

# R21 Curriculum

## Bachelor of Computer Applications



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JIS University  
Agarpara, Kolkata

SEMESTER-1							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA1001	Computer Fundamentals and C Programming	3	1	-	4
2	ES	XCA1002	Digital Electronics	3	1	-	4
3	BS	XBT1003	Environmental Studies	3	1	-	4
4	BS	XMT1002	Basic Mathematics	3	1	-	4
<b>PRACTICAL</b>							
5	PC	XCA1101	C Programming Lab	-	-	6	3
6	PC	XCA1102	Office Tools	-	-	4	3
<b>SESSIONAL(ONLY INTERNAL EVALUATION)</b>							
7	Project	XCA1201	Skillx	-	-	1	1
<b>TOTAL</b>							<b>23</b>

SEMESTER-2							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA2001	Computer Organization and Architecture	3	1	-	4
2	PC	XCA2002	Software Engineering	3	1	-	4
3	PC	XCA2003	Data Structure with C	3	1	-	4
4	BS	XMT2001	Advanced Mathematics	3	1	-	4
5	HS	XED2001	Communicative English	3	1	-	2
<b>PRACTICAL</b>							
6	PC	XCA2101	Data Structure Lab	-	-	6	3
7	HS	XED2101	Language Lab	-	-	4	2
<b>SESSIONAL</b>							
8	Project	XCA2201	Skillx	-	-	1	1
<b>TOTAL</b>							<b>24</b>

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SEMESTER-3							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA3001	Operating System	3	1	-	4
2	PC	XCA3002	OOPS with C++	3	1	-	4
3	PC	XCA3003	Computer Graphics	3	1	-	4
4	BS	XMT3001	Mathematics for Computing	3	1	-	4
<b>PRACTICAL</b>							
5	PC	XCA3101	Operating System Lab	-	-	6	3
6	PC	XCA3102	C++ Lab	-	-	6	3
7	PC	XCA3103	Graphics Lab	-	-	6	3
<b>SESSIONAL</b>							
8	Project	XCA3201	NPTEL courses	-	-	-	2
9	OE	XCA3202	Seminar and GD	-	-	1	1
10	Project	XCA3203	Skillx	-	-	1	1
<b>TOTAL</b>							<b>29</b>

SEMESTER-4							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA4001	Data Base Management System	3	1	-	4
2	PC	XCA4002	Programming with Java	3	1	-	4
3	PC	XCA4003	Computer Networking	3	1	-	4
4	BS	XMT4001	Numerical Analysis	3	1	-	4
<b>PRACTICAL</b>							
5	PC	XCA4101	DBMS Lab	-	-	6	3
6	PC	XCA4102	JAVA Lab	-	-	6	3
7	PC	XCA4103	Network Lab	-	-	6	3
<b>SESSIONAL</b>							
8	Project	XCA4201	Soft Skill Development	-	-	3	2
9	OE	XCA4202	Seminar and GD	-	-	1	1
10	Project	XCA4203	Skillx	-	-	1	1
<b>TOTAL</b>							<b>29</b>

SEMESTER-5							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA5001	Web Technology	3	1	-	4
2	PC	XCA5002	Network Administration with Linux/U-nix	3	1	-	4
3	OE	XBB5001	Management and Accounting	3	1	-	4
<b>PRACTICAL</b>							
6	PC	XCA5101	Web Technology Laboratory	-	-	6	3
7	PC	XCA5102	Network Administration Lab	-	-	6	3
8	Project	XCA5103	Minor Project	-	-	9	6
<b>SESSIONAL</b>							
10	Project	XCA5201	Industrial Training	-	-	-	3
11	OE	XCA5202	Seminar and GD	-	-	1	1
12	Project	XCA5203	Skillx	-	-	1	1
<b>TOTAL</b>							<b>29</b>

SEMESTER-6							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PE		Elective I	3	1	-	4
		XCA601A	Python Programming				
		XCA601B	Artificial Intelligence				
		XCA601C	PHP/MySQL				
2	PE		Elective II	3	1	-	4
		XCA602A	Machine Learning				
		XCA602B	Mobile Computing				
		XCA602C	Cyber Law and Security				
		XCA602D	E Commerce				
3	HS	XBB6001	Values and Ethics	3	1	-	4
<b>PRACTICAL</b>							
4	PE		Lab for Elective I	-	-	6	3
		XCA611A	Python Programming Lab				
		XCA611B	Artificial Intelligence Lab				
		XCA611C	PHP/MySQL Lab				
5	Project	XCA6101	Major Project with viva voice	-	-	15	12
<b>SESSIONAL)</b>							
6	OE	XCA6201	Seminar and GD	-	-	1	1
7	Project	XCA6202	Skillx	-	-	1	1
<b>TOTAL</b>							<b>29</b>

### Credit Distribution Ratio:

Category	Credit Allocation As per Autonomy	Credit Allocation As per AICTE
Humanities, Social Sciences & Management Courses	8	
Basic Sciences Courses	20	
Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc	4	
Professional Core Courses	81	
Professional Elective Courses relevant to chosen	11	
Open Elective Courses-Electives from other technical and /or emerging subjects	8	
Project work, seminar and internship in industry or elsewhere	30	
Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracurricular activities		
Total	163	

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**Credit Distribution in details:**

<b>A. Humanities, Social Sciences &amp; Management Courses (HS)</b>							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	XED2001	Communicative English	3	1	-	4	2
2	XED2101	Language Lab	-	-	4	4	2
3	XBB6001	Values and Ethics	3	1	-	4	4
<b>Total Credit:</b>							<b>8</b>

<b>B. Basic Sciences Courses (BS)</b>							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	XCA1003	Environmental Studies	3	1	-	4	4
2	XMT1001	Basic Mathematics	3	1	-	4	4
3	XMT2001	Advanced Mathematics	3	1	-	4	4
4	XMT3001	Mathematics for Computing	3	1	-	4	4
5	XMT4001	Numerical Analysis	3	1	-	4	4
<b>Total Credit:</b>							<b>20</b>

<b>C. Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc. (ES)</b>							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	XCA1002	Digital Electronics	3	1	-	4	4
<b>Total Credit:</b>							<b>4</b>

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D. Professional Core Courses (PC)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	XCA1001	Computer Fundamentals and C Programming	3	1	-	4	4
2	XCA1101	C Programming Lab	-	-	6	6	3
3	XCA1102	Office Tools	-	-	4	4	3
4	XCA2001	Computer Organization and Architecture	3	1	-	4	4
5	XCA2002	Software Engineering	3	1	-	4	4
6	XCA2003	Data Structure with C	3	1	-	4	4
7	XCA2101	Data Structure Lab	-	-	6	6	3
8	XCA3001	Operating System	3	1	-	4	4
9	XCA3002	OOPS with C++	3	1	-	4	4
10	XCA3003	Computer Graphics	3	1	-	4	4
11	XCA3101	Operating System Lab	-	-	6	6	3
12	XCA3102	C++ Lab	-	-	6	6	3
13	XCA3103	Graphics Lab	-	-	6	6	3
14	XCA4001	Data Base Management System	3	1	-	4	4
15	XCA4002	Programming with Java	3	1	-	4	4
16	XCA4003	Computer Networking	3	1	-	4	4
17	XCA4101	DBMS Lab	-	-	6	6	3
18	XCA4102	JAVA Lab	-	-	6	6	3
19	XCA4103	Network Lab	-	-	6	6	3
20	XCA5001	Web Technology	3	1	-	4	4
21	XCA5002	Network Administration with Linux/Unix	3	1	-	4	4
22	XCA5101	Web Technology Lab	-	-	6	6	3
23	XCA5102	Network Administration Lab	-	-	6	6	3
		<b>Total Credit:</b>					<b>81</b>

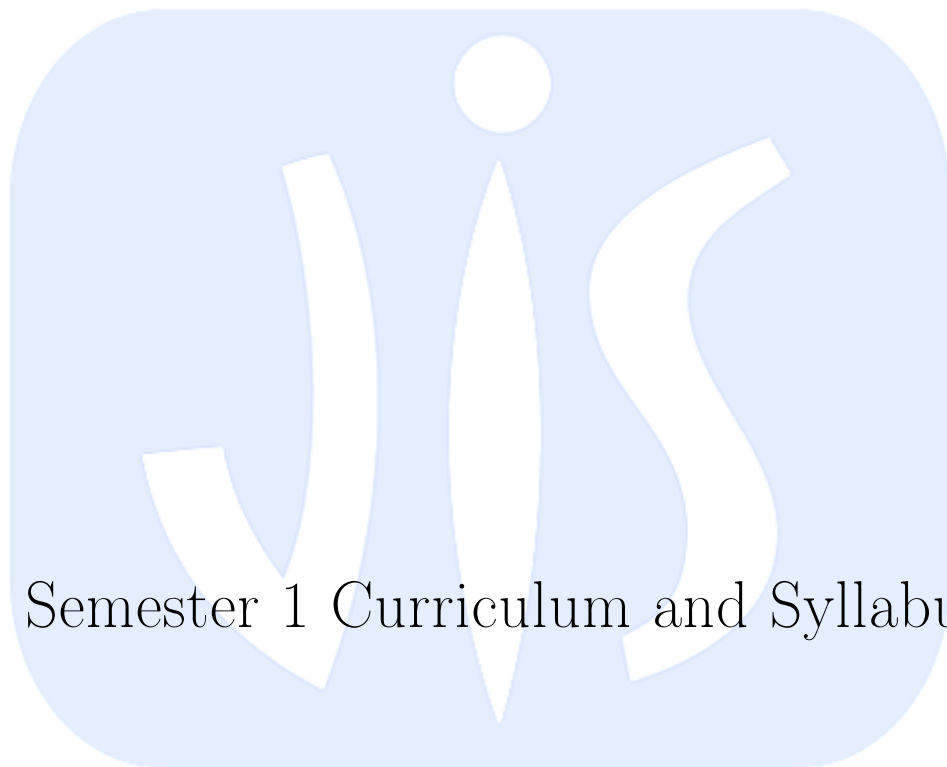
E. Professional Elective Courses relevant to chosen specialization/Branch (PE)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	XCA601A	Python Programming	3	1	-	4	4
	XCA601B	Artificial Intelligence					
	XCA601C	PHP/MySQL					
2	XCA602A	Machine Learning	3	1	-	4	4
	XCA602B	Mobile Computing					
	XCA602C	Cyber Law and Security					
	XCA602D	E Commerce					
3	XCA611A	Machine Learning Lab	-	-	6	6	3
	XCA611B	Mobile Computing Lab					
	XCA611C	E Commerce Lab					
		<b>Total Credit:</b>					<b>11</b>

F. Open Elective Courses-Electives from other technical and / or emerging subjects (OE)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	XCA3202	Seminar and GD	-	-	1	1	1
2	XCA4202	Seminar and GD	-	-	1	1	1
3	XBB5001	Management and Accounting	3	1	-	4	4
4	XCA5202	Seminar and GD	-	-	1	1	1
5	XCA6201	Seminar and GD	-	-	1	1	1
		<b>Total Credit:</b>					<b>8</b>

G. Project work, seminar and internship in industry or elsewhere (PW)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	XCA2201	Skillx	-	-	1	1	1
2	XCA3201	NPTEL courses	-	-	-	-	2
3	XCA3203	Skillx	-	-	1	1	1
4	XCA4201	Soft Skill Development	-	-	3	3	2
5	XCA4203	Skillx	-	-	1	1	1
6	XCA5103	Minor Project	-	-	9	9	6
7	XCA5201	Industrial Training	-	-	-	-	3
8	XCA5203	Skillx	-	-	1	1	1
9	XCA6101	Major Project with viva-voice	-	-	15	15	12
10	XCA6202	Skillx	-	-	1	1	1
		<b>Total Credit:</b>					<b>30</b>

H. Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracurricular activities] (MC)							
Sl. No.	Paper Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	-	-	-	-	-	-	-
		<b>Total Credit:</b>					<b>0</b>





Semester 1 Curriculum and Syllabus

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SEMESTER-1							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA1001	Computer Fundamentals and C Programming	3	1	-	4
2	ES	XCA1002	Digital Electronics	3	1	-	4
3	BS	XBT1003	Environmental Studies	3	1	-	4
4	BS	XMT1002	Basic Mathematics	3	1	-	4
<b>PRACTICAL</b>							
5	PC	XCA1101	C Programming Lab	-	-	6	3
6	PC	XCA1102	Office Tools	-	-	4	3
<b>SESSIONAL(ONLY INTERNAL EVALUATION)</b>							
7	Project	XCA1201	Skillx	-	-	1	1
<b>TOTAL</b>							<b>23</b>

Course Code	XCA1001			
Course Title	Computer Fundamentals and C Programming			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1		4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

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

### Course Outcome:

- CO1:** Understand the basics of computer generations and system architecture.
- CO2:** Learn the way of design, execution and debug programs in C language.
- CO3:** Understand and learn the data types, loops, functions and apply to solve different problems.
- CO4:** Apply to the dynamic behavior of memory by the use of pointers through Functions.
- CO5:** Design and analyze modular programs using control structure, selection Union and understand the file handling.

### Course Content:

**Module 1: Introduction to Computers** [#L]  
 Introduction, Characteristics of Computers, Block diagram of computer, Types of computers and features, Mini Computers, Micro Computers, Mainframe Computers, Super Computers, Types of Programming Languages, Machine Languages, Assembly Languages, High Level Languages, Data Organization, Drives, Files, Directories. Types of Memory: Primary And Secondary Memory, RAM, ROM, PROM, EPROM, Secondary Storage Devices, CD, HD, Pen drive. I/O Devices: Scanners, Plotters, LCD, Plasma Display. Number Systems: Decimal, Binary, Octal, Hexadecimal.

**Module 2: Algorithm and Flowcharts** [#L]  
 Algorithm: Definition, Characteristics, Advantages and disadvantages with Examples. Flowchart Definition, Define symbols of flowchart, Advantages and disadvantages, Examples

**Module 3: Operating System and Services in O.S** [#L]  
 DOS History, Files and Directories, Internal and External Commands, Batch Files, Types of O.S.

**Module 4: Windows Operating Environment** [#L]  
 Features of MS Windows, Control Panel, Task Bar, Desktop, Windows Application, Icons, Windows Accessories, Notepad

**Module 5: Overview of C** [#L]

Constants, Variables & Data Types – Operators and Expressions

**Module 6: Decision Making and Branching Statements** [#L]  
 Looping Statements – User Defined Functions.

**Module 7: Arrays** [#L]  
 Strings – Structures and Unions.

**Module 8: Pointers** [#L]  
 Pointer Expressions – Pointers and Arrays – Pointers and Functions.

**Module 9: Files Management in C** [#L]  
 I/O Operations on Files – Random Access Files

**Text/Reference Books:**

1. S. K. Basandra, “Computer Today”, Galgotia Publications, New Delhi.
2. E Balagurusamy, “Programming in ANSI C”
3. Gottfried, "Programming With C",TMH
4. Tondo,"The C Answer Book",PHI
5. "Programming and Problem Solving Through C Language", EXCEL BOOKS

**CO-PO Mapping:**

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

Course Code	XCA1002			
Course Title	Digital Electronics			
Category	ES			
LTP & Credits	L	T	P	Credits
	3	1		4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

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

### Course Outcome:

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

### Course Content:

#### Module 1: Number Systems and Codes [6L]

Decimal Number, Binary Number, Octal Number, Hexadecimal Number, Conversion – Decimal to Binary, Binary to Decimal, Octal to Binary, Binary to Octal, Hexadecimal to Binary, Binary to Hexadecimal, Octal to Binary to Hexadecimal, Hexadecimal to Binary to Octal; Floating Point Number Representation, Conversion of Floating Point Numbers, Binary Arithmetic, 1's and 2's Complement, 9's and 10's Complement, Complement Arithmetic, BCD, BCD addition, BCD subtraction, Weighted Binary codes, Non-weighted codes, Parity checker and generator, Alphanumeric codes

#### Module 2: Logic Gates [2L]

OR, AND, NOT, NAND, NOR, Exclusive – OR, Exclusive – NOR, Mixed logic

#### Module 3: Boolean Algebra [4L]

Boolean Logic Operations, Basic Law of Boolean Algebra, Demorgan's Theorem, Principle of Duality

#### Module 4: Minimization Techniques [5L]

Sum of Products, Product of Sums, Karnaugh Map (up to 4 variables)

#### Module 5: Multilevel Gate Network [3L]

Implementation of Multilevel Gate Network, Conversion to NAND-NAND and NOR-NOR Gate Networks

**Module 6: Arithmetic Circuits**
**[5L]**

Half Adder, Full Adder, Half Subtractor, Full Subtractor, Carry Look Ahead Adder, 4-Bit Parallel Adder

**Module 7: Combinational Circuits**
**[5L]**

Basic 2-input and 4-input multiplexer, Demultiplexur, Basic binary decoder, BCD to binary converters, Binary to Gray code converters, Gray code to binary converters, Encoder.

**Module 8: Sequential Circuits**
**[5L]**

Introduction to sequential circuit, Latch, SR Flip Flop, D Flip Flop, T Flip Flop, JK Flip Flop, Master Slave Flip Flop 9.

**Module 9: Basics of Counters**
**[2L]**

Asynchronous (Ripple or serial) counter, Synchronous (parallel) counter 10.

**Module 10: Basics of Registers**
**[3L]**

SIS0, SIPO, PISO, PIPO, Universal Registers

**Text/Reference Books:**

1. Salivahan, "Digital Circuit and Design", VIKAS
2. M. Morris. Mano and Michael D. Ciletti "Digital Design", PEARSON
3. Anand Kumar, "Fundamentals of Digital Circuits", PHI
4. Tokheim, "Digital Electronics", TMH
5. S. Rangnekar, "Digital Electronics", ISTE/EXCEL

**CO-PO Mapping:**

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

Course Code	XBT1003			
Course Title	Environment Studies			
Category	BS			
LTP & Credits	L	T	P	Credits
	3	1		4
Total Contact Hours	48			
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.

### Course Content:

**Module 1: Introduction.** [5L]  
Introduction to environment and ecology. Components of the environment, environmental degradation, natural cycles of environment.

**Module 2: Ecology** [2L]  
Elements of Ecology, Ecological balance, Effects of afforestation and deforestation

**Module 3: Air Pollution and Control** [15L]  
Atmospheric composition, Segments of atmosphere climate, weather. Atmospheric Stability, dispersion of pollutants. Sources and effects of air pollutants, primary and secondary pollutants. Criteria Pollutants: PM10, Source, Effect, Control. CO, NO<sub>x</sub>, Source, Effect, Control. SO<sub>x</sub>, Source, Effect, Control. Lead, Ozone, Source, Effect, Control. Green house effect, Control Measures. Depletion of ozone layer, Effects of UV exposer, Control Measures

**Module 4: Water Pollution and Control** [10L]  
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** [5L]  
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** [3L]  
Sources, effects, standards and control

converters, Gray code to binary converters, Encoder.

**Text/Reference Books:**

1. A. K. Dey, "Environmental Chemistry", New Age international
2. G.M. Masters, "Environmental Engineering", Prentice Hall India

**CO-PO Mapping:**

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




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Course Code	XMT1002			
Course Title	Basic Mathematics			
Category	BS			
LTP & Credits	L	T	P	Credits
	3	1		4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

In this course the students will learn about the basic knowledge of linear algebra, two dimensional geometry differential calculus and integral calculus. At the end of the course, the students will be able to solve engineering problems.

### Course Outcome:

- CO1:** To explain the distinctive characteristics of linear algebra and its application
- CO2:** To explain the theoretical concept of Geometry and apply the concepts to solve problems
- CO3:** To explain the theoretical concept of differential calculus and apply the concepts to solve problems
- CO4:** To explain indefinite and definite integrals and apply the concept to solve problems

### Course Content:

#### Module 1: Linear Algebra [12L]

Determinant and its properties (up to third order), Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew -symmetric matrices and their properties, Adjoint, Inverse matrix, Solution of linear equations in three variables by Cramer's rule and matrix inversion method, Permutation and Combinations, Binomial theorem.

#### Module 2: Two dimensional Geometry [8L]

Locus, Straight lines, Circle, Conic section. Transformation of axes, Plane polar curves

#### Module 3: Differential Calculus [12L]

Limits of function and continuity, fundamental properties of continuous functions (without proof), Derivatives, Geometric meaning of derivative, successive differentiation, Rolle's theorem, Mean value theorems, Taylor's and Maclaurin's theorem, Taylor's series, Functions of several variables, Limit and Continuity, Partial derivatives, Total differential, Euler's theorem on homogeneous functions of two variables. Tangents and normal

#### Module 4: Integral Calculus [8L]

Indefinite integrals, Definite integrals and their elementary properties, Definite integral as the limit of sum, Idea of improper integrals. Area under a plane curve

**Text/Reference Books:**

1. S. K. Mapa, “Higher Algebra”, Levant Books.
2. Chakravorty and Ghosh, “Advanced Higher Algebra”, U N Dhar Pvt. Ltd.
3. S. L. Loney, “Co-ordinate Geometry”, Arihant
4. Das and Mukherjee, “Integral Calculus”, U N Dhar Pvt. Ltd.
5. Das and Mukherjee, “Differential Calculus”, U N Dhar Pvt. Ltd.
6. E Kreyszig, “Advanced Engineering Mathematics”, Wiley

**CO-PO Mapping:**

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

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Course Code	XCA1101			
Course Title	C Programming Lab			
Category	PC			
LTP & Credits	L	T	P	Credits
	-	-	6	3
Total Contact Hours	72			
Pre-requisites	None / If Any			

### Learning Objective:

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

### Course Outcome:

- CO1:** Learn and understand the DOS system commands and familiarize with C programming environment.
- CO2:** Learn and translate the algorithms into simple programs and understand the flowchart design and test.
- CO3:** Understand and implement conditional branching, iteration and recursion.
- CO4:** Apply and analyze various C programs with Arrays, Pointers, Structures, Union along with functions.
- CO5:** Apply programming to solve matrix addition and multiplication problems and understand the file handling.

### Suggestive List of Experiments:

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

**Text/Reference Books:**

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

**CO-PO Mapping:**

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

Course Code	XCA1102			
Course Title	Office Tools			
Category	PC			
LTP & Credits	L	T	P	Credits
	0	0	4	3
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

To develop skills for effective use of the Open Office tools by preparing and applying various features in documentation, spreadsheet and presentation.

### Course Outcome:

- CO1:** To educate MS-office system, internet operations, online, offline working areas
- CO2:** List Open Office Software
- CO3:** Apply Word Processing Tools including Document Formatting, Using Graphics, Working with Macro and Mail Merge.
- CO4:** Apply Spread Sheet Tools including Worksheet formatting, Using Functions, Graphics and Charts
- CO5:** Create effective Presentation Using Animation and Transition.

### Suggestive List of Experiments:

1. MS-WORD- Creating, Editing, Formatting, Font name, size, colour, alignment, changing, paragraph settings, change case, Mail Marge, Creating Tables, editing tables, alignment settings in tables. **[12 days]**
2. MS-EXCEL- Creating, Editing, Formatting: font name, size, colour, alignment, changing, entering data, Sorting Data, Inserting, renaming and deleting Sheet, Inserting row, column, cell, picture, background, graph, symbol, hyperlink, object, diagram. **[12 days]**
3. MS-POWERPOINT- Creating, Editing, Formatting: font name, size, colour, alignment, changing, Inserting table, picture, background, graph, symbol, hyperlink, object, diagram. **[12 days]**

### Text/Reference Books:

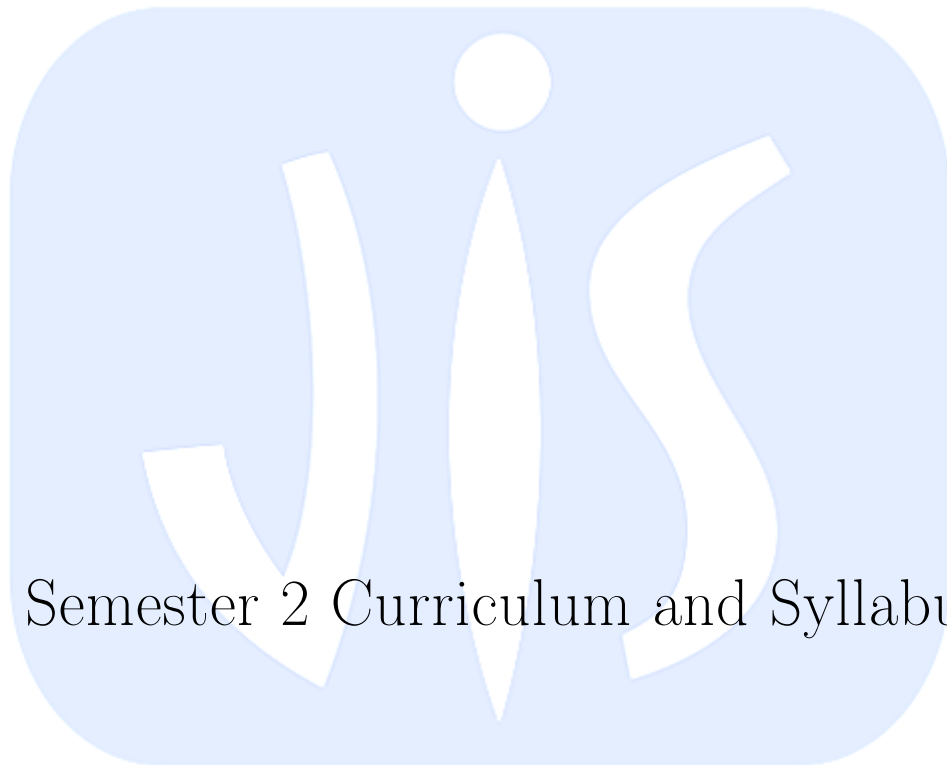
1. Shelly, "Office 2007", Cengage Publication.
2. G.Courter and A.Marquis, "MS-Office 2000 – No Experience Required", BPB Publications.
3. Vikas Gupta, "Comdex windows 7 with Office 2010", Dreamtech Press.
4. R.Mansfield, "Working in Microsoft Office", Tata McGraw Hill Edition.
5. Steve Sagman, "MS-Office 2000 (For Windows)"

**CO-PO Mapping:**

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



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Semester 2 Curriculum and Syllabus

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SEMESTER-2							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA2001	Computer Organization and Architecture	3	1	-	4
2	PC	XCA2002	Software Engineering	3	1	-	4
3	PC	XCA2003	Data Structure with C	3	1	-	4
4	BS	XMT2001	Advanced Mathematics	3	1	-	4
5	HS	XED2001	Communicative English	3	1	-	2
<b>PRACTICAL</b>							
6	PC	XCA2101	Data Structure Lab	-	-	6	3
7	HS	XED2101	Language Lab	-	-	4	2
<b>SESSIONAL</b>							
8	Project	XCA2201	Skillx	-	-	1	1
<b>TOTAL</b>							<b>24</b>



Course Code	XCA2001			
Course Title	Computer Organization and Architecture			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

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

### Course Outcome:

- CO1:** To explain the process of instruction execution
- CO2:** To analyze and design control unit of a computer system
- CO3:** To analyze and design adder, multiplier and division unit
- CO4:** To analyze and design memory subsystems
- CO5:** To explain and classify various input/output data transfer techniques

### Course Content:

#### Module 1: Data Representation [4L]

Number Systems – decimal, binary, octal, hexadecimal, alphanumeric representation, Complements – 1's complement, 2' complement, 9's complement, 10' complement, (r-1)'s complement, r's complement, Fixed point representation – Integer representation, arithmetic addition, arithmetic subtraction, overflow, decimal fixed point representation, Floating point representation, IEEE 754 floating point representation

#### Module 2: Computer Arithmetic [5L]

Addition algorithm of sign magnitude numbers, Subtraction algorithm of sign magnitude numbers, Addition algorithm of signed 2's complement data, Subtraction algorithm of signed 2's complement data, Multiplication algorithm, Booth's algorithm, Division algorithm

#### Module 3: Register transfer and micro operations [5L]

Register transfer language, Register transfer, Bus system for registers, Memory transfers – memory read, memory write, Micro operations – register transfer micro operations, arithmetic micro operations, logic micro operations, shift micro operations, Binary adder, binary adder subtractor, binary incremter, arithmetic circuit for arithmetic micro operations, One stage logic circuit, Selective set, Selective complement, Selective clear, Mask, Insert, Clear

#### Module 4: Basic Computer organization and design [4L]

Instruction codes, Direct address, Indirect address and Effective address, List of basic computer registers, Computer instructions: memory reference, register reference and input – output instructions, Block diagram and brief idea of control unit of basic computer, Instruction cycle.

**Module 5: Micro programmed control** **[2L]**

Control memory, Address sequencing, Micro program examples

**Module 6: Central processing unit** **[5L]**

General register organization, Stack organization, Register stack, Memory stack, Stack operations – push and pop, Evaluation of arithmetic expression using stack, Instruction format, Types of CPU organization (single accumulator, general register and stack organization) and example of their instructions, Three, two, one and zero address instruction, Definition and example of data transfer, data manipulation and program control instructions, Basic idea of different types of interrupts (external, internal and software interrupts), Difference between RISC and CISC.

**Module 7: Introduction to Microprocessors** **[3L]**

Evolution of Microprocessors – Single Chip Microcontrollers – Embedded Microprocessors – Hardware, Software and Firmware – Central Processing Unit – Memory – Buses – Processing Speed of a Computer – Classification of Computers – Von Neumann Architecture – Harvard Architecture – Data Flow Architecture – Types of Microprocessors – Microprocessor Applications.

**Module 8: Input Output Organization** **[6L]**

Peripheral devices, Input – output interface, Isolated I/O, Memory mapped I/O, Asynchronous data transfer: strobe and handshaking, Programmed I/O, Interrupt initiated I/O, Basic idea of DMA and DMAC Input – output processor

**Module 9: Memory Organization** **[6L]**

Memory hierarchy, Main memory definition, types of main memory, types of RAM, ROM, difference between SRAM and DRAM, Cache memory, Cache memory mapping – Direct, Associative, Set Associative, CAM, hardware organization of CAM, Virtual memory, mapping using pages, page fault, mapping using segments, TLB, Auxiliary memory, diagrammatic representation of magnetic disk and hard disk drive, Definitions of seek time, rotational delay, access time, transfer time, latency.

**Text/Reference Books:**

1. M. Morris Mano, “Computer System Architecture”, PEARSON
2. William Stallings, “Computer Organization and Architecture – Designing For Performance”, PEARSON
3. J.P. Hayes, “Computer Architecture and Organization”, TATA MCGRAW HILL
4. T. K. Ghosh, “Computer Organization and Architecture”, TATA MCGRAW-HILL
5. Behrooz Parhami, “Computer Architecture”, OXFORD UNIVERSITY PRESS
6. Badri Ram, “Fundamentals of Microprocessors and Microcomputers”, Dhanpat Rai Publications

**CO-PO Mapping:**

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



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Course Code	XCA2002			
Course Title	Software Engineering			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

In this course, the students will learn about concepts in software engineering and its applications. They will learn about the layered architecture and the process framework, and analyze software process models like waterfall, spiral, evolutionary models.

After completing the course the students will be able to design software requirements and specifications of documents, understand project planning, scheduling, cost estimation, risk management and also describe data models, object models, context models and behavioural models and about the quality checking mechanism for software process and product.

### Course Outcome:

- CO1:** To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project
- CO2:** To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns
- CO3:** To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice
- CO4:** To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning

### Course Content:

**Module 1: Overview of Computer Based Information System [12L]**  
 TPS, OAS, MIS, DSS, KBS Development Life Cycles- SDLC and its phases Models- Waterfall, Prototype, Spiral, Evolutionary Requirement Analysis and Specification, SRS System analysis- DFD, Data Modeling with ERD, Cost Benefit Analysis

**Module 2: Feasibility Analysis, System Design Tools [12L]**  
 data dictionary, structured chart, decision table, decision tree, Concept of User Interface, Essence of UML, CASE tool.

**Module 3: Testing [12L]**  
 Test case, Test suit, Types of testing - unit testing, system testing, integration testing, acceptance testing Design methodologies: top down and bottom up approach, stub, driver, black box and white box testing.

**Module 4: SQA and CMM [12L]**  
 ERP, MRP, CRM, Software maintenance SCM, concept of standards (ISO and CMM), Risk Management, Configuration Management

**Text/Reference Books:**

1. Igor Hawryskiewicz , “System analysis and design”, Pearson
2. V Rajaraman, “Analysis and design of Information System”, PHI
3. Ian Sommerville, “Software Engineering”, Addison-Wesley

**CO-PO Mapping:**

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



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Course Code	XCA2003			
Course Title	Data Structure with C			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Basic programming			

### Learning Objective:

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

### Course Outcome:

- CO1:** To differentiate how the choices of data structure and algorithm methods impact the performance of program.
- CO2:** To solve problems based upon different data structure and also write programs.
- CO3:** To identify appropriate data structure and algorithmic methods in solving problem.
- CO4:** To discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.
- CO5:** To compare and contrast the benefits of dynamic and static data structures implementations.

### Course Content:

- Module 1: Concept of Abstract Data types** [4L]  
 Concept of abstract data types, Structure, union, enum, pointer to structure, Self referential structure, Pointer to pointer
- Module 2: Dynamic Memory Allocation** [4L]  
 Difference between static and dynamic memory allocation, Using functions such as malloc(), calloc(), realloc(), free().
- Module 3: File Management** [4L]  
 Application of functions such as fopen(), fclose(), getc(), putc(), fprintf(), fscanf(), getw(), putw(), command line argument.
- Module 4: Data Structure using array** [4L]  
 Stack, queue, circular queue, priority queue, dequeue and their operations and applications.
- Module 5: Searching and Sorting** [6L]  
 Searching: linear search, Binary search, their comparison, sorting: insertion sort, Selection sort. Quick sort, Bubble sort Heap sort, Comparison of sorting methods, Analysis of algorithm, complexity using big 'O' notation
- Module 6: Linked Lists** [4L]

Linear link lists, doubly linked lists, stack using linked list, queue using linked list, circular linked list and their operations and applications.

**Module 7: Trees** **[5L]**

Binary trees, binary search trees, representations and operations, thread representations, sequential representations, B tree , B+ tree

**Module 8: Graphs** **[5L]**

Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Graph Traversal: Depth first search and Breadth first search. Spanning Trees, minimum spanning Tree, Shortest path algorithm

**Module 9: Hashing** **[4L]**

Definition, Hashing functions, Load factor and collision, open addressing (linear probing) and chaining method to avoid collision.

**Text/Reference Books:**

1. Ajay Agarwal, “Data Structures in C”, Cyber Tech
2. Radhakrishnan and Shrinivasan, “Data Structures Using C”, ISTE/EXCEL BOOKS
3. Radhaganesan, “C and Data Structure”, Scitech
4. Tannenbaum, “Data Structure Using C and C++”, PHI
5. Loudon, “Mastering Algorithms with C”, SPD/O’REILLY

**CO-PO Mapping:**

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

Course Code	XMT2001			
Course Title	Advanced Mathematics			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Basic Mathematics			

### Learning Objective:

The course will give the students a clear idea about the advance mathematical formulations which is required to solve the numerical based problems.

### Course Outcome:

- CO1:** To Understand the concepts of Abstract Algebra.
- CO2:** To Understand and apply the concepts of Differential Equations.
- CO3:** To Understand and apply the concepts of Sequence and Series.

### Course Content:

**Module 1: Algebra** [20L]  
 Abstract Algebra: Sets, Algebra of sets and their applications, Relations, Mapping, Compositions, Groups, Abelian groups, Sub-groups, Cyclic groups, Notion of ring and fields.

Complex numbers, Modulus and amplitudes, De Moivre's theorem Polynomials, Division algorithm, Fundamental theorem of classical algebra (statement only), Descart's rule of sign, Relation between roots and coefficients, symmetric function of the roots, transformation of polynomial equations, Binomial equations

**Module 2: Differential Equations** [14L]  
 Order, degree, formation of a differential equation, Solutions of ODE, First order and first degree: Variable separation method, Homogeneous equations, Exact equations, Condition of exactness (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli's equation. General solution of ODE of first order and higher degree, Clairaut's equation, second order linear ODE with constant coefficients, Solutions using D operator method. Cauchy-Euler equations and their solutions

**Module 3: Sequence and Series** [6L]  
 Bounded and unbounded sequences, convergence or divergence of a sequence, behaviour of monotone sequences, algebra of convergent sequences, Cauchy's sequence, Cauchy's general principle of convergence, infinite series – its convergence and sum, series with positive terms and standard tests of convergence (without proof), alternating series, Leibnitz test, absolute convergence.

### Text/Reference Books:

1. S. K. Mapa, "Higher Algebra", Levant Books
2. Chakravorty and Ghosh "Advanced Higher Algebra", U N Dhar Pvt. Ltd
3. Shepley L Ross, "Differential Equations", Wiley
4. Das and Mukherjee, "Differential Calculus", U N Dhar Pvt. Ltd



**CO-PO Mapping:**

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



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Course Code	XED2001			
Course Title	Communicative English			
Category	HS			
LTP & Credits	L	T	P	Credits
	3	1	0	2
Total Contact Hours	24			
Pre-requisites	None / If Any			

### Learning Objective:

To develop communicative competence in students so as to make them industry-ready. To impart knowledge of proper pronunciation, usage of appropriate vocabulary and correct grammar

### 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 grammar
- CO3:** To develop requisite skills for effective reading and comprehension of texts
- CO4:** To learn how to compose formal, written communication

### Course Content:

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

Communication skills: definition and practical dimension

Use of technology in contemporary communication

Communication in workplaces

Dimensions of workplace communication: ethics, cross-cultural contexts and virtual contexts

#### **Module 2: Functional Grammar** [8L]

Articles and prepositions

Direct and indirect verbs, subject-verb agreement

Tense and voice

Phrases and clauses

Direct and indirect speech

#### **Module 3: Reading Comprehension** [6L]

Reading purposes and skills- skimming, scanning and intensive reading

Reading comprehension: fictional and non-fictional prose

One-word substitution and sentence making

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

Business emails: enquiry, order, complaint, job application and formal invitations

Minutes of meeting

Proposals

Notices

Importance of punctuation in writing

**Text/Reference Books:**

1. Wren and Martin, Revised by Dr, N.D.V. Prasad Rao “High School English Grammar and Composition”, Blackie
2. Steven A. Beebe and Timothy P. Mottet, "Business and Professional Communication-Principles and Skills and Leadership ”, 3rd Edition, Pearson Education.
3. Anjana Sethi and Bhavana Adhikari, “Business Communication”, Tata McGraw Hill Education Private Limited

**CO-PO Mapping:**

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

Course Code	XCA2101			
Course Title	Data Structure Lab			
Category	PC			
LTP & Credits	L	T	P	Credits
	-	-	6	3
Total Contact Hours	72			
Pre-requisites	None / If Any			

### Learning Objective:

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

### Course Outcome:

- CO1:** To choose appropriate data structure as applied to specified problem definition.
- CO2:** To compare operations like searching, insertion, deletion, traversing mechanism on various data structures.
- CO3:** To explain various practical applications of data structures.
- CO4:** To analyze how to store, manipulate and arrange data in an efficient manner.
- CO5:** To demonstrate how to implement various data structures using arrays and linked list.

### Suggestive List of Experiments:

1. Experiments on arrays [1 day]  
Addition and Multiplication of Arrays  
Implementation of Sparse Matrices
2. Experiments on Abstract Data Types [2 days]  
Implementation of stack using Array  
Applications of stack –infix to postfix conversion, expression evaluation
3. Experiments on Linked List [2 days]  
Implementation of linked lists and its operations– insertion, deletion and reverse  
Implementation of stacks and queues using linked list.  
Polynomial addition and polynomial multiplication.
4. Experiments on Searching and Sorting [2 days]  
Searching: Linear Search, Binary Search  
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort
5. Experiments on Non-linear Data Structures [2 days]  
Traversals of binary tree, Binary Search Tree (BST), Threaded binary tree  
Height balanced binary tree – AVL tree (insertion, deletion)  
B- Trees – insertion, deletion

6. Experiments on Hashing [1 day]  
Implementation of Hash tables and its operations – searching, inserting, and deleting, handling collisions.
7. Innovative Experiments [2 days]  
Case study of solving complex problems from various engineering domains using suitable data structures (e.g., mesh analysis in electrical circuits, event-driven simulation, etc.).

**Text/Reference Books:**

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

**CO-PO Mapping:**

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

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Course Code	XED2101			
Course Title	Language Lab			
Category	HS			
LTP & Credits	L	T	P	Credits
			4	2
Total Contact Hours	24			
Pre-requisites	None / If Any			

### Learning Objective:

To emphasize the need of English in workplace. To equip the students with good language skills, communication skills and soft skills

### Course Outcome:

- CO1:** Learn to apply different skills of technical communication in English
- CO2:** Learn to use correct pronunciation when speaking English
- CO3:** Learn to use the appropriate techniques for effective and active listening
- CO4:** Learn to speak clearly and coherently in the professional arena

### Suggestive List of Experiments:

1. Introduction to Phonetics and Phonetic Table (IPA Chart), Tongue and lip movements for vowels and consonants, Monophthongs/Diphthongs, voiced/unvoiced, aspirated/unaspirated, minimal pairs, Syllables, stress and intonation **[4 days]**
2. Active listening and its techniques, Academic listening vs. Business listening, Listening activities: answering questions, form-filling, summarizing news bulletin, presentation, video clip, lecture, story, Listening in Business Telephony **[10 days]**
3. Basic parameters of speaking, Fluency-focused activities - JAM, Conversational Role Plays, speaking using picture, Group Discussions and Personal Interviews **[10 days]**

### Text/Reference Books:

1. Peter Ladefoged, "A Course in Phonetics", Harcourt Brace Jovanovich College Publishers, 1993
2. Jay Sullivan, "Simply Said: Communicating Better at Work and Beyond", Wiley, 2016
3. Nixaly Leonardo, "Active Listening Techniques: 30 Practical Tools to Hone Your Communication Skills", Rockridge Press, 2020

**CO-PO Mapping:**

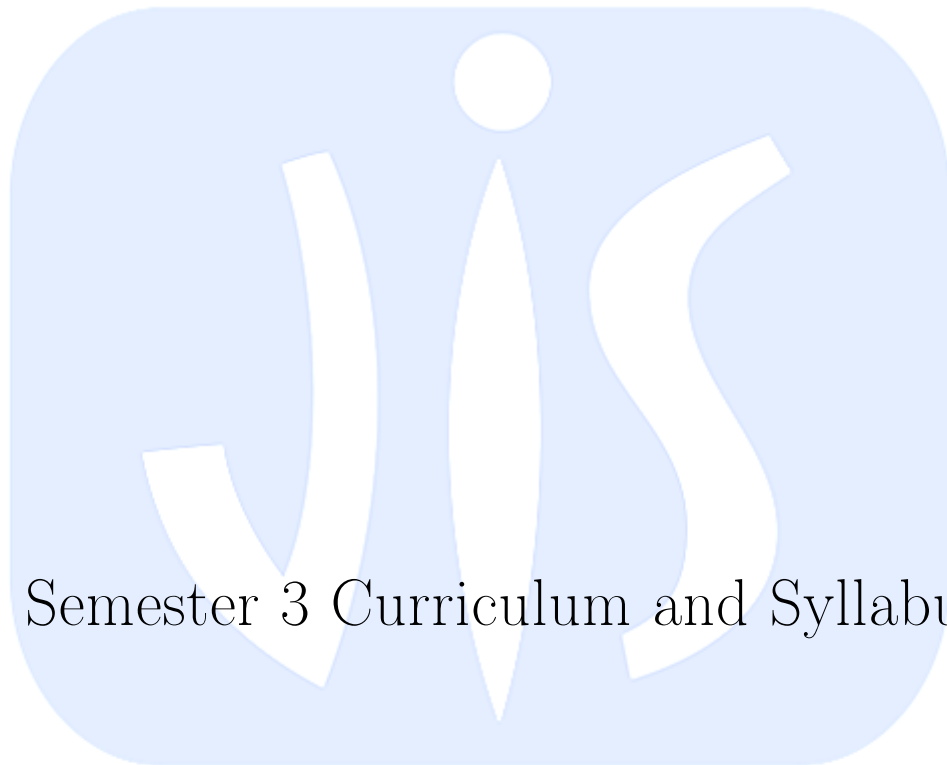
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	3	-	2	-	-	-	2	-	2	3
CO2	-	3	-	-	-	-	-	2	-	-	1	-
CO3	-	3	3	-	2	-	-	1	-	-	2	1
CO4	-	3	3	-	2	-	-	1	-	-	1	1




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Semester 3 Curriculum and Syllabus

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SEMESTER-3							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA3001	Operating System	3	1	-	4
2	PC	XCA3002	OOPS with C++	3	1	-	4
3	PC	XCA3003	Computer Graphics	3	1	-	4
4	BS	XMT3001	Mathematics for Computing	3	1	-	4
<b>PRACTICAL</b>							
5	PC	XCA3101	Operating System Lab	-	-	6	3
6	PC	XCA3102	C++ Lab	-	-	6	3
7	PC	XCA3103	Graphics Lab	-	-	6	3
<b>SESSIONAL</b>							
8	Project	XCA3201	NPTEL courses	-	-	-	2
9	OE	XCA3202	Seminar and GD	-	-	1	1
10	Project	XCA3203	Skillx	-	-	1	1
<b>TOTAL</b>							<b>29</b>

Course Code	XCA3001			
Course Title	Operating System			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	-	
Total Contact Hours	48			
Pre-requisites	None			

### Learning Objective:

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

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

### Course Outcome:

- CO1:** To explain the role of operating system and how it acts as interface between hardware and software.
- CO2:** To contrast the concepts of processes and threads, and how they are scheduled.
- CO3:** To demonstrate the use of various synchronization tools in solving the critical section problem.
- CO4:** To explain and classify the various memory management techniques including virtual memory.
- CO5:** To apply the knowledge of data structures to explain how file systems can be implemented on secondary storage.

### Course Content:

- Module 1: Introduction** [3L]  
Importance of OS, Basic concepts and terminology, Types of OS, Different views, Journey of a command execution, Design and implementation of OS
- Module 2: Process** [10L]  
Concept and Views, OS view of processes, OS services for process management, Scheduling algorithms, Performance evaluation; Inter-process communication and synchronization, Mutual exclusion, Semaphores, Hardware support for mutual exclusion, Queuing implementation of semaphores, Classical problem of concurrent programming, Critical region and conditional critical region, Monitors, Messages, Deadlocks
- Module 3: Resource Management** [8L]  
Memory management, File management, Processor management, Device management
- Module 4: Security and related Issues** [5L]  
Security and protection, Authentication, Protection and access control, Formal models of protection, Worms and viruses
- Module 5: Multiprocessor System** [6L]  
Multiprocessor system, Classification and types, OS functions and requirements, Introduction to parallel computing, Multiprocessor interconnection synchronization
- Module 6: Distributed OS** [4L]  
Introduction to distributed processing
- Module 7: Case studies** [12L]  
Different Operating Systems

**Text/Reference Books:**

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

**CO-PO Mapping:**

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

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Course Code	XCA3002			
Course Title	Object Oriented Programming with C++			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Basic Programming			

### Learning Objective:

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

### Course Outcome:

- CO1:** To study the process of interaction between objects, classes and functions.
- CO2:** To acquire basic knowledge of Object Orientation with different properties.
- CO3:** To analyze various string handling functions with various I/O operations.
- CO4:** To remember basic code reusability feature with respect to Inheritance.

### Course Content:

- Module 1: Concept of OOP** [4L]  
Introduction OOP, Procedural vs. Object Oriented Programming, Principles of OOP, Benefits and applications of OOP
- Module 2: C++ Basics** [4L]  
Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures
- Module 3: C++ Functions** [6L]  
Simple functions, Call and return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions
- Module 4: Objects and Classes** [9L]  
Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion
- Module 5: Inheritance** [9L]  
Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class
- Module 7: Polymorphism** [7L]  
Pointers in C++, Pointes and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism
- Module 5: I/O and File Management** [6L]  
Concept of streams, cin and cout objects, C++ stream classes, Unformatted and formatted I/O, manipulators, File stream, C++ File stream classes, File management functions, File modes, Binary and random Files
- Module 8: Templates, Exceptions and STL** [3L]  
About template, Function templates and class templates, Introduction to exception, try-catch-throw, Overview and use of Standard Template Library

**Text/Reference Books:**

1. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill.
2. H. Schlitdt, "C++ the Compete Reference", TMH Publication.
3. R. Lafore, "Object-oriented programming in Turbo C++", Galgotia publications.

**CO-PO Mapping:**

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



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Course Code	XCA3003			
Course Title	Computer Graphics			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Basic Programming			

### Learning Objective:

Introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.

### Course Outcome:

- CO1:** To explain the foundations of computer graphics and different display technology and devices.
- CO2:** To develop the concept of geometric, mathematical and algorithmic approach necessary for programming computer graphics.
- CO3:** To implement clipping with the comprehension of windows, view-ports in relation to images display on screen.
- CO4:** To analyze and compare different hidden surface illumination methods.

### Course Content:

- Module 1: Introduction to Computer Graphics** [6L]  
 Introduction to Computer Graphics & Graphics systems, Graphics Display Devices, Raster and Random Scan Display
- Module 2: Line Drawing and Circle Drawing Algorithms** [11L]  
 Points & Lines, Line Drawing Algorithms (DDA Algorithm, Bresenham's Line Drawing Algorithm) Circle Generation algorithm (Midpoint Circle Algorithm, Bresenham's Algorithm)
- Module 3: 2D Transformations** [12L]  
 Translation, Rotation, Scaling, Reflection, Shear etc. Homogenous Coordinates, Composite Transformation
- Module 4: Projection (2-dimension)** [5L]  
 Line of Sight, Plane of Projection, Projection methods (Perspective and Parallel)
- Module 5: Viewing and Clipping** [#L]  
 Window to Viewport co-ordinate transformation, Point Clipping, Line Clipping (Cohen-Sutherland Line Clippings, Midpoint Sub-division Algorithm)
- Module 6: Curves and Surfaces** [4L]  
 Bezier Curves, B-splines, Hidden line/surface removal methods (Depth Buffer(Z-Buffer)Method)

**Text/Reference Books:**

1. D. Hearn , M.P. Baker , "Computer Graphics", PHI.
2. D.F. Rogers , "Procedural & Mathematical Elements in Computer Graphics", TMH.

**CO-PO Mapping:**

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



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Course Code	XMT3001			
Course Title	Mathematics for Computing			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Basic Programming			

### Learning Objective:

The objective of the course is to introduce the fundamental concepts and results in Propositional logic, graph theory, probability and statistics and to develop the student's ability to deal with different problems related to discrete structure and probabilistic and Statistical applications in real life problem.

### Course Outcome:

- CO1:** Recall the distinctive characteristics of probability distribution.
- CO2:** Evaluate the various statistical techniques to solve statistical problems.
- CO3:** Analyze statistical techniques in solving real life problems.
- CO4:** Understand the theoretical concept of propositional logic.
- CO5:** Solve a range of problems using the graph theory techniques covered here.

### Course Content:

#### Module 1: Propositional Logic [10L]

Construction of truth table, Tautology, Contradiction, Contingency, Logical equivalence, Generating functions, Recurrence relations

#### Module 2: Graph Theory [18L]

Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Bipartite graph, Degree of a graph, Theorems on graph, Complement of a graph, Regular graph, Complete graph, Sub-graph, Walks, Paths, Circuits, Hamiltonian and Euler Graph, Cut sets and cut vertices, Adjacency and incidence matrices of a graph, Graph isomorphism, Dijkstra's Algorithm for shortest path problem, Definition and properties of tree, Binary tree, Spanning tree of a graph, Minimal spanning tree, Algorithms: DFS, BFS, Kruskal's and Prim's algorithms

#### Module 3: Probability Theory [12L]

Basics of Probability Theory: Axiomatic definition of probability. Conditional probability, Independent events and related problems, Bay's theorem (Statement only) & its application, One dimensional random variable, Probability distributions-discrete and continuous, Expectation, Binomial, Poisson, Uniform, Exponential, Normal distributions

#### Module 4: Frequency Distribution [8L]

Collection of data, Charts and diagram, Measure of central tendency, Measure of dispersion



**Text/Reference Books:**

1. G.S. Rao, "Discrete Mathematical Structure", New Age International.
2. S.K.Rathore, "Discrete Structure & Graph Theory", EPH.
3. Banerjee, Dey and Sen, "Mathematical Probability", U N Dhar Pvt. Ltd.

**CO-PO Mapping:**

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

Course Code	XCA3101			
Course Title	Operating Systems Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	6	3
Total Contact Hours	36			
Pre-requisites	a) Data Structures and Algorithms b) Computer Organization and Architecture			

### Learning Objective:

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

### Course Outcome:

- CO1:** To learn how to write shell scripts.
- CO2:** To learn how to use Unix/Linux system calls and to design a shell program.
- CO3:** To analyze the performance of CPU scheduling algorithms through simulation.
- CO4:** To learn how to use multi-threaded programming.
- CO5:** To design and implement one OS module like memory management, file system, etc.

### Suggestive List of Experiments:

1. Write shell scripts using “bash” shell scripting language for simple system administration tasks, text search and replacement, directory and file manipulation, simple numeric computations, etc. **[2 days]**
2. Write programs in C for familiarization with the Unix/Linux system calls fork, exec, wait, exit, dup, pipe, shared memory, etc. **[2 days]**
3. Write a command line interpreter (shell) program using the Unix/Linux system calls with the facilities for: (a) running executable programs, (b) running a program in the background, (c) input and output redirection, (d) command piping. **[2 days]**
4. Implementation of various CPU scheduling algorithms in C, and compare their performances. **[2 days]**
5. Write programs using “pthread” library with multiple threads, and use semaphores for mutual exclusion. **[1 day]**
6. Design and implement a Unix-like memory-resident file system using the concept of inodes.

**OR**

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

**Text/Reference Books:**

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

**CO-PO Mapping:**

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

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Course Code	XCA3102			
Course Title	OOPS with C++			
Category	PC			
LTP & Credits	L	T	P	Credits
	-	-	6	3
Total Contact Hours	72			
Pre-requisites	Basic Programming			

### Learning Objective:

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

### Course Outcome:

- CO1:** To understand and remember object-oriented programming concepts using the C++ language.
- CO2:** To understand and analyze the principles of data abstraction, inheritance and polymorphism.
- CO3:** To understand and remember the concepts of virtual functions.
- CO4:** To understand formatted and unformatted I/O operations.
- CO5:** To apply exception handling.

### Course Content:

1. Programming using basic features of C++.  
 Executing programs in UNIX environment. Understand pre-processors directives, header Files and namespaces, library files, variables, data types, operators, control, basic loop control, through simple C++ programs. **[3 days]**
2. Functions and String Manipulation  
 Writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures and unions.  
 Longest common subsequence problem. **[2 days]**
3. Object Oriented Programming  
 Programs to demonstrate fundamentals of classes, abstract class, virtual class, overriding, template class, constructors-destructors and deal with member functions, operator overloading and polymorphism (both static and dynamic), inheritance, derived class handling. **[2 days]**
4. Exception handling, Input/output and Dynamic Memory Management  
 Write simple programs to demonstrate exception handling, I/O management, creation of linked list using dynamic memory management. **[3 days]**

5. Innovative Experiments

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

[2 days]

**Text/Reference Books:**

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

**CO-PO Mapping:**

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

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Course Code	XCA3103			
Course Title	Computer Graphics Lab			
Category	PC			
LTP & Credits	L	T	P	Credits
	-	-	6	3
Total Contact Hours	72			
Pre-requisites	None / If Any			

### Learning Objective:

To make students aware of the concepts underlying modern Computer Graphics and Machine Vision. At the end of the course the student will have the generic skills to design algorithms for digital image synthesis for a broad-based set of computing problems in various domains.

### Course Outcome:

- CO1:** To draw Geometric primitives.
- CO2:** To execute scan line polygon filling
- CO3:** To implement basic transformations on objects
- CO4:** To implement clipping algorithm on lines

### Suggestive List of Experiments:

1. Study of basic graphics functions defined in “graphics.h”. [2 day(s)]
2. Program for Line Drawing using DDA algorithm. [2 day(s)]
3. Program for Line Drawing using Bresenhams algorithm. [2 day(s)]

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4. Program for Circle Drawing using Bresenhams algorithm. [2 day(s)]
5. Program for Ellipse Drawing using Bresenhams algorithm. [2 day(s)]

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6. Programs for 2-D transformations on different objects. [2 day(s)]
7. Study of basic graphics functions defined in “graphics.h”. [2 day(s)]
8. Program for Polygon filling algorithms [Flood-Fill Algorithm]. [2 day(s)]
9. Program for Polygon filling algorithms [Boundary-Fill Algorithm]. [2 day(s)]
10. Program for Polygon filling algorithms [Scan Line Algorithm]. [2 day(s)]

11. Programs to study window to viewport transformations [2 day(s)]
12. Program for Cohen Sutherland Line clipping algorithm [2 day(s)]
13. Programs to study 3-D transformations in C. [2 day(s)]

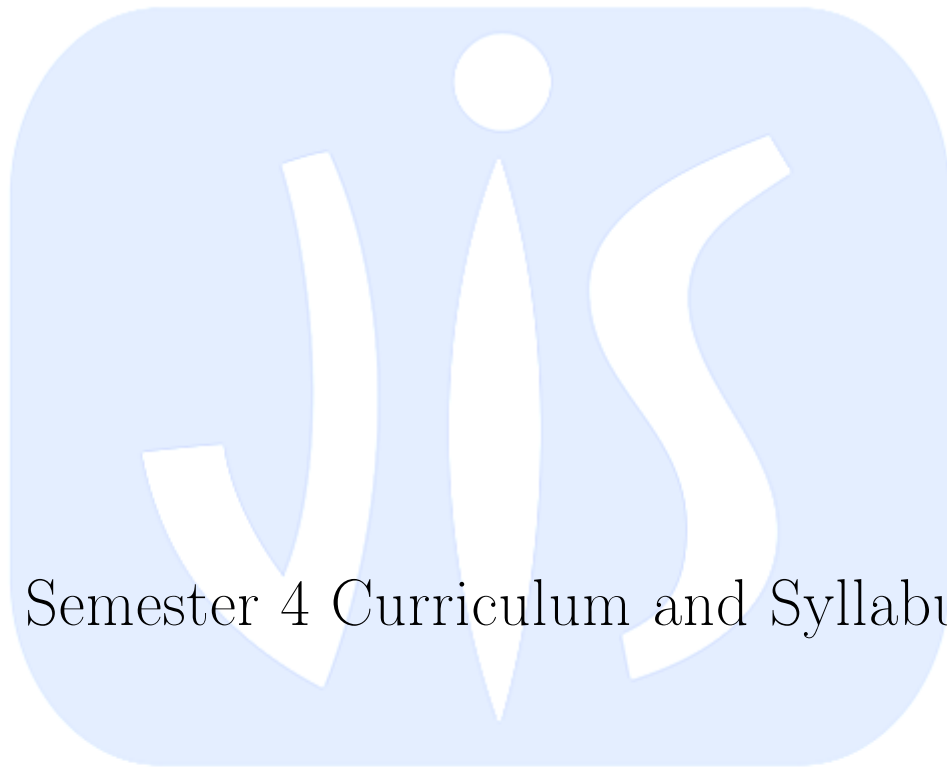
**Text/Reference Books:**

D. Hearn, "Computer Graphics C ", Pearson Education.

**CO-PO Mapping:**

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

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Semester 4 Curriculum and Syllabus

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SEMESTER-4							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA4001	Data Base Management System	3	1	-	4
2	PC	XCA4002	Programming with Java	3	1	-	4
3	PC	XCA4003	Computer Networking	3	1	-	4
4	BS	XMT4001	Numerical Analysis	3	1	-	4
<b>PRACTICAL</b>							
5	PC	XCA4101	DBMS Lab	-	-	6	3
6	PC	XCA4102	JAVA Lab	-	-	6	3
7	PC	XCA4103	Network Lab	-	-	6	3
<b>SESSIONAL</b>							
8	Project	XCA4201	Soft Skill Development	-	-	3	2
9	OE	XCA4202	Seminar and GD	-	-	1	1
10	Project	XCA4203	Skillx	-	-	1	1
<b>TOTAL</b>							<b>29</b>

Course Code	XCA4001			
Course Title	Database Management System			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	-	4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

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

### Course Outcome:

- CO1:** To apply the knowledge of E-R diagram for an application
- CO2:** To explain the creation of the normalized relational database model
- CO3:** To analyze real world queries to generate reports from it
- CO4:** To determine whether the transaction satisfies the ACID properties
- CO5:** To create and maintain the database of an organization

### Course Content:

#### Module 1: Introduction to data and data management

**[5L]**

Introduction, Data and Information, Database and Data Base Management System, Components of Database System, Basics of Database Management System, File-based System and Database Management System, Advantages of using Database over File based system, Data Dictionary and Metadata, ANSI-SPARC Architecture, Database Users, Role of Database Administrator (DBA) and Data Administrator(DA), Database Environment, Need for a Database, Characteristics, or Features, or Advantages of Database Systems, Limitations of Database

#### Module 2: Data Models and Architecture of DBMS

**[7L]**

Schemas and Instances, DBMS Architecture, Three Level Architecture of Database(ANSI SPARC architecture), Evolution of Data Models, Hierarchical Data Model, Network Data Model, Relational Data Model Object-oriented Data Model, Object-relational Data Model, Data and Structural Independence, Database Languages DDL, DML, DCL, TCL, Database Access, Database Structure

#### Module 3: Data Modeling using ER Modeling

**[7L]**

Basic Terminology related to ER Model, Relational Model – Introduction, Advantages and Disadvantages, Identifying Entities, and Relationships, Types of Relationships, Relationship Participation, Notations in ER Model, Strong and Weak entity sets Composite entity, Managing Many-to-many, Relationship, Example of E-R Model, Types of Integrity Constraints, Extended E-R Model, Translating the ER Model into Relational Model, Object Modeling, Subclass and Super class, Specialization, Generalization and Aggregation, Class Diagram

**Module 4: Relational Model and RDBMS**

**[7L]**

Introduction, RDBMS Terminology, Various Types of Keys, Relational Integrity Rules Entity integrity Rule, referential integrity rule, Functional Dependency, Armstrong Axioms, Relational Set Operators, Retrieval Operators, CODD's Twelve Rules of Relational Database, ACID properties, Views and their purpose, Database Life Cycle, Data Dictionary, Relational Algebra and relational calculus, exercise on Relational calculus and relational algebra, Comparisons of relational algebra and calculus Tuple Relational Calculus, Domain Relational Calculus, Introduction to SQL

**Module 5: Normalization**

**[7L]**

Introduction, Need for Normalization, Types of Dependencies - Functional Partial functional and Transitive, Multi-valued Dependency, Join Dependency, Lossless and Lossy Decompositions, Normalizing Tables, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Examples on Normalization, Determining, Candidate Key and further decomposition, Closure of a set and FD's and MVD's, Armstrong's AXIOMS, Minimal or canonical cover of FD's, Lossless Decomposition

**Module 6: Managing Data Using Structured Query Language (SQL)**

**[7L]**

Features of SQL, Database Languages - data definition and Data manipulation languages, Data Definition Commands, Data Manipulation Commands, (SELECT Statement and different Clauses, SQL Functions - Aggregate, Date and Time Functions, String Functions, Conversion Functions, Mathematical Functions, Special Operators), Types of Constraints, Different types of Join and Set Operators, Group by and having clauses, Sub-query, Views, Advances SQL Roll-up, Commit and Save point, Create user grant revoke, Introduction to PL/SQL – conditional statements, loop, variable binding, Embedded SQL.

**Module 7: Transaction and Query Processing**

**[6L]**

Transaction Processing States, ACID Properties of Transaction, read and write operations in transaction, concurrency problems and reasons for recovery, System log, Steps of Query Processing, Query Optimization

**Module 8: Indexing and Hashing**

**[2L]**

Introduction, Overview, Primary Secondary Multi level, Dense and Space Index

**Text/Reference Books:**

1. A.Silberschatz et al., "Database System Concepts", TMH.
2. A. Kahate , "Introduction to Database Management Systems ", Pearson.
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**CO-PO Mapping:**

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

Course Code	XBCA4002			
Course Title	Programming with Java			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	-	4
Total Contact Hours	48			
Pre-requisites	Basic Programming			

### Learning Objective:

On completion of the course the student should be able to: Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs. Read and make elementary modifications to Java programs that solve real-world problems.

### Course Outcome:

- CO1:** Design the process of interaction between Objects, classes & methods w.r.t. Object Oriented Programming.
- CO2:** Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.
- CO3:** Analyze various activities of different string handling functions with various I/O operations.
- CO4:** Discuss basic code reusability feature w.r.t. Inheritance, Package and Interface.
- CO5:** Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

### Course Content:

- Module 1: OOPS Concept [5L]**  
Object, Class, Data abstraction, Data encapsulation, Inheritance, Polymorphism, Dynamic binding.
- Module 2: An overview of Java [3L]**  
Java features, JVM, Comparison between Java and C++, Idea of any Java Development Kit (JDK), learn to run java program through command line and with any JDK.
- Module 3: Data Concept [3L]**  
Data Types, variables and constants Tokens in Java (Identifiers, Literals, Keywords, Operator)
- Module 4: Control and Iteration Statements [5L]**  
Simple if statement, if...else statement, Nesting of if-else statement, switch statement, For loop, While loop, Do-While loop
- Module 5: Array and Vector [3L]**  
1D and 2D array, vector concepts
- Module 6: Class and Object [4L]**

Creating main() in a separate class, Methods with parameters, Methods with a return type, Method overloading, Passing Objects as Parameters, Passing Values to methods and Constructor, Abstract classes

**Module 7: Inheritance** [3L]  
Basic concepts, types of inheritance, use of super keyword, overriding methods.

**Module 8: String and String Buffer** [3L]  
Use of different functions

**Module 9: Packages, Interfaces** [3L]  
User defined package, import package, Class path, How to create interface, use and extend interface

**Module 10: Exception Handling** [2L]  
Overview, What is Exceptions and handling exception?, Compile time errors Run time errors, try... catch, Using Multiple catch Blocks, finally Block, Throwing an Exception, Using the throw and throws Statement.

**Module 11: Stream** [3L]  
Byte Streams, Input Stream, Output Stream Character Streams (Reader, Writer), How Files and Streams Work, Working with Reader classes (InputStreamReader, BufferedReader)

**Module 12: Multithreaded Programming** [3L]  
Overview, Thread Life cycle, Advantages of multithreading over multi-tasking Thread Creation and simple programs, Synchronized threads, Synchronized Methods

**Module 13: Applets** [4L]  
Applet vs. Application, Applet class, Advantages of Applet, Applet Lifecycle My First Applet, Applet tag, How to run applet

**Module 14: Abstract Windows Toolkit** [4L]  
GUI Components, Interface and Classes of AWT Package, Labels, Buttons, Check Boxes, Radio button, Text Area, Text Field, Scrollbar, Panels, Layout managers, Simple event driven programming with Text Field and Button.

#### Text/Reference Books:

1. H. Schildt, "Java 2 a beginner's guide", The McGraw-Hill Companies, Inc.
2. E. Balaguruswami, " Programming with JAVA ", McGraw-Hill Professionals.

#### CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	2	-	-	-	-	-	-	-	-	3
CO3	3	3	1	-	-	-	-	-	2	-	-	3
CO4	3	-	2	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	-	3
CO6	3	-	-	-	2	-	-	-	2	2	2	3

Course Code	XCA4003			
Course Title	Computer Networking			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	-	4
Total Contact Hours	48			
Pre-requisites	None			

### Learning Objective:

In this course, the students will learn about the fundamental concepts of computer networking, with detailed understanding about the TCP/IP protocol suite that drives the Internet. In addition, various important network applications shall be discussed. The course will be very helpful for the students in understanding how data flows through a real network and the various issues involved therein.

### Course Outcome:

- CO1:** To explain the fundamental concepts of data communication
- CO2:** To illustrate how the various protocols at the data link layer level work
- CO3:** To explain the functionalities of the various protocols at the network and transport layer level
- CO4:** To demonstrate how various internetworking devices can be used to connect several different networks together
- CO5:** To learn about various network applications with particular emphasis on security

### Course Content:

#### Module 1: [12L]

Data Communication, Analog-Digital Signals. TCP/IP and OSI Model, Client, Server and Peers, Client/Server architecture, Wired & Wireless transmission, Guided-Unguided Media, Bus, Star, Ring, Mesh, Hybrid, LAN, MAN, WAN, Simplex, Half duplex and Full duplex, Asynchronous and Synchronous Transmission, Parallel and Serial Transmission, Base band and Broadband transmission.

#### Module 2: [18L]

Different networking devices, IEEE 802.3, IEEE 802.4, IEEE 802.5, FDDI, DQDEB, ATM, Physical Addressing, Logical Addressing, Port Addresses, IPV4, IPV6, Classfull-Classless Addressing, Subnetting and Masking, NAT, DHCP, BOOTP, ARP, RARP, ICMP

#### Module 3: [10L]

Different Encoding Techniques, FDM, TDM, Circuit Switching, Packet Switching, Message Switching. Routing, Routing Protocols: Distance Vector, Link State, Congestion Control: Leaky Bucket and Token Bucket Algorithm, ISDN

#### Module 4: [8L]

TCP, UDP, Firewalls, Proxy Router, DNS, FTP, TFTP, SMTP, TELNET, NFS, WWW, E-mail, HTTPS, Cable Network, Telephone Network

**Text/Reference Books:**

1. A. S. Tanenbaum, "Computer Networks, 3rd Edition", PHI.
2. 1. B. Fourauzan, "Data Communications and Networking", , Tata McGraw-Hill

**CO-PO Mapping:**

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

Course Code	XMT4001			
Course Title	Numerical Analysis			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	-	4
Total Contact Hours	48			
Pre-requisites	Basic Programming			

### Learning Objective:

The objective of the course is to introduce the fundamental concepts and results in Numerical analysis and to develop the student's ability to deal with different problems in real life where numerical methods are used.

### Course Outcome:

- CO1:** Recall the distinctive principles of numerical analysis and the associated error measures.
- CO2:** Understand the theoretical workings of numerical techniques.
- CO3:** Apply numerical methods used to obtain approximate solutions to intractable mathematical problems such as interpolation, integration, the solution of linear and nonlinear equations, and the solution of ordinary differential equations
- CO4:** Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.

### Course Content:

#### **Module 1: Error Analysis and Interpolation [12L]**

Numerical errors and their computations, Truncation and rounding errors, Calculus of differences: Forward, Backward, Shift, Average, Central, Differential and Divided difference operators, Relation between the operators, Problems on missing terms Interpolation: Newton's forward and backward interpolation, Lagrange's interpolation, Newton's divided difference, related problems.

#### **Module 2: Numerical Integration [20L]**

Numerical Integration: General quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule, Expression for corresponding error terms, related problems.

#### **Module 3: Numerical Solution of Linear and Non-linear Equations [10L]**

Solutions of Nonlinear Equations: Bisection method, Regula-Falsi method, Method of Iteration, Newton Raphson method, related problems.

#### **Module 4: Numerical Solution of a System of Linear Equations [8L]**

Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method, related problems.

#### **Module 5: Numerical Solution of Differential Equation [10L]**

Euler's method, Modified Euler's method, Runge-Kutta method, Predictor-Corrector method, related problems.



**Text/Reference Books:**

1. S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI.
2. S.A.Mollah, "Numerical Analysis and Computational Procedure", Books & Allied Pvt. Ltd.

**CO-PO Mapping:**

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



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Course Code	XCA4101			
Course Title	DBMS Lab			
Category	PC			
LTP & Credits	L	T	P	Credits
	-	-	6	3
Total Contact Hours	72			
Pre-requisites	None / If Any			

### Learning Objective:

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

### Course Outcome:

- CO1:** To understand the basic concepts regarding database, SQL queries
- CO2:** To explain the concepts of PL/SQL
- CO3:** To differentiate between DBMS and advanced DBMS
- CO4:** To analyze database system concepts and apply normalization to the database
- CO5:** To apply and create different transaction processing and concurrency control applications

### Course Content:

1. Experiments on fundamentals of database systems
  - Creating a Database
  - Creating a Table
  - Specifying Relational Data Types
  - Specifying Constraints
  - Creating Indexes

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

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

**[3 days]**

4. Experiments on Miscellaneous Database Management  
 Creating Views  
 Creating Column Aliases  
 Creating Database Users  
 Use of GRANT and REVOKE [1 day]
  
5. Experiments on PL/SQL  
 Use of decision making statement, different loop structures to solve simple programs (e.g., sum of few numbers, pattern prints, etc.).  
 Inserting values into tables, reading data from a table.  
 Basic working with CURSORS [1 day]
  
6. Innovative Experiments  
 Case study of handling complex databases (e.g., College Management System, Hospital management System, Library management System, Payroll management System, etc.) [3 days]

**Text/Reference Books:**

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

**CO-PO Mapping:**

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

Course Code	XCA4102			
Course Title	JAVA Lab			
Category	PC			
LTP & Credits	L	T	P	Credits
	-	-	6	3
Total Contact Hours	72			
Pre-requisites	Basic Programming			

### Learning Objective:

Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc. 2. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.

### Course Outcome:

- CO1:** Create the procedure of communication between Objects, classes & methods.
- CO2:** Understand the elementary facts of Object Orientation with various characteristics as well as several aspects of Java.
- CO3:** Analyze distinct features of different string handling functions with various I/O operations.
- CO4:** Discuss simple Code Reusability notion w.r.t. Inheritance, Package and Interface.
- CO5:** Apply Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

### Suggestive List of Experiments:

1. Simple Java programming using operators, control statements & loops, array. **[2 day(s)]**
2. Programming on class, object, and method, access specifier, Programming on constructor, method/constructor overloading. **[2 day(s)]**
3. Programming on this keyword, call by value & call by reference, static variables & methods, inner classes. **[2 day(s)]**
4. Programming to show the use of String class methods - charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray(), toLowerCase(), toString(), toUpperCase(), trim(), valueOf() methods. **[2 day(s)]**
5. Programming to show the use of StringBuffer class methods - append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods. **[2 day(s)]**
6. Programming using keyboard input by implementing BufferedReader & Scanner classes. **[2 day(s)]**

7. Programming on Simple Inheritance, super and final keywords, super() method [2 day(s)]
8. Programming on method overriding, dynamic method dispatch, abstract classes & methods, multiple inheritance by using interface. [2 day(s)]
9. Programming on importing system package, creating user-defined package, importing user-defined package, using protected access specifier, subclassing an imported class of a package, using same names for classes of different packages, adding multiple public classes to a package. [2 day(s)]
10. . Programming on exception handling using try-catch block, implementing throw and throws keywords, using finally block, creating user-defined exception. [2 day(s)]
11. Programming on creating child threads i) by extending thread class ii) by implementing runnable interface, creating child threads by assigning thread priorities. [2 day(s)]
12. Programming on creating simple applet to display some message, creating applet two add 2 integers, creating applet to do GUI based programming. [2 day(s)]

**Text/Reference Books:**

1. H. Schildt , "Java: The Complete Reference " , TMH
2. E. Balagurusamy , " Programming With Java: A Primer " , , TMH.

**CO-PO Mapping:**

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

Course Code	XCA4103			
Course Title	Network Lab			
Category	PC			
LTP & Credits	L	T	P	Credits
	-	-	6	3
Total Contact Hours	72			
Pre-requisites	None / If Any			

### Learning Objective:

In this laboratory course, the students will be learning network programming using the socket API system calls, and also analyze packets flowing over the network. Also, a number of algorithms at the datalink and network layers shall be simulated and the results analyzed.

### Course Outcome:

- CO1:** To learn how to use socket API system calls for network programming
- CO2:** To learn how to capture network packets and analyze them
- CO3:** To analyze various algorithms at the datalink and network layers through simulation

### Suggestive List of Experiments:

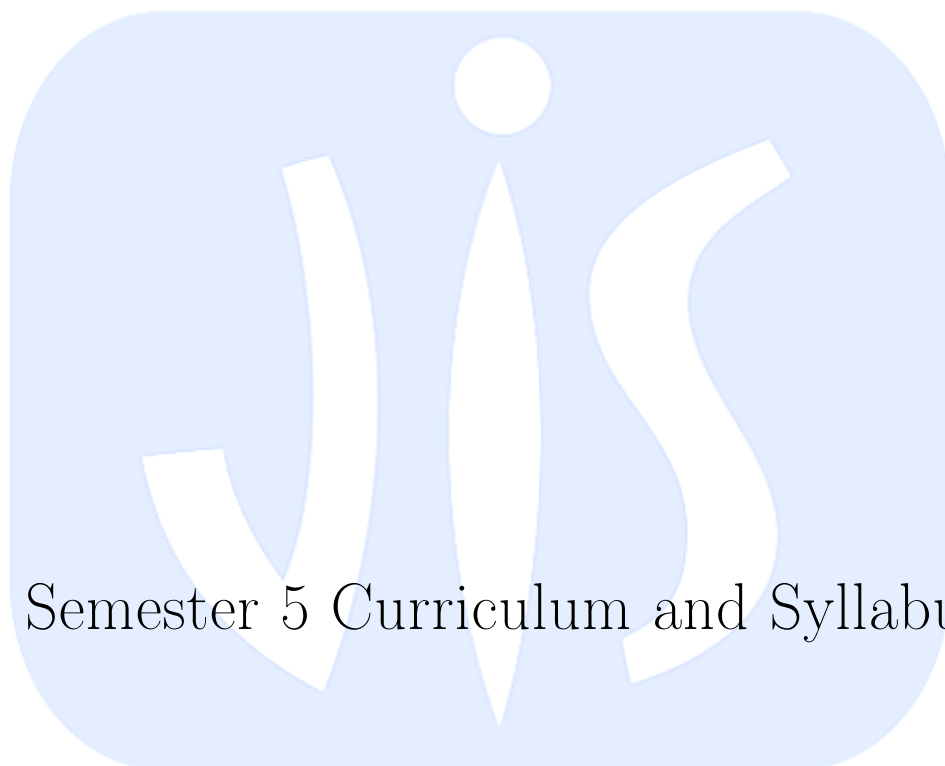
1. Familiarization with Berkeley socket interface system calls in C, and writing programs to communicate between two machines using both connection-oriented (TCP) and connection-less (UDP) protocols. **[3 days]**
2. Write programs in C to simulate the stop-and-wait and sliding-window protocols, and carry out performance analyses both in the absence of errors and also in presence of errors. **[2 days]**
3. Familiarization with a packet capturing and analysis tool (like Wireshark), and analyze packets as captured under various data transfer scenarios over the network. **[2 days]**
4. Write a program in C to simulate a router for filtering IP packets (make the specification of the problem as realistic as possible).. **[3 days]**
5. Write programs to implement the distance vector algorithm for building up the routing tables in a network of routers.. **[2 days]**

### Text/Reference Books:

1. W. Stallings, "Data and Computer Communication (5th Ed.)", PHI / Pearson Education.
2. B. A. Forouzan, "Data Communication and Networking (3rd Ed.)", Tata-McGraw Hill.
3. W. R. Stevens, "UNIX Network Programming (3rd Ed.)", Prentice-Hall, Addison-Wesley.

### CO-PO Mapping:

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



Semester 5 Curriculum and Syllabus

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SEMESTER-5							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PC	XCA5001	Web Technology	3	1	-	4
2	PC	XCA5002	Network Administration with Linux/U-nix	3	1	-	4
3	OE	XBB5001	Management and Accounting	3	1	-	4
<b>PRACTICAL</b>							
6	PC	XCA5101	Web Technology Laboratory	-	-	6	3
7	PC	XCA5102	Network Administration Lab	-	-	6	3
8	Project	XCA5103	Minor Project	-	-	9	6
<b>SESSIONAL</b>							
10	Project	XCA5201	Industrial Training	-	-	-	3
11	OE	XCA5202	Seminar and GD	-	-	1	1
12	Project	XCA5203	Skillx	-	-	1	1
<b>TOTAL</b>							<b>29</b>



Course Code	XCA5001			
Course Title	Web technology			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	40			
Pre-requisites	None / If Any			

### Learning Objective:

To impart the design, development and implementation of Static and Dynamic Web Pages

To develop programs for Web using Scripting Languages and .net framework.

To give an overview of Server Side Programming in Web

### Course Outcome:

- CO1:** To understand the notions of World Wide Web(www), Internet, HTTP Protocol, Web Browsers, Client-Server etc.
- CO2:** To develop interactive web pages using HTML, DHTML and CSS.
- CO3:** To procure the knowledge of different information interchange formats like XML.
- CO4:** To design web applications using scripting languages like JavaScript, CGI, PHP.
- CO5:** To acquire the server side programming concepts using servlet, JSP and .Net framework.

### Course Content:

#### **Module 1 : Visual Basic .NET and the .NET Framework [8L]**

Introduction to .net framework - Features, Common Language Runtime (CLR), Framework Class Library (FCL), Visual Studio.Net – IDE, Languages Supported, Components, Visual Programming, VB.net- Features, IDE- Menu System, Toolbars, Code Designer, Solution Explorer, Object Browser, Toolbox, Class View Window, Properties Window, Server Explorer, Task List, Output Window, Command Window

#### **Module 2: : Elements of Visual Basic .net [8L]**

Properties, Events and Methods of Form, Label, Text Box, List Box, Combo Box, Radio Button, Button, Check Box, Progress Bar, Date Time Picker, Calendar, Picture Box, Scroll bar, Group Box, ToolTip Timer

#### **Module 3: : Programming in Visual basic .net [8L]**

Data Types, Keywords, Declaring Variables and Constants, Operators, Understanding Scope and accessibility of variables, Conditional Statements- If- Then, If-Then- Else, Nested If, Select Case, Looping Statement- Do loop, For Loop, For Each-Next Loop, While Loop, Arrays-Static and Dynamic

#### **Module 4: : Functions, Built in Dialog Boxes, Menus and Toolbar [8L]**

Menus and toolbars- Menu Strip, Tool Strip, Status Strip, Built-In Dialog Boxes – Open File Dialogs, Save File Dialogs, Font Dialogs, Color Dialogs, Print Dialogs, Input Box, Message Box, Interfacing With End user - Creating MDI Parent and Child, Functions and Procedures- Built-In Functions- Mathematical and String Functions, User Defined Functions and Procedures

**Module 5: : Object Oriented Programming**

**[8L]**

Object Oriented Programming- Creating Classes , Objects, Fields, Properties, Methods, Events , Constructors and destructors, Exception Handling - Models, Statements, File Handling- Using File Stream Class, File Mode, File Share, File Access Enumerations, Opening or Creating Files with File Stream Class, Reading and Writing Text using StreamReader and StreamWriter Classes, Data Access withADO.Net – What are Databases?, Data Access with Server Explorer, Data Adapter and Data Sets, ADO.NET Objects and Basic SQL. Connection with Sql Server.

**Text/Reference Books:**

1. F. Barwell, “Professional VB.NET (2nd edition)”, WROX Publication.

**CO-PO Mapping:**

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

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Course Code	XCA5002			
Course Title	Network Administration with Linux/Unix			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Operating System			

### Learning Objective:

- To familiarize the students with the Linux/UNIX environment.
- To learn the fundamentals of shell scripting/programming
- To familiarize students with basic Linux administration

### Course Outcome:

- CO1:** Work confidently in Unix/Linux environment
- CO2:** Write shell scripts to automate various tasks
- CO3:** Master the basics of Linux administration
- CO4:** Implement and innovate commands using the basic programming tool kit.

### Course Content:

**Module 1:** [6L]  
 UNIX operating system, UNIX architecture: Kernel and Shell, Files and Processes, System calls, Features of UNIX, POSIX and single user specification, Internal and external commands Calendar (cal), Display system date (date), Message display (echo), Calculator (bc), Password changing (password), Knowing who are logged in (who), System information using uname, File name of terminal connected to the standard input (tty) File system, Types of file, File naming convention, Parent & Child relationship, HOME variable, inode number, Absolute pathname, Relative pathname, Significance of dot (.) and dotdot (.), Displaying pathname of the current directory (pwd), Changing the current directory (cd), Make directory (mkdir), Remove directories (rmdir), Listing contents of directory (ls), Very brief idea about important file systems of UNIX: /bin, /usr/bin, /sbin, /usr/sbin, /etc, /dev, /lib, /usr/lib, /usr/include, /usr/share/man, /temp, /var, /home

**Module 2:** [12L]  
 Displaying and creating files (cat), Copying a file (cp), Deleting a file (rm), Renaming/ moving a file (mv), Paging output (more), Printing a file (lp), Knowing file type (file), Line, word and character counting (wc), Comparing files (cmp), Finding common between two files (comm), Displaying file differences (diff), Creating archive file (tar), Compress file (gzip), Uncompress file (gunzip), Archive file (zip), Extract compress file (unzip), Brief idea about effect of cp, rm and mv command on directory File and directory attributes listing and very brief idea about the attributes, File ownership, File permissions, Changing file permissions & relative permission & absolute permission, Changing file ownership, Changing group ownership File system and inodes, Hard link, Soft link, Significance of file attribute for directory Default permissions of file and directory and using umask, Listing of modification and access time, Time stamp changing (touch), File locating (find)

**Module 3: [12L]**

Interpretive cycle of shell, Types of shell, Pattern matching, Escaping, Quoting, Redirection, Standard input, Standard output, Standard error, /dev/null and /dev/tty, Pipe, tee, Command substitution, Shell variables Basic idea about UNIX process, Display process attributes (ps), Display System processes, Process creation cycle, Shell creation steps (init -> getty -> login -> shell), Process state, Zombie state, Background jobs (& operator, nohup command) Reduce priority (nice), Using signals to kill process, Sending job to background (bg) and foreground (fg), Listing jobs (jobs), Suspend job, Kill a job, Execute at specified time (at and batch)

**Module 4: [6L]**

Use of environment variables, Some common environment variables (HOME, PATH, LOGNAME, USER, TERM, PWD, PS1, PS2), Aliases, Brief idea of command history Prepare file for printing (pr), Custom display of file using head and tail, Vertical division of file (cut), Paste files (paste), Sort file (sort), Finding repetition and non-repetition (uniq), Manipulating characters using tr, Searching pattern using grep, Brief idea of using Basic Regular Expression (BRE), Extended Regular Expression (ERE), and egrep, grep

**Module 5: [12L]**

Simple shell scripts, Interactive shell script, Using command line arguments, Logical operator (&&,I,||), Condition checking (if, case), Expression evaluation (test, ||), Computation(expr), Using expr for strings, Loop (while, for), Use of positional parameters Essential duties of UNIX system administrator, Starting and shutdown, Brief idea about user account management (username, password, home directory, group id, disk quota, terminal etc.)

**Text/Reference Books:**

1. S. Das, "UNIX-Concepts & Applications", TMH
2. J. Peek, "Learning UNIX Operating System", SPD/O'REILLY
3. A.E. Frisch, "Essentials Systems Administration", SPD/O'REILLY

**CO-PO Mapping:**

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

Course Code	XBB5001			
Course Title	Management and Accounting			
Category	OE			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

To develop , understand the importance of Financial Accounting, Cost Accounting and Management Accounting in Business. To develop ability to analyse and interpret Financial Statements, the cost elements and the decision making aspects.

### Course Outcome:

- CO1:** To learn preparation of financial statements in accordance with appropriate accounting standards.
- CO2:** To learn and implement the knowledge of accounting while preparing journal, ledger accounts using double entry book keeping system
- CO3:** To learn the cost elements and different types of cost incurred in the production process
- CO4:** To implement the cost related information like material, labour & overhead for planning and control
- CO5:** To enhance the knowledge about the about the decision making aspects of Management Accounting
- CO6:** To understand and identify the profitability aspect in a business

### Course Content:

#### Module 1: Financial Accounting [15L]

1. Basic Concept of Accounting 2. Concepts and Conventions of Accounting 3. Journal Entries and Ledger Posting 4. Trial Balance. 5. Financial Statement

#### Module 2: Cost Accounting [10L]

1. Basic Concept of Cost 2. Classification of Cost 3. Cost Sheet 4. Materials - EOQ, LIFO and FIFO 5. Labor - Wage payment System (Piece Rate, Time Rate, Halsey and Rowan Scheme) 6. Overheads - Meaning and Distribution (Primary Distribution)

#### Module 3: Management Accounting [15L]

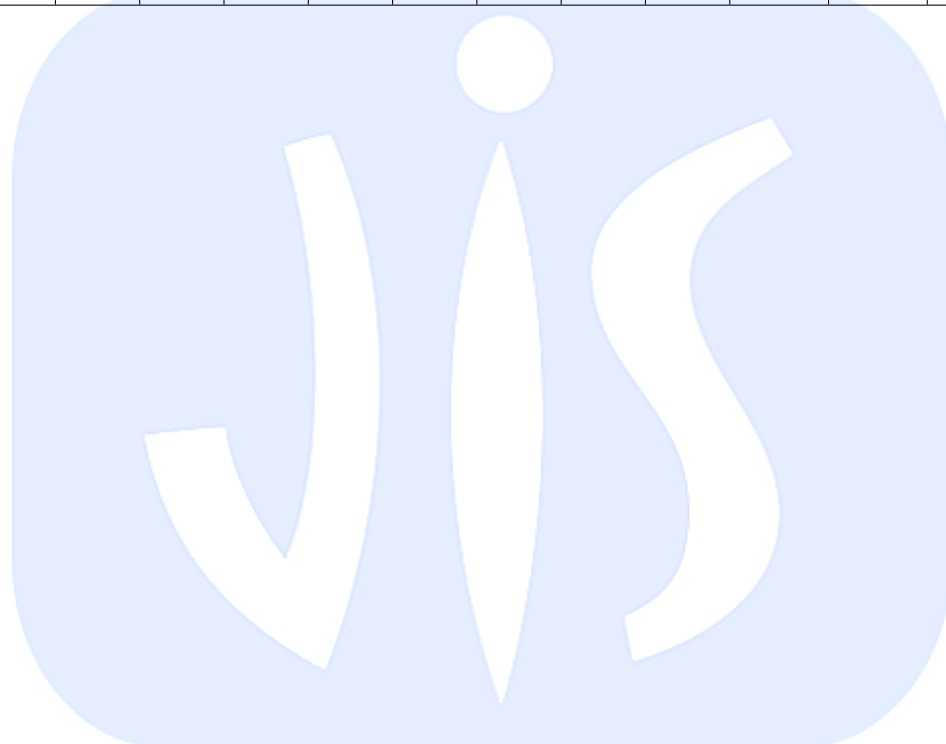
1. Basics of Management (Planning, Scheduling, Organizing, Staffing, Directing and Controlling) 2. Sources of Finance- long Term and Short Term 3. Cost-Volume -Profit Analysis 4. Capital Budgeting 5. Budget and Budgetary Control (Cash and Flexible Budget) 6. Investment of Funds [Conceptual Framework of Mutual Fund and Systematic Investment Plan (SIP)]

### Text/Reference Books:

1. P. Chatterjee, "Economics for Engineers" , Vrinda Publications P Ltd

**CO-PO Mapping:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	3	1	1	3	-	3	3
CO2	1	-	3	-	-	2	1	3	3	1	3	3
CO3	-	-	2	3	3	-	2	3	3	-	1	3
CO4	-	1	-	3	-	2	1	2	2	2	3	2
CO5	-	1	-	3	-	3	2	2	3	1	3	3
CO6	-	-	-	2	-	2	1	3	3	3	3	3




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Course Code	XCA5101			
Course Title	Web Technology Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	6	3
Total Contact Hours	36			
Pre-requisites	a) Data Structures and Algorithms b) Operating Systems c) Data Base Management System d) Computer Networks			

### Learning Objective:

In this laboratory course, the students will be carrying out various software assignments on web page designing using html, creating standard document structure using xml, client side scripting using javascript and java applet, and serverside scripting using perl, php, java servlet and jsp. Also, assignments for creating client-server application using TCP/IP sockets.

### Course Outcome:

- CO1:** To design web page using HTML and customizing their appearance using CSS.
- CO2:** To learn how to create standard document structure using XML and validating documents using XML schema.
- CO3:** To learn how to write javascripts and java applets for web pages to carry out dynamic tasks on a web page.
- CO4:** To create web pages dynamically on request, authenticating user access and managing information access from a database.
- CO5:** To create and simulate client-server application using TCP/IP sockets.

### Suggestive List of Experiments:

1. Design web pages using HTML using various components for user inputs (text field, password field, text area, selection box, checkbox, radio button, reset button and submit button), representing data in tabular form, changing appearance of web pages, incorporating audio, image, etc., linking to other resources (web pages/images) and sections. **[4 days]**
2. Create document structure using XML and use DTD and stylesheet to validate documents and change their appearance. **[4 days]**
3. Write client side scripts that includes javascripts and java applet and embed them in web pages. **[4 days]**
4. Write cgi scripts using pearl to generate web pages dynamically. **[2 day]**

5. Create dynamic web pages, managing user's session, storing information in a database using php, servlet and jsp. **[8 days]**
  
6. Implement client-server applications running on different systems connected via a network using TCP/IP socket programming. **[2 days]**

**Text/Reference Books:**

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007
2. Marty Hall and Larry Brown, "Core Web Programming"- Second Edition-Volume I and II, Pearson Education, 2001.
3. A. Ravichandran, "Internet and Web Technology", Khanna Book Publishing Company, 2013
4. C. Xavier, "Web Technology and Design", New Age, 2018.
5. M. Bach, "Design of the Unix Operating System", Prentice-Hall of India.

**CO-PO Mapping:**

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



Course Code	XCA5102			
Course Title	Network Administration Laboratory			
Category	Professional Core			
LTP & Credits	L	T	P	Credits
	0	0	6	3
Total Contact Hours	36			
Pre-requisites	a) Operating Systems b) Computer Networks			

### Learning Objective:

In this laboratory course, the students will understand the basic set of commands and utilities in Linux/UNIX systems. They will be able to learn command structure of LINUX, various types of shells, types of commands. Moreover, the course will also familiarize students with some general commands, directory and file related commands. The student will also learn editors available in LINUX and the detailed working using Vi editor.

### Course Outcome:

- CO1:** Understand Shell variables and shell keyword
- CO2:** Write the shell program for simple problem
- CO3:** Understand type of process and pipes in Linux.
- CO4:** Understand back ground and fore ground Process
- CO5:** Understand Linux System Administration

### Suggestive List of Experiments:

1. Calendar, Display system date, Message display, Calculator, Password changing, Knowing who are logged in, Knowing System information **[4 days]**
2. Displaying pathname of the current directory (pwd), Changing the current directory (cd), Make directory (mkdir), Remove directories (rmdir), Listing contents of directory (ls and its options), Absolute pathname, Relative pathname, Using dot (.) and dotdot (..) **[4 days]**
3. Displaying and creating files, Copying a file, Deleting a file, Renaming/ moving a file, Paging output, Knowing file type, Line, word and character counting (wc), Comparing files, Finding common between two files, Displaying file differences **[4 days]**
4. File and directory attributes listing, File ownership, File permissions, Changing file permissions – relative permission and absolute permission, Changing file/group ownership, File system and inodes, Hard link, Soft link, Default permissions of file, directory and using umask, Listing of modification and access time, Time stamp changing, File locating **[6 day]**
5. Types of shell, Pattern matching, Escaping, Quoting, Redirection, Pipe, tee, Command substitution, Shell variables **[4 days]**

6. Display process attributes, Display System processes, Background jobs, Reduce priority, Sending job to background and foreground, Listing jobs **[4 days]**
7. Prepare file for printing, Custom display of file using head and tail, Vertical division of file, Paste files, Sort file, Finding repetition and non-repetition, Manipulating characters using, Searching pattern **[4 days]**
8. Introduction to VI/VIM editor, Different commands of the editor, File editing in the editor, Introduction to shell script Simple shell scripts, Interactive shell script, Using command line arguments, Logical operator, Condition checking (if-then, if-then-else-fi, if-then—elif-else-fi, case), Expression evaluation (test, []), Computation (expr), Using expr for strings, Loop (while, for, until, continue), Use of positional parameters, Simple implementation of basic LINUX commands, utilities, filters etc. using shell scripts **[6 days]**

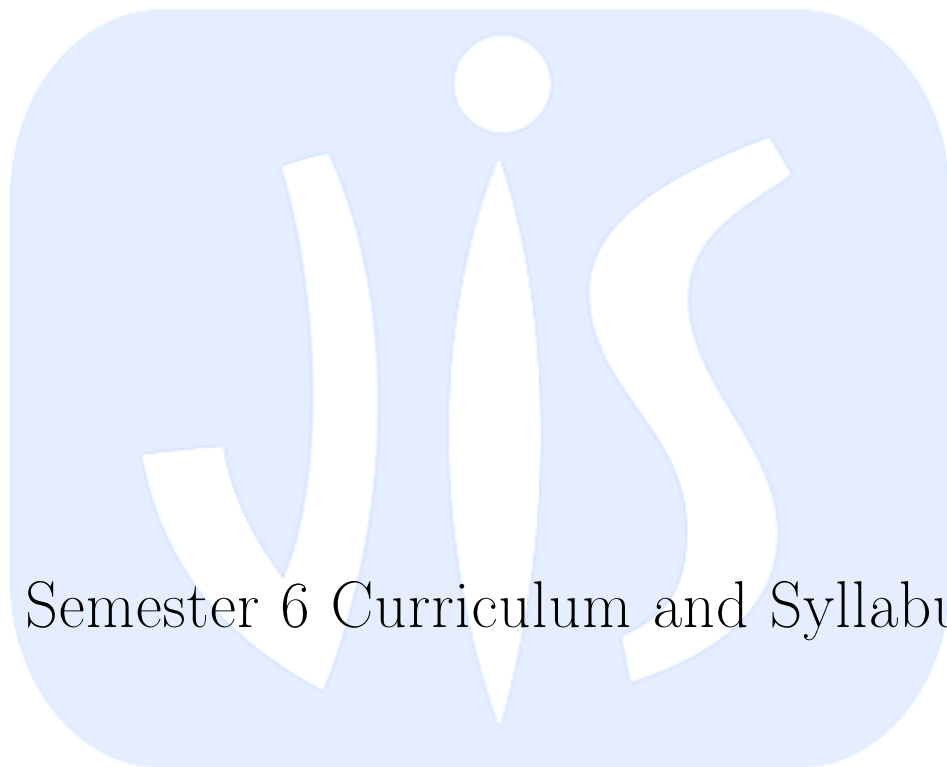
#### Text/Reference Books:

1. M. Bach, “Design of the Unix Operating System”, Prentice-Hall of India.
2. Fedora 9 And Red Hat Enterprise Linux Bible by Christopher Negus, Wiley India Ltd.
3. Linux Bible, 9ed, by Christopher Negus, Wiley India Ltd.

#### CO-PO Mapping:

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

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Semester 6 Curriculum and Syllabus

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SEMESTER-6							
Sl. No.	Type	Course No.	Course Name	L	T	P	Credits
<b>THEORY</b>							
1	PE		Elective I	3	1	-	4
		XCA601A	Python Programming				
		XCA601B	Artificial Intelligence				
		XCA601C	PHP/MySQL				
2	PE		Elective II	3	1	-	4
		XCA602A	Machine Learning				
		XCA602B	Mobile Computing				
		XCA602C	Cyber Law and Security				
		XCA602D	E Commerce				
3	HS	XBB6001	Values and Ethics	3	1	-	4
<b>PRACTICAL</b>							
4	PE		Lab for Elective I	-	-	6	3
		XCA611A	Python Programming Lab				
		XCA611B	Artificial Intelligence Lab				
		XCA611C	PHP/MySQL Lab				
5	Project	XCA6101	Major Project with viva voice	-	-	15	12
<b>SESSIONAL)</b>							
6	OE	XCA6201	Seminar and GD	-	-	1	1
7	Project	XCA6202	Skillx	-	-	1	1
<b>TOTAL</b>							<b>29</b>

Course Code	XCA601A			
Course Title	Python Programming			
Category	Elective			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Computer Fundamentals and C Programming			

### Learning Objective:

The Python programming language which is one of the most popular programming languages worldwide. The course shows you how to use the free open-source Python to write basic programs and high level applications using concepts such as Class, list, tuple, dictionary, functions, variables, If Else statements, For loops, While loops, iterative and recursive programs and the students will be made familiar with the concepts of various modules, packages and python libraries used for various applications.

### Course Outcome:

- CO1:** Understand and explain the basic principles of Python programming language and object oriented concept.
- CO2:** Define and demonstrate the use of built-in data structures along with the help of condition checking and looping structures.
- CO3:** Understand and apply various applications of different modules and packages in Python.
- CO4:** Learn to handle exceptions and files in Python.

### Course Content:

#### **Module 1: Parts of Python Programming Language [12L]**

Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language, Control Flow Statements, The if Decision Control Flow Statement, The if...else Decision Control Flow Statement, The if...elif...else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Catching Exceptions Using try and except Statement, Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Command Line Arguments.

#### **Module 2: Strings in Python [8L]**

Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement.

#### **Module 3: Data Structures in Python [10L]**

Dictionaries, Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement, Tuples and Sets, Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Tuple Methods, Using zip() Function, Sets, Set Methods, Traversing of Sets, Frozenset.

**Module 4: Modules and File Handling in Python [8L]**

Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules, Regular Expression Operations, Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module.

**Module 5: OOPs Features in Python [10L]**

Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism.

**Text/Reference Books:**

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

**CO-PO Mapping:**

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

Course Code	XCA601B			
Course Title	Artificial Intelligence			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	-	4
Total Contact Hours	48			
Pre-requisites	Data Structure, Algorithms			

### Learning Objective:

In this course, the students will learn the basic concepts, theories and techniques of artificial intelligence and also help students to learn the application of machine learning / AI algorithms in different fields of Computer Engineering.

### Course Outcome:

- CO1:** To explain the basic concept of Artificial Intelligence and its applications
- CO2:** To classify and analyze various AI tools and techniques
- CO3:** To learn and evaluate various AI algorithms
- CO4:** To apply the basic understanding of artificial intelligence in real world applications

### Course Content:

#### Module 1: Introduction to Artificial Intelligence (AI)

**[7L]**

Overview: foundations, scope, problems, and approaches of AI. Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents.

#### Module 2: AI Techniques

**[7L]**

Artificial Intelligence programming techniques, Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A\*, AO\*, min-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. Kaushik, " Logic and prolog programming. New Age", 2002.

**CO-PO Mapping:**

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



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Course Code	XCA601C			
Course Title	PHP/MySQL			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	a) Programming and Data Structures b) Data Base Management Systems			

### Learning Objective:

In this course, the students will learn about web server programming using PHP and database programming to access and manipulate data in a MySQL database. This course will cover the basic PHP statements, client request, server response, session, cookies and error handling. This course will also cover database management in MySQL and manipulating data using PHP. After the completion of this course, the students will better understand the development of web applications.

### Course Outcome:

- CO1:** To explain the server side scripting language to construct web applications
- CO2:** To know how requests are processed and responses are generated using PHP
- CO3:** To know the interaction between PHP and MySQL database for data manipulation
- CO4:** To design web applications as one-, two- and three-tier architectures

### Course Content:

#### Module 1: PHP Language [8L]

Basics of HTML: forms, GET, POST.

PHP requisites, xampp and wampp installation, syntax, data types: variables, strings, constants, operators, images, date and time, strings and array functions, regular expressions, control structures: if...else...elseif and switch.

Loops: for, foreach, while, user defined functions

#### Module 2: MySQL Database [6L]

Introduction to database, DDL queries: create, alter, delete, and drop tables.

DML queries: select, insert, update, delete table data .

Clause and operators: and, or, in, between, like, distinct, order by, group by, union, sub-queries, left join, right join, inner join.

#### Module 3: PHP and MySQL Integration [6L]

Connecting to MySQL database: MySQL, MySQLi (object oriented and procedural), and PDO.

Searching database and rendering web page, insert, update and delete records.

Database architecture: one tier, two tier and three tier. Data prevention and SQL injection.

**Module 4: File, Session and Cookies**

**[6L]**

*Functions for file inclusion include, include\_once, require, require\_once, fileupload/download, file variables, create, modify and destroy.*

**Module 5: Advanced PHP**

**[10L]**

OOP's Concept: Classes and objects, inheritance, static methods, method overloading, abstract class and interface.

Error handling: exception, try-catch-throw, filters.

jQuery: syntax, selectors, events, effects, show/hide, fade, slide, animate, stop.

Ajax: jQuery AJAX example, AJAX database programming with PHP, pagination, query string.

**Text/Reference Books:**

1. R. Nixon, "Learning PHP, MySQL and JavaScript: With jQuery, CSS and HTML5", O'Reilly, 2018.
2. D. Reiersol, M. Baker, C. Shiflett, "PHP in Action: Objects, Design, Agility", Manning, 2007.
3. B. Brinzarea-Iamandi, C. Darie, A. Hendrix, "AJAX and PHP: Building Modern Web Applications", Packt, 2009

**CO-PO Mapping:**

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

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Course Code	XCA602A			
Course Title	Machine Learning			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	-	4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

It covers some of the important regression, classification, clustering, rule-based and probabilistic models and algorithms. The Themes included linear and logistic regression, regularization, decision trees, probabilistic, SVMs and neural networks, clustering and reduction in feature dimensionality.

### Course Outcome:

- CO1:** To explain and formulate machine learning problems corresponding to different applications
- CO2:** To classify machine learning algorithms and analyze their strengths and weaknesses
- CO3:** To explain the basic theory underlying machine learning
- CO4:** To apply machine learning algorithms to solve problems of moderate complexity

### Course Content:

#### Module 1: Introduction to Machine-based Learning [4L]

Applications and problems, learning scenarios, concepts of tasks (problems to be solved by machine learning), models (output of machine learning) and features (workhorses of machine learning), geometric models, probabilistic models, logical models.

#### Module 2: Binary and Multi-class Classification [5L]

Binary classification, assessing and visualizing performance of classification, scoring and ranking, turning rankers into classifiers, class probability estimation. Multiclass classification, multiclass scores and probabilities, regression, unsupervised and descriptive learning, predictive and descriptive clustering.

#### Module 3: Rule Learning and Decision Trees [7L]

Decision trees, ranking and probability estimation trees, tree learning as variance reduction, regression trees, learning ordered rule lists, learning unordered rule sets, descriptive rule learning, rule learning for subgroup discovery, association rule mining, first-order rule learning, Least squares method, multivariate linear regression, 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, naïve Bayes model for classification, probabilistic models with hidden variables, Gaussian mixture model, compression-based model.

**Module 5: Feature Processing**
**[6L]**

Types of features, calculation on features, categorical, ordinal and quantitative features, structured features, thresholding and discretization, normalization and calibration, incomplete features, feature selection - matrix transformations and decompositions.

**Module 6: Other Machine Learning Topics of Interest**
**[6L]**

Bagging and random forests, boosted rule learning, mapping the ensemble landscape – bias, variance and margins, meta learning. What to measure, how to measure, how to interpret, interpretation of results over multiple data sets.

**Text/Reference Books:**

1. P. Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, Cambridge University Press.
2. M. Mohri, A. Rostamizadeh and A. Talwalkar, “Foundations of Machine Learning”, MIT Press.
3. K. P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press.

**CO-PO Mapping:**

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

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Course Code	XCA602B			
Course Title	Mobile Computing			
Category	PC			
LTP & Credits	L	T	P	Credits
	3	1	-	4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

Describe the basic concepts and principles in mobile computing. To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices. Understand positioning techniques and location-based services and security issues

### Course Outcome:

- CO1:** Analyze the working of modern communication technologies.
- CO2:** Demonstrate the various routing algorithms for both infrastructure based and ad hoc networks.
- CO3:** Develop mobility and bandwidth management in cellular network
- CO4:** Design and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies
- CO5:** Identify the technical issues related to recent mobile computing environment.

### Course Content:

#### Module 1: Introduction

**[7L]**

Evolution of different types of wireless communication devices; Effects of mobility of devices; Cellular mobile networks – mobility management (call setup, handoff, interoperability and internetworking), bandwidth management, energy management, security; Brief introduction about different generations of wireless communication technology – 1G, 2G, 3G, 4G, 5G.

#### Module 2: Mobile Data Communication

**[7L]**

Mobile Data Communication, WLANs (Wireless LANs) IEEE 802.11 standard, Bluetooth technology, Bluetooth Protocols, Ad hoc networks initialization, leader election, location identification, communication protocols, energy and security.

#### Module 3: Mobility Management in Cellular Networks

**[7L]**

Call setup in PLMN (location update, paging), GPRS, Call setup in mobile IP networks; Handoff management; Mobility models- random walk, random waypoint, map-based, group-based.

#### Module 4: Bandwidth Management in Cellular Mobile networks

**[4L]**

Mathematical formulation of the channel assignment problem (CAP); CAP and generalized graph coloring; Benchmark instances; Lower bound on bandwidth.

#### Module 5: Localization of Nodes in a Mobile Network

**[5L]**

Different approaches, Indoor and outdoor localizations, LOS and NLOS signals, Outdoor localization techniques – triangulation (TOA-based, AOA- based), errors due to inaccuracies in coordinates of beacon nodes and in measurements.

**Module 6: Message Communication in Ad Hoc Networks [6L]**

Collision avoidance mechanism (different schemes for a deterministic transmission schedule), collision resolution mechanism – successive partitioning approach; Time slot assignment based on location information, Point-to-point routing in ad hoc networks – proactive, reactive and hybrid approaches, different protocols - DSDV, DSR, AODV, TORA, ZRP

**Module 7:Energy-efficient Communication [5L]**

Energy efficiency at various layers - Physical layer, MAC layer, Network layer, Application layer, performance analysis in noisy channel environment.

**Module 8: Secure Wireless Communication [6L]**

Introduction-different types of attacks, internal attacks, external attacks; measures against attacks (authentication, intrusion detection, encryption); RC4 algorithm

**Text/Reference Books:**

1. K. Sinha, S.Ghosh,B. P. Sinha, "Wireless Networks and Mobile Computing", CRC Press : New York, 2015.
- :

**CO-PO Mapping:**

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

Course Code	XCA602C			
Course Title	Cyber Law and Security			
Category	PE			
LTP & Credits	L	T	P	Credits
	3	1	-	4
Total Contact Hours	48			
Pre-requisites	None / If Any			

### Learning Objective:

In this course, the students will understand, explore and acquire a critical understanding of laws and regulations that exist in cyber space. Topics like IT Act 2000, legal issues in e-business, and case studies will be discussed.

### Course Outcome:

- CO1:** To explain the fundamental concepts of Cyber Law and their implications
- CO2:** To analyze the essential concepts under IT Act 2000
- CO3:** To explain and analyze the rules and regulations that exists in cyber space

### Course Content:

#### Module 1: Introduction to Cyber Law [10L]

Evolution of information technology: emergence of cyber space, cyber jurisprudence, jurisprudence and law, doctrinal approach, consensual approach.

Cyber ethics, cyber jurisdiction, hierarchy of courts, civil and criminal jurisdictions, cyberspace: web space, web hosting and web development agreement, legal and technological significance of domain names, Internet as a tool for global access.

#### Module 2: Information Technology Act [10L]

Overview of IT Act 2000, amendments and limitations of IT Act, digital signatures, drawbacks of public-key and private-key cryptography, electronic governance, legal recognition of electronic records, legal recognition of digital signature certifying authorities, cyber crime and offences, network service providers liability, cyber regulations appellate tribunal, penalties and adjudication.

#### Module 3 : Cyber Law and Related Legislation [12L]

Patent law, trademark law, copyright, software piracy, domain names and copyright disputes, electronic database and its protection, civil procedure code, IT act and criminal procedural code.

Relevant sections of: Indian evidence act, bankers book evidence act, Indian Penal Code, Reserve Bank of India Act. Law relating to employees and Internet, alternative dispute resolution, online disputes resolution.

#### Module 4 : Electronic Business and Legal Issues [8L]

Evolution and development in E-commerce, paper versus paper-less contracts. E-Commerce models: B2B, B2C, E-security.

Application area: business, taxation, electronic payments, supply chain, E-markets, emerging trends.

**Module 5 : Case Studies on Cyber Crime**

**[8L]**

Harassment over emails, email spoofing, cyber pornography, cyber stalking.

**Text/Reference Books:**

1. K. Kumar, “Cyber Laws: Intellectual Property and E-Commerce Security”, Dominant Publisher.
2. R. D. Ryder, “Guide to Cyber Laws”, Wadhwa and Company.
3. NIIT, “Information Security: Policies and Implementation Issues”, Prentice-Hall of India.
4. V. Sharma, “Handbook of Cyber Laws”, Prentice-Hall of India.
5. Lawmann’s, “The Information Technology Act 2000”, Law Literature Publication, Kamal Publishers.

**CO-PO Mapping:**

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

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Course Code	XCA602D			
Course Title	E-Commerce			
Category	Elective			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	Software Engineering			

### Learning Objective:

In this course, the students will learn about e-marketplaces, the major types of electronic markets, and also know about different types of intermediaries in e-commerce. This subject also gives the idea on electronic catalogs, shopping carts, search engines, and describe the various types of auctions and list their characteristics.

### Course Outcome:

- CO1:** To explain the basic concept of E-Commerce and its applications.
- CO2:** To learn and analyze various ERP Tools.
- CO3:** To learn and analyze various E-Commerce concepts.
- CO4:** To apply the basic understanding of ERP in business environment.

### Course Content:

#### Module 1: Introduction to E-Commerce [14L]

Introduction What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of E-Commerce, Inter Organizational E-Commerce Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework Network Infrastructure for E-Commerce Network Infrastructure for E-Commerce, Market forces behind I Way, Component of I way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

#### Module 2: Mobile Commerce and ERP [9L]

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices, Web Security Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, firewalls & Network Security.

#### Module 3: E-Commerce Payment and Gateways [10L]

Electronic Payments Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card I Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

#### Module 4: E-Commerce and EDA [7L]

Net Commerce EDA, EDI Application in Business, Legal requirement in E -Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

**Module 5: Internet and E-Commerce**

**[8L]**

Internet and Electronic commerce, internet, extranet and enterprise solutions, information system for business operations, information system for managerial decision support, information system for strategic advantage.

**Text/Reference Books:**

1. T.P. Liang, “Electronic Commerce, A Managerial Perspective”, Prentice Hall.
2. R. Kalakota and A. Whinston, “Frontiers of Electronic Commerce”, Addison Wesley.
3. D. Amor, “The E-Business Revolution”, Addison Wesley.
4. M. Greenstein, “Electronic Commerce”, McGraw-Hill.

**CO-PO Mapping:**

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

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Course Code	XBB6001			
Course Title	Values and Ethics in Profession			
Category	HS			
LTP & Credits	L	T	P	Credits
	3	1	0	4
Total Contact Hours	48			
Pre-requisites	None			

### Learning Objective:

In this course, the students will learn to be awareness on professional ethics and human values.

### Course Outcome:

- CO1:** To explain the core values that shape the ethical behavior of an engineer
- CO2:** To understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories
- CO3:** To analyze various social issues, industrial standards, code of ethics, and role of professional ethics in engineering field
- CO4:** To explain the responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer
- CO5:** To acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

### Course Content:

#### Module 1: Introduction

**[2L]**

Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

#### Module 2: Psycho-social theories of moral development

**[4L]**

View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

#### Module 3: Ethical Concerns

**[4L]**

Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society.

Nature of values: Value Spectrum of a good life.

#### Module 4: Ethics of Profession

**[4L]**

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.

Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

**Module 5: Self Development**
**[4L]**

Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

**Module 6: Effects of Technological Growth**
**[6L]**

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics. Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

**Text/Reference Books:**

1. S. H. Unger, "Controlling Technology: Ethics and the Responsible Engineers", John Wiley & Sons.
2. D. Johnson, "Ethical Issues in Engineering", Prentice Hall.
3. A. N. Tripathi, "Human Values in the Engineering Profession", Monograph published by IIM, Calcutta, 1996.

**CO-PO Mapping:**

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

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Course Code	XCA611A			
Course Title	Python Programming Lab			
Category	Elective			
LTP & Credits	L	T	P	Credits
	0	0	6	3
Total Contact Hours	72			
Pre-requisites	XCA1101			

### Learning Objective:

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

### Course Outcome:

- CO1:** Understand and explain the basic principles of Python programming language and object oriented concept.
- CO2:** Define and demonstrate the use of built-in data structures along with the help of condition checking and looping structures.
- CO3:** Understand and apply various applications of different modules and packages in Python.
- CO4:** Learn to handle exceptions and files in Python.

### Suggestive List of Experiments:

1. History, Features, Setting up path, working with Python, Basic Syntax, Variable and Data Types, Operator. **[2 days]**
2. Conditional Statements: If, If- else, Nested if-else, Looping, For, While, Nested loops, Control Statements : Break, Continue, Pass. **[3 days]**
3. String Manipulation: Accessing Strings, Basic Operations on Strings, String slices, Function and Methods. Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods. **[3 days]**
4. Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods. Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties, Tuple vs. Dictionaries. **[3 days]**
5. Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables. **[3 days]**
6. Modules: Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing files, Reading

and writing files, Functions.

[4 days]

7. Exception and File Handling: Exception, Exception Handling, Except clause, Try & finally clause, User Defined Exceptions. [4 days]
  
8. A case study on using a computer game for teaching data structures on stacks and queues. The computer game is developed to help students visualize the data structures and data access operations on stacks and queues. This game-based learning is engaging, fun and, more importantly, abstract concepts in data structures can be visualized and learnt through game playing skills. [2 days]

**Text/Reference Books:**

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

**CO-PO Mapping:**

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

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Course Code	XCA611B			
Course Title	A			
Category	Artificial Intelligence Lab			
LTP & Credits	L	T	P	Credits
	-	-	6	3
Total Contact Hours	36			
Pre-requisites	Basic Programming, Design and Analysis of Algorithms			

### Learning Objective:

To learn the fundamentals of PROLOG Programming and to impart adequate knowledge on the need of PROLOG programming languages and problem solving techniques.

### Course Outcome:

- CO1:** Learn the concept of simple programming using PROLOG.
- CO2:** Understand the concept of AI based programs using PROLOG.
- CO3:** Develop the capability to represent various real life problem domains using logic based techniques

### Suggestive List of Experiments:

1. Basic computational related programs, e.g., factorial, Fibonacci, GCD etc. **[6 day(s)]**
2. Mini program to express the flavour of intelligence, e.g. if any symptoms are given, the disease should be identified using the program **[6 day(s)]**
3. Family tree related problem to understand how to apply logic to solve complex problems **[6 day(s)]**
4. Programs related to list/array **[6 day(s)]**

### Text/Reference Books:

1. S. Kaushik, " Logic and prolog programming, New Age," 2002.
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### CO-PO Mapping:

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

Course Code	XCA611C			
Course Title	PHP/MySQL Laboratory			
Category	Professional Elective			
LTP & Credits	L	T	P	Credits
	0	0	6	3
Total Contact Hours	72			
Pre-requisites	a) Programming and Data Structures b) Data Base Management Systems			

### Learning Objective:

In this course, the students will learn about PHP based implementation of web applications interfacing MySQL database for storage and retrieval of information and rendering information on web pages dynamically based on request from authentic users.

### Course Outcome:

- CO1:** To understand how to write dynamic web pages using PHP.
- CO2:** To design web pages using PHP and deploying in XAMPP or WAMPP server.
- CO3:** To store and retrieve information from MySQL database using PHP.
- CO4:** To learn how to provide secure access of web pages using session and cookies.

### Suggestive List of Experiments:

1. Basic web page creation using HTML. [2 day(s)]  
Basic PHP scripts and deployment on web server.  
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2. HTML form to accept user inputs and process using PHP. [2 day(s)]  
PHP scripts to page redirection.
3. PHP scripts to render data in tabular form. [2 day(s)]  
PHP scripts to perform arithmetic operations.
4. PHP scripts to verify information provided by user. [2 day(s)]  
PHP scripts to search/sort a list of user specified numeric data.
5. PHP scripts to store and retrieve information from database. [5 day(s)]
6. PHP scripts for file handling that includes file creation/writing, file opening/writing, file uploading/downloading. [4 day(s)]
7. PHP scripts to provide access to secure web pages to authenticated users using session and cookies. [2 day(s)]



8. PHP scripts to define class, interface, create objects, and method overloading. **[2 day(s)]**
9. PHP scripts, jQuery and Ajax to perform database access and other operations. **[3 day(s)]**

**Text/Reference Books:**

R. Nixon, "Learning PHP, MySQL and JavaScript: With jQuery, CSS and HTML5", O'Reilly, 2018.

D. Reiersol, M. Baker, C. Shiflett, "PHP in Action: Objects, Design, Agility", Manning, 2007.

B. Brinzarea-Iamandi, C. Darie, A. Hendrix, "AJAX and PHP: Building Modern Web Applications", Packt, 2009

**CO-PO Mapping:**

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

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