divide functions.
6. Write a program to implement classification of linearly separable Data with a perceptron.
7. To study ImageNet, GoogleNet, ResNet convolutional Neural Networks.
8. To study Convolutional Neural Network and Recurrent Neural Network.
9. Write a program to draw a graph with multiple curve.
10. How the weight and biased value are able to represent a decision boundary in the feature space.
11. Write a program to develop Auto encoders using MNIST Handwritten Digits.
12. Write a program to develop a GAN for Generating MNIST Handwritten Digits.

Text/Reference Books:

1. Navin Kumar Manaswi ,Deep Learning with Applications Using Python Chatbots and Face, Object, and Speech Recognition With TensorFlow and Keras , Apress,2018.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016.
3. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7102 I			
Course Title	Advanced Algorithms Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

The fundamental design, analysis, and implementation of basic data structures. Basic concepts in the specification and analysis of programs. Principles for good program design, especially the uses of data abstraction.

Course Outcome:

CO1: Analyze a variety of algorithms with practical applications and the resource requirements of each.

CO2: Determine the most suitable algorithm for any given task and apply it to the problem

CO3: Demonstrate adequate comprehension of the theory of intractability and prove when certain kinds of problems are intractable

CO4: Work with advanced algorithms

CO5: Design and implement basic algorithms using recursion and iteration to solve computational problems

Course Content:

- Overview of Java programming language
- Introduction to data structures: arrays, linked lists
- Stacks and queues: implementations and applications
- Trees and graphs: traversals and algorithms
- Sorting and searching algorithms
- Advanced data structures: hash tables, heaps, and priority queues
- Algorithm analysis and complexity

Software Packages Required:

- Open-source tools for building neural network models, fuzzy logic, and genetic algorithms

List of Experiments:

1. Implementing searching methods using recursive and non-recursive functions: Linear search, Binary search

2. Implementing List ADT using arrays and linked lists
3. Implementing Stack and Queue ADT using arrays
4. Converting infix expressions to postfix form using stacks ADT
5. Implementing circular queue ADT using an array
6. Testing palindrome strings using both stack and queue
7. Implementing Stack and Queue ADT using a singly linked list
8. Implementing deque ADT using Array, Singly linked list, Doubly linked list
9. Implementing dictionary (ADT) functions using Hashing
10. Traversing binary tree using recursive and non-recursive functions: Preorder, Inorder, Postorder
11. Implementing BFS and DFS for a given graph
12. Implementing KMP algorithm for pattern matching

Text/Reference Books:

1. Data Structures and Algorithms in Java, 3rd edition, A. Drozdek, Cengage Learning.
2. Data Structures and Algorithms in Java, 2nd Edition, R. Lafore, Pearson Education.
3. Data Structures using Java, D.S. Malik and P.S. Nair, Cengage Learning.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 7102 J			
Course Title	High Performance Computing Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0	3	1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

This course is to understand the concepts of General-Purpose GPU Programming . To understand GPU Architecture and Performance. To learn parallel programming on Single and Multiple GPUs. To

understand programming in OpenCL and pyCUDA

Course Outcome:

CO1: Identify different GPU architecture basics in terms of functional units.

CO2: Learn how to install parallel programming platforms OpenMP, CUDA platform.

CO3: Apply GPU kernel implementation using CUDA/OpenMP.

CO4: Evaluating program performance using architecture specific details like GPU thread scheduling, shared memory.

CO5: Develop process on GPU which uses huge datasets like image data, text data.

Course Content:

1. Vector and Matrix Operations- Design parallel algorithm to1. Add two large vectors2. Multiply Vector and Matrix3. Multiply two N × N arrays using (n)^2processors

2. Parallel Sorting Algorithms- For Bubble Sort and Merger Sort, based on existing sequential algorithms, design and implement parallel algorithm utilizing all resources available.

3. Parallel Search Algorithm- Design and implement parallel algorithm utilizing all resources available. for· Binary Search for Sorted Array Depth-First Search (tree or an undirected graph) **OR** Breadth-First Search(tree or an undirected graph) **OR**· Best-First Search that (traversal of graph to reach a target in the shortest possible path)

4. Parallel Implementation of the K Nearest Neighbors Classifier

5. Mini Project: Database Query Optimization Long running database Query processing in parallel

Text/Reference Books:

1. High Performance Cluster Computing, Volume 1, Architecture and Systems, Rajkumar Buyya, Pearson Education.
2. Berman, Fox and Hey, Grid Computing – Making the Global Infrastructure a Reality, Wiley India.
3. Hurwitz, Bllor, Kaufman, Halper, Cloud Computing for Dummies, Wiley India

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS7102K			
Course Title	Advanced Operating Systems Laboratory			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	0	0		1.5
Total Contact Hours	36			
Pre-requisites	None			

Learning Objective:

Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management. Advanced operating system topics include multi-tasking, synchronization mechanisms, distributed system architecture, client–server models, distributed mutual exclusion and concurrency control, agreement protocols, load balancing, failure recovery, fault tolerance, cryptography, and multiprocessor operating systems.

Course Outcome:

CO1: Ability to implement inter process communication between two processes.

CO2: Ability to design and solve synchronization problems.

CO3: Ability to simulate and implement operating system concepts such as scheduling, deadlock management, file management, and memory management.

CO4: To comprehend how an operating system virtualizes CPU and memory

CO5: To discuss various scheduling and swapping policies. learn basic concurrent programming in C and assembly code

Course Content:

List of Experiments:

a. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
b. Write programs using the I/O System calls of UNIX operating system (open, read, write, etc.).
c. Write C programs to simulate UNIX commands like ls, grep, etc.
d. Given the list of processes, their CPU burst times and arrival times. Display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
e. Given the list of processes, their CPU burst times and arrival times. Display/print the

Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.

f. Develop application using Inter-Process Communication (using shared memory, pipes or message queues).
g. Implement the Producer-Consumer problem using semaphores (using UNIX system calls)
h. Implement Memory management schemes like paging and segmentation.
i. Implement Memory management schemes like First fit, Best fit and Worst fit.
j. Implement any file allocation techniques (Contiguous, Linked or Indexed)

Text/Reference Books:

1. Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjan G. Shivaratri, Tata McGraw-Hill Edition 2001
2. 1. Distributed Systems: Andrew S. Tanenbaum, Maarten Van Steen, Pearson Prentice Hall, Edition – 2, 2007

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Semester 8 Curriculum and Syllabus

Course Code	YCS 8001J			
Course Title	Real Time system			
Category	ENGG, Major			
LTP& Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	Operating System			

Learning Objective:

Real-time operating systems are event-driven and preemptive, meaning the OS can monitor the relevant priority of competing tasks, and make changes to the task priority. Event-driven systems switch between tasks based on their priorities, while time-sharing systems switch the task based on clock interrupts.

Course Outcome:

CO1: Explain the basic concept of Artificial Intelligence and its applications.
CO2: Classify and analyze various AI tools and techniques.
CO3: Learn and evaluate various AI algorithms.
CO4: Apply the basic understanding of artificial intelligence in real-world applications.
CO5: Evaluate and assess the performance, effectiveness, and ethical implications of artificial intelligence systems in various real-world applications.

Course Content:

Module 1: [9L]

Introduction: Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads, Scheduling

Module 2: [7L]

Basics Of Real-Time Concepts: Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel

Module 3: [8L]

Process Management: Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals

Module 4 [8L]

Inter-Process Communication: Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion.

Pipes Memory Management:- Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection

Module 5: [4L]

Case Studies: Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, uItron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling

Text/Reference Books:

1. J. J Labrosse, "MicroC/OS-II: The Real –Time Kernel", Newnes, 2002.
2. Jane W. S. Liu, "Real-time systems", Prentice Hall, 2000
3. W. Richard Stevens, "Advanced Programming in the UNIX® Environment", 2nd Edition, Pearson Education India, 2011.
4. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wley& Sons, 2004

CO-PO Mapping:

ourse Outcome (CO)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO-1**	**PSO-2**	**PSO-3**
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 8001H			
Course Title	Data Analytics			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	36			
Pre-requisites	DBMS Data Science and Analytics			

Learning Objective:

This course gives an overview of Data, i.e. storage, retrieval and processing of big data. In addition, it also focuses on the "technologies", i.e., the tools/algorithms that are available for storage, processing of Big Data. It also helps a student to perform a variety of "analytics" on different data sets and to arrive at

positive conclusions.

Course Outcome:

CO1: Outline the importance of Big Data Analytics
CO2: Apply statistical techniques for Big data Analytics.
CO3: Analyze problems appropriate to mining data streams.
CO4: Apply the knowledge of clustering techniques in data mining.
CO5: Use Graph Analytics for Big Data and provide solutions.

Course Content:

Module 1: Introduction To Big data [6L]

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting- Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

Module 2: Data Analysis, Clustering and Classification [8L]

Regression Modeling - Multivariate Analysis - Bayesian Modeling - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction. Overview of Clustering - K-means - Use Cases - Overview of the Method -Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes‘ Theorem - Naïve Bayes Classifier.

Module 3: Stream Memory [6L]

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Module 4: Association and Graph Memory [8L]

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Graph Analytics for Big Data: Graph Analytics - The Graph Model - Representation as Triples - Graphs and Network Organization - Choosing Graph Analytics - Graph Analytics Use Cases - Graph Analytics Algorithms and Solution Approaches - Technical Complexity of Analyzing Graphs- Features of a Graph Analytics Platform.

Module 5: Frameworks and Visualization [8L]

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Analytics Applications - Analytics using Statistical packages-Approaches to modeling in Analytics – correlation, regression, decision trees, classification, association Intelligence from unstructured information-Text analytics-Understanding of emerging trends and Technologies-Industry challenges and application of Analytics- Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

Text / Reference Books:

1. D. Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
2. Rajaraman and J. D. Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
3. M. Berthold, D. J. Hand, “Intelligent Data Analysis”, Springer, 2007.
4. Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
5. K. H. Pries and R. Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015
6. C. Eaton, D. DeRoos, T. Deutsch, G. Lapis, P. Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.

PO-CO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	0	0	3
CO2	3	2	-	1	2	-	-	-	-	-	-	1	0	0	0
CO3	3	2	2	3	2	-	-	-	-	-	-	-	0	0	3
CO4	3	3	2	1	2	-	-	-	-	-	-	-	0	0	3
CO5	3	2	3	2	2	-	-	-	-	-	-	1	0	0	3

Course Code	YCS 8001I			
Course Title	Soft Computing			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	36			
Pre-requisites	None/If Any			

Learning Objective:

The main objective of the course is to expose the students to soft computing, various types of soft computing techniques, and applications of soft computing. .Upon completion of this course, the student should be able to get an idea on: Artificial Intelligence, Various types of production

systems, characteristics of production systems. Neural Networks, architecture, functions and various algorithms involved. Fuzzy Logic, Various fuzzy systems and their functions. Genetic algorithms, its applications and advances.

Course Outcome:

At the end of the course the student should be able to

CO1: To learn about soft computing techniques and their applications
CO2: To analyze various neural network architectures
CO3: To understand perceptron and counter propagation networks
CO4: To Define the fuzzy systems
CO5: To analyze the genetic algorithms and their applications

Course Content:

Module 1: **[6L]**

Introduction: Introduction to soft computing Introduction to fuzzy sets and fuzzy logic systems Introduction to biological and artificial neural networks Introduction to Genetic Algorithm

Module 2: **[10L]**

Fuzzy Sets and Fuzzy Logic Systems: Classical Sets and Fuzzy Sets and Fuzzy relations Operations on Classical sets, properties of classical sets Fuzzy set operations, properties of fuzzy sets, cardinality
Membership functions, standard forms, boundaries, fuzzification methods Fuzzy to Crisp conversions, Lambda Cuts, Defuzzification methods Classical Logic and Fuzzy Logic, Approximate reasoning, Fuzzy Implication Fuzzy Rule based Systems, Linguistic Hedges, Fuzzy Rule based system, Fuzzy Inference System, Mamdani Fuzzy Models, Sugeno Fuzzy Models Applications of Fuzzy Logic in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems, Weather forecasting

Module 3: **[7L]**

Neural Network: Introduction to Neural Networks Biological Neurons and Artificial neural network

Model of artificial neuron Learning Methods: Hebbian, competitive, Boltzmann etc.Neural Network models: Perceptron, Adaline, Madeline networks, single layer network Back propagation and multi-layer networks Competitive learning networks: Kohonen self-organizing networks, Hebbian learning, Hopfield Networks Neuro-Fuzzy modeling Applications of Neural Networks in Pattern Recognition and classification

Module 4: **[8L]**

Genetic Algorithms Simple GA, crossover, mutation Multi-objective Genetic Algorithm (MOGA) Applications of Genetic Algorithm in search and optimization, GA based clustering Algorithm, Image processing, pattern Recognition

Module 5: **[5L]**

Other Soft Computing techniques Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO)

Text/Reference Books:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
3. Principles of Soft Computing, S N Sivanandam, S. Sumathi, John Wiley & Sons
4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH,

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS8002J			
Course Title	VLSI			
Category	ENGG, Major			
LTP & Credits	**L**	**T**	**P**	Credits
	3	1	0	4
Total Contact Hours	36			
Pre-requisites				

Learning Objective:

This is an introductory course which covers basic theories and techniques of digital VLSI design in CMOS technology. In this course, we will study the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures, interconnect analysis, CMOS chip layout, simulation and testing, low power techniques, design tools and methodologies, VLSI architecture.

Course Outcome:

CO1: Students gain the knowledge about MOSFET / CMOS operation and CMOS Process flow

CO2: Students gain the knowledge of transistor sizing, logical effort and combinational logic.

CO3: Students learn the design concepts with sequential logic

CO4: Students learn the issues related with the static timing analysis and clock distribution

CO5: Students become aware of concepts of memory design and interconnect delay

Course Content:

Module 1: **[7L]**

Introduction to VLSI Design, Levels of abstraction and the complexity of design, Challenges of VLSI design: power, timing, area, noise, testability, reliability and yield; CAD tools: simulation, layout, synthesis and test.

Module 2: **[10L]**

MOS modeling, MOS device models, Short-channel effects and velocity saturation, Scaling of MOS circuits; The CMOS inverter, VTC, Switching behavior, Noise margins and power dissipation; Static and dynamic CMOS combinational logic gate, Transistor sizing in static CMOS, logical effort , Passtransistor

logic, sizing issues , Domino logic gates , estimating load capacitance , Simple delay models (RC) for CMOS gates , Power consumption;

Module 3: **[10L]**

Layout design, Design rules, Stick diagrams; Standard-cell layout, Chip layout and floor planning, Array layout; Data path units, Adders, Shifters, Multipliers; Control logic strategies, PLAs , Multilevel logic, Synthesis and place and route; Latches and clocking, Flip-flops, Set-up and hold tests, Static and dynamic latch and flip-flop, clock distribution, clock synthesis and synchronization using PLLs.

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Module 4: **[9L]**

MOS memories, Register, SRAM , DRAM; Global interconnect modeling, Capacitance, resistance and inductance of interconnect; Signal and power-supply integrity issues, Electromigration, RC interconnect modeling Driving large capacitive load, reducing RC delays; Verilog HDL

Text/Reference Books:

1. J. M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, Second Edition, Pearson/PH, 2003.
2. J. P. Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2001.
3. W.Wolf, Modern VLSI Design: Systems on Chip Design, Third Edition, Pearson/PH, 2002.
4.R. L. Geiger, P. E. Allen and N. R. Strader, VLSI Design Techniques for Analog and Digital Circuits, McGraw-Hill, 1990.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS8002K			
Course Title	Bioinformatics			
Category	ENGG, Major			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	36			
Pre-requisites				

Learning Objective:

To provide a national bio-information network designed to bridge the inter-disciplinary gaps in biotechnology information. b. To establish link among scientists in organizations involved in R & D and manufacturing activities in biotechnology. c. To build up information resources, prepare database on biotechnology and to develop relevant information handling tools and techniques.

Course Outcome:

CO1: Infer the biological problems using appropriate in silico approaches
CO2: Select the suitable tools or servers to solve the specific biological issue and curate experimental data.
CO3: Perform and analyze database and similarity search sequence alignment.
CO4: Construct and analyze phylogenetic trees
CO5: Use appropriate tools and packages to analyze varied range of biological problems.

Course Content:

Module 1: **[5L]**

Introduction to strings, edit distance strings, string similarity, elementary commands and protocols, Scope of Bioinformatics.

Module 2: **[7L]**

Sequence Databases And Their Use Introduction to databases, database search, algorithms issues in database search, sequence database search, parametric sequence alignments, sub optimal alignments, dynamic programming global and local alignment

gaps, multiple alignment, common multiple alignment methods. FASTA and BLAST. Amino acid substitution matrices PAM and BLOSSOM.

Module 3: **[6L]**

Evolutionary Trees And Phylogeny : Ultrasonic trees, parsimony, ultrametric problem, perfect phylogeny, phylogenetic alignment, connection between multiple alignment and tree constructions.

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Module 4: **[7L]**

Protein Classification And Structure Visualization : Overview of the protein structure, protein structure visualization, visualization tools and databases, protein structure alignment, protein classification approaches, tools for plotting Protein - ligand interaction.

Module 5: **[6L]**

Protein Structure Prediction : Protein identification and characterization, primary structure analysis and prediction, secondary structure analysis and prediction, Ab initio method for protein prediction, protein function prediction.

Module 6: **[5L]**

Applications Of Bioinformatics: DNA mapping and sequencing, gene predictions, molecular predictions with DNA strings, role of bioinformatics in drug design

Text/Reference Books:

1. David W. Mount. 2005. Bioinformatics: Sequence and Genome analysis, Cold Spring Harbor Laboratory Press.
2. Jones, N.C. and Pevzner, P. A. 2004. An Introduction to Bioinformatics Algorithms. The MIT Press

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS8002L			
Course Title	Robotics			
Category	Major ENGG			
LTP & Credits	**L**	**T**	**P**	Credits
	3	1	0	4
Total Contact Hours	36			
Pre-requisites				

Learning Objective:

To study the kinematics, drive systems and programming of robots. To study the basics of robot laws and transmission systems. To familiarize students with the concepts and techniques of robot manipulator, its kinematics. To familiarize students with the various Programming and Machine Vision application in robots. To build confidence among students to evaluate, choose and incorporate robots in engineering systems.

Course Outcome:

CO1:Interpret the features of robots and technology involved in the control
CO2:Apply the basic engineering knowledge and laws for the design of robotics.
CO3:Explain the basic concepts like various configurations, classification and parts of end effectors compare various end effectors and grippers and tools and sensors used in robots
CO4:Explain the concept of kinematics, degeneracy, dexterity and trajectory planning..
CO5:Demonstrate the image processing and image analysis techniques by machine vision system.

Course Content:

Module 1: **[6L]**

Fundamentals Of Robot : Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications..

Module 2: **[8L]**

Robot Kinematics Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

Module 3: **[8L]**

Robot Drive Systems And End Effectors Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper

.

Module 4: **[7L]**

Sensors In Robotics Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - 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, other algorithms, applications – Inspection, identification, visual serving and navigation.

Module 5: **[7L]**

Programming And Applications Of Robot Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields

Text/Reference Books:

1. Ganesh.S.Hedge,"A textbook of Industrial Robotics", Lakshmi Publications, 2006.
2. Mikell.P.Groover , "Industrial Robotics – Technology, Programming and applications" McGraw Hill 2ND edition 2012.
3. Fu K.S. Gonalz R.C. and ice C.S.G."Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co. 2007.
4. YoramKoren, "Robotics for Engineers", McGraw Hill Book, Co., 2002.

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 8003A			
Course Title	Introduction to Iot			
Category	ENGG, Minor			
LTP & Credits	L	T	P	Credits
	3	0	0	3
Total Contact Hours	36			
Pre-requisites	c) Probability and Statistics d) Design and Analysis of Algorithms			

Learning Objective:

The main objective of image processing is to transform an image into digital form and perform certain operations on it in order to obtain specific models or to extract useful information from the image.

Course Outcome:

CO1: Upon successfully completing the course, the students should:

CO2: Have an appreciation of the fundamentals of Digital Image Processing including the topics of filtering, transforms and morphology, and image analysis and compression.

CO3: Be able to implement basic image processing algorithms in MATLAB.

CO4: Have the skill base necessary to further explore advanced topics of Digital Image Processing.

CO5: Be in a position to make a positive professional contribution in the field of Digital Image Processing.

Course Content:

Module 1: **[7L]**

Digital image fundamentals & Image Transforms: Digital Image fundamentals, Sampling and quantization, Relationship between pixels. Image Transforms: 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Discrete Wavelet Transform.

Module 2: **[9L]**

Image enhancement (spatial domain): Introduction, Image Enhancement in Spatial Domain, Enhancement Through Point Operation, Types of Point Operation, Histogram Manipulation, gray level Transformation, local or neighborhood operation, median filter, spatial domain high-pass filtering. Image enhancement (Frequency domain): Filtering in Frequency Domain, Obtaining Frequency Domain Filters from Spatial Filters, Generating Filters Directly in the Frequency Domain, Low Pass(smoothing) and High Pass (sharpening) filters in Frequency Domain

Module 3: **[6L]**

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration.

Module 4: **[7L]**

Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region-oriented segmentation Morphological Image Processing: Dilation and Erosion, Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, The Hit or Miss Transformation.

Module 5: **[7L]**

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error-Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

Text/ Reference Books:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008
2. Digital Image Processing - S Jayaraman, S. Essakkirajan, T. Veerakumar-TMH, 2010
3. Digital Image Processing and analysis-human and computer vision application with using CVIP Tools - Scotte Umbaugh, 2nd Ed, CRC Press, 2011
4. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology

5. Fundamentals of Digital Image Processing - A.K. Jain, PHI, 1989
6. Digital Image Processing and computer Vision - Somka, Halavac, Boyle - Cengage learning (Indian edition) 2008,
7. Digital Image Processing using Matlab, Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Pearson Education.
8. Introduction to Image Processing & Analysis - John C. Russ, J. Christian Russ, CRC Press, 2010
9. Digital Image Processing with MATLAB & Labview - Vipula Singh Elsevier

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3

Course Code	YCS 8003B				
Course Title	Image Processing				
Category	ENGG, Minor				
LTP & Credits	L	T	P	Credits	
	3	0	0	3	
Total Contact Hours	36				
Pre-requisites	Probability and Statistics Design and Analysis of Algorithms				

Learning Objective:

The main objective of image processing is to transform an image into digital form and perform certain operations on it in order to obtain specific models or to extract useful information from the image.

Course Outcome:

CO1: Upon successfully completing the course, the students should:

CO2: Have an appreciation of the fundamentals of Digital Image Processing including the topics of filtering, transforms and morphology, and image analysis and compression.

CO3: Be able to implement basic image processing algorithms in MATLAB.

CO4: Have the skill base necessary to further explore advanced topics of Digital Image Processing.

CO5: Be in a position to make a positive professional contribution in the field of Digital Image Processing.

Course Content:

Module 1: **[6L]**

Digital image fundamentals & Image Transforms: Digital Image fundamentals, Sampling and quantization, Relationship between pixels. Image Transforms: 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Discrete Wavelet Transform.

Module 2: **[10L]**

Image enhancement (spatial domain): Introduction, Image Enhancement in Spatial Domain, Enhancement Through Point Operation, Types of Point Operation, Histogram Manipulation, gray level Transformation, local or neighborhood operation, median filter, spatial domain high-pass filtering. Image enhancement (Frequency domain): Filtering in Frequency Domain, Obtaining Frequency Domain Filters from Spatial Filters, Generating Filters Directly in the Frequency Domain, Low Pass(smoothing) and High Pass (sharpening) filters in Frequency Domain

Module 3: **[5L]**

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration.

Module 4: **[8L]**

Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region-oriented segmentation Morphological Image Processing: Dilation and Erosion, Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, The Hit or Miss Transformation.

Module 5: **[7L]**

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error-Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

Text/ Reference Books:

10. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008

11. Digital Image Processing - S Jayaraman, S. Essakkirajan, T. Veerakumar-TMH, 2010
12. Digital Image Processing and analysis-human and computer vision application with using CVIP Tools - Scotte Umbaugh, 2nd Ed, CRC Press, 2011
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14. Fundamentals of Digital Image Processing - A.K. Jain, PHI, 1989
15. Digital Image Processing and computer Vision - Somka, Halavac, Boyle - Cengage learning (Indian edition) 2008,
16. Digital Image Processing using Matlab, Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Pearson Education.
17. Introduction to Image Processing & Analysis - John C. Russ, J. Christian Russ, CRC Press, 2010
18. Digital Image Processing with MATLAB & Labview - Vipula Singh Elsevier

CO-PO Mapping:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	3	2	0	0	3	0	0	3	0	0	3
CO2	2	2	1	1	1	1	0	0	0	0	0	3	0	0	0
CO3	1	3	1	2	2	1	0	0	1	0	0	3	0	0	3
CO4	2	2	2	1	1	1	0	0	1	0	0	3	0	0	3
CO5	2	1	1	1	2	2	0	0	2	0	0	3	0	0	3