

MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102



SCHOOL OF LIBERAL ARTS AND SCIENCES

B.Sc. - Computer Science
(3 years)

B.Sc. - Computer Science (Hons.)
(4 Years Degree)

CURRICULUM AND SYLLABUS
(From 2025-26 Admitted Students)

FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM (FFCBCS)

Vision

To be a globally respected institution with an innovative and entrepreneurial culture that offers transformative education to advance sustainability and societal good.

Mission

- ❖ Develop industry-focused professionals with a global perspective.
- ❖ Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity.
- ❖ Create confluence of research, innovation, and ideation to bring about sustainable and socially relevant enterprises.
- ❖ Uphold high standards of professional ethics leading to harmonious relationship with environment and society.

SCHOOL OF LIBERAL ARTS AND SCIENCES

Vision

To be the ideal culmination for the edification of liberal arts and sciences recognised for excellence, innovation, entrepreneurship, environment and social consciousness.

Mission

- ❖ Infuse the essential knowledge of liberal arts and sciences, skills and an inquisitive attitude to conceive creative and appropriate solutions to serve industry and community.
- ❖ Proffer a know-how par excellence with the state-of-the-art research, innovation, and incubation ecosystem to realise the learners' fullest entrepreneurial potential.
- ❖ Endow continued education and research support to working professionals in liberal arts and sciences to augment their domain expertise in the latest technologies
- ❖ Entice the true spirit of environment and societal consciousness in citizens of tomorrow in solving challenges in liberal arts and sciences.

DEPARTMENT OF MATHEMATICAL SCIENCES

Vision

To become a Nation's center of excellence in the field Mathematical Sciences and its allied areas through teaching, training, and research.

Mission

- ❖ Disseminate the knowledge of a diverse group of students by providing solutions through contemporary curriculum.
- ❖ Creating a talent pool of faculty in diverse domains through continuous training.
- ❖ Domain and transferable skill development for holistic personality of students and employability.
- ❖ Inculcating values and Ethics for effective professional practice.

B.Sc. - Computer Science

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of B.Sc. Computer Science, will:

- PEO1.** Pursue higher education in their core or allied areas of specialization.
- PEO2.** Employed as a productive and valued professional in industry/teaching/research.
- PEO3.** Engaged in innovation and deployment as a successful entrepreneur.
- PEO4.** Adapt evolving technologies in the core or allied areas by participating in continuing education programs for lifelong learning.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of B.Sc. Computer Science will be able to:

- PO1** **Knowledge:** To study as well as apply concepts, theories, and practices across the disciplines to gain the foundational knowledge.
- PO2** **Problem Analysis:** To identify, analyze and evaluate various experiences and perspectives using foundational disciplinary knowledge for substantiated conclusions.
- PO3** **Design/Development of solutions:** To design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4** **Modern tool usage:** To create, select, and apply appropriate techniques, resources and modern tools with an understanding of the limitations.
- PO5** **Environment and Sustainability:** Understand the issues of environmental contexts and demonstrate the knowledge for sustainable development.
- PO6** **Ethics and Society:** Apply the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities under moral dimensions.
- PO7** **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, to manage projects and finance in multidisciplinary settings.
- PO8** **Effective Communication:** To develop proficiency and efficiency in communicating by connecting people, ideas, books, media, and technology.
- PO9** **Life-long learning:** Recognize the need for and acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the Program, the graduates of B.Sc. Computer Science program students will be able to:

- PSO1** Design, implement and test applications for complex computing problems for desired specifications through modern tool usage, appropriate technologies and programming skills
- PSO2** Use managerial and domain Skills of Information Management to model an application's data requirements using domain specific modeling tools, Transaction & Query processing, Indexing & Searching techniques, and extract information for interpreting the datasets for Decision Making.
- PSO3** Apply adaptive algorithms and techniques to develop intelligent systems for solving problems from inter-disciplinary domains. Use appropriate Computer networking models, design and develop secured information systems using appropriate algorithms, standards and principles for efficient data security and communication.

B.Sc. - Computer Science
Basket Wise - Credit Distribution

Sl. No.	Baskets	Credits (Min.- Max.)
1	SCHOOL CORE	28-36
2	PROGRAM CORE	36-42
3	PROGRAM ELECTIVES	24-30
4	INTERDISCIPLINARY MINOR	18-24
5	UNIVERSITY ELECTIVE	9-12
TOTAL CREDITS		Min. 120

B.Sc. - Computer Science Honours
Basket Wise - Credit Distribution

Sl. No.	Baskets	Credits (Min.- Max.)
1	SCHOOL CORE	28-36
2	PROGRAM CORE	42-54
3	PROGRAM ELECTIVES	36-45
4	INTERDISCIPLINARY MINOR	21-30
5	UNIVERSITY ELECTIVE	9-12
TOTAL CREDITS		Min. 160

SCHOOL CORE (28-36 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25CA102001	Programming for Problem Solving	3	-	2	-	4	-
25MM105001	IT Workshop	-	1	2	-	2	-
25MM101410	Discrete Mathematics for Computer Science	3	-	-	-	3	-
25MM102001	Digital Logic Design	3	-	2	-	4	
25CA105001	Computer Hardware and System Essentials	-	1	2	-	2	-
25CA101003	Basics of Virtualization and Cloud Technology	3	-	-	-	3	-
25LG102402	General English	2	-	2	-	3	-
25LG111001	English Language Proficiency	-	-	-	-	2	
25LG101403	German Language	2	-	-	-	2	-
25LG101407	French Language	2	-	-	-	2	-
25LG101402	Telugu	2	-	-	-	2	-
25LG101404	Sanskrit	2	-	-	-	2	-
25MM111001	Internship	-	-	-	-	2	-
25MM108001	Capstone Project	-	-	-	-	8	-
Mandatory Courses (Min. 6 Credits to be earned) Earned Credits will not be considered for CGPA							
25CB107601	Essentials of Cyber Security *	2	-	-	-	2	-
25LG107601	Professional Ethics and Human Values	2	-	-	-	2	-
25CE107601	Environmental Science*	2	-	-	-	2	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25CE107602	Disaster Mitigation and Management	2	-	-	-	2	-
25CE107603	Rural Technology	2	-	-	-	2	-
25LG107603	Spoken English	-	1	2	-	2	-
25LG107602	Essential Life Skills for Holistic Development	2	-	-	-	2	-
25AB107601	NSS Activities	-	-	-	-	2	-
25AB107602	Yoga	-	-	-	-	2	-
25AB107603	NCC Activities	-	-	-	-	2	-
25MG107601	Innovation, Incubation and Entrepreneurship	2	-	-	-	2	-
25EE107601	Intellectual Property Rights	2	-	-	-	2	-
25EE107602	Fundamentals of Research Methodology	2	-	-	-	2	-

*Compulsory Course

PROGRAM CORE

Program Core (36-42 Credits)- B.Sc. - Computer Science – 3 years
Program Core (42-54 Credits)- B.Sc. - Computer Science with Honours – 4 years

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project-based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25CA104001	Object Oriented Programming with C++	3	-	2	-	4	Problem solving with C
25MM101020	Computer Organization and Architecture	3	-	-	-	3	-
25MM101003	Design and Analysis of Algorithms	3	-	-	-	3	
25CA102006	Java Programming	3	-	2	-	4	Object Oriented Programming with C++
25MM102002	Web Technologies	3	-	2	-	4	-
25CA101006	Software Engineering	3	-	-	-	3	-
25MM102003	Operating Systems	3	-	2	-	4	-
25CA101012	Computer Networks	3	-	-	-	3	Introduction to Data Communication and Networks
25MM102004	Big Data Technologies Using R	3	-	2	-	4	Database Management Systems
25MM102005	PHP and My SQL Programming	3	-	2	-	4	Database Management Systems
25CA101010	Internet of things	3	-	-	-	3	
25CA102002	Database Management Systems	3	-	2	-	4	-
25CA102003	Data Warehousing and Data Mining	3	-	2	-	4	Database Management Systems
25CA102004	Data Structures	3	-	2	-	4	-
25CA102005	Python Programming	3	-	2	-	4	Programming for Problem Solving
25MM101001	Introduction to Data Communication and Networks	3	-	-	-	3	-

PROGRAM ELECTIVE (36–45 Credits)

Program Electives (24-30 Credits)- B.Sc. - Computer Science – 3 years

Program Electives (36-45 Credits)- B.Sc. - Computer Science with Honours – 4 years

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project-based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25CA101015	Cloud Computing	3	-	-	-	3	-
25CA101019	Artificial Intelligence	3	-	-	-	3	-
25CA101014	Machine Learning	3	-	-	-	3	
25MM102006	Machine Learning and AI using Python	3	-	2	-	4	Python Programming
25MM101004	Object-Oriented Analysis and Design Patterns	3	-	-	-	3	SOFTWARE ENGINEERING
25MM101005	Software Project Management	3	-	-	-	3	
25CA101018	Ethical Hacking	3	-	-	-	3	
25MM101006	Fundamentals of Data Science	3	-	-	-	3	
25CA102008	Data Analytics	3	-	2	-	4	
25MM101007	Software Testing and Quality Assurance	3	-	-	-	3	
25CA101009	Advanced Databases	3	-	-	-	3	Database Management Systems
25CA101004	Responsible AI Artificial Intelligence	3	-	-	-	3	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project-based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25CA102037	User Interface Design	3	-	2	-	4	-
25CA101017	Cyber Security	3	-	-	-	3	Computer Networks
25MM101008	Block chain Technologies	3	-	-	-	3	
25MM101009	Cryptography	3	-	-	-	3	
25MM101010	Multimedia Systems	3	-	-	-	3	

Interdisciplinary Minor (21-30 Credits)

Interdisciplinary Minor (18-24 Credits)- B.Sc. - Computer Science – 3 years

Interdisciplinary Minor(21-30 Credits) - B.Sc. - Computer Science with Honours – 4 years

(Mathematics)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project - based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25MM101002	Single Variable Calculus	3	-	-	-	3	-
25MM101011	Ordinary Differential Equations	3	-	-	-	3	Single Variable Calculus

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project - based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25MM101012	Multi Variable Calculus	3	-	-	-	3	Single Variable Calculus
25MM101013	Partial Differential Equations	3	-	-	-	3	Multi Variable Calculus
25MM101014	Integral Transforms	3	-	-	-	3	-
25MM101015	Number Theory and Algebra	3	-	-	-	3	-
25MM101016	Group Theory	3	-	-	-	3	-
25MM101017	Rings and Fields	3	-	-	-	3	-
25MM101018	Linear Algebra	3	-	-	-	3	Rings and Fields
25MM101019	Numerical Analysis, Probability and Statistics	3	-	-	-	3	

University Elective (9-12 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25EC101701	AI in Healthcare	3	-	-	-	3	-
25CM101701	Banking and Insurance	3	-	-	-	3	-
25DS101701	Bioinformatics	3	-	-	-	3	-
25BS101701	Biology for Engineers	3	-	-	-	3	-
25CE101701	Civil Engineering and The Society	3	-	-	-	3	-
25SS101701	Constitution of India	3	-	-	-	3	-
25CM101702	Cost Accounting and Financial Management	3	-	-	-	3	-
25CB101701	Cyber Laws and Security	3	-	-	-	3	-
25EE101701	Electrical Safety and Safety Management	3	-	-	-	3	-
25MG101701	Entrepreneurship for Micro, Small and Medium Enterprises	3	-	-	-	3	-
25CE101702	Environmental Pollution and Control	3	-	-	-	3	-
25EC101702	Essentials of VLSI	3	-	-	-	3	-
25CB101702	Introduction to Ethical Hacking	3	-	-	-	3	-
25BS101703	Forensic Science	3	-	-	-	3	-
25SS101702	Gender and Environment	3	-	-	-	3	-
25ME101701	Global Strategy and Technology	3	-	-	-	3	-
25EE101704	Green Technologies	3	-	-	-	3	-
25ME101702	Human Resource Management	3	-	-	-	3	-
25SS101703	Indian Economy	3	-	-	-	3	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25SS101704	Indian History	3	-	-	-	3	-
25SS101705	Indian Tradition and Culture	3	-	-	-	3	-
25EC101703	Instrumentation in Industries	3	-	-	-	3	-
25EC101704	Introduction to Nano technology	3	-	-	-	3	-
25AI101701	Introduction to Artificial Intelligence	3	-	-	-	3	-
25DS101702	Introduction to Data Science	3	-	-	-	3	-
25AI101702	Introduction to Machine Learning	3	-	-	-	3	-
25CS101701	Introduction to Python Programming	3	-	-	-	3	-
25CB101704	Introduction to Internet of Things	3	-	-	-	3	-
25ME101703	Management Science	3	-	-	-	3	-
25ME101704	Managing Innovation and Entrepreneurship	3	-	-	-	3	-
25ME101705	Material Science	3	-	-	-	3	-
25LG201701	Personality Development	3	-	-	-	3	-
25CE101703	Planning for Sustainable Development	3	-	-	-	3	-
25EC101705	Principles of Communication Engineering	3	-	-	-	3	-
25EE101702	Reliability and Safety Engineering	3	-	-	-	3	-
25CE101704	Remote Sensing, GIS and GPS	3	-	-	-	3	-
25CE101705	Smart Cities	3	-	-	-	3	-
25EC101706	Smart Sensors for Engineering Applications	3	-	-	-	3	-
25EE101703	Sustainable Energy Systems	3	-	-	-	3	-
25CS101702	Web Design Fundamentals	3	-	-	-	3	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
25SS101706	Women Empowerment	3	-	-	-	3	-
25SS101707	Indian Knowledge System in Science	3	-	-	-	3	-
25SS101708	Introduction to Indian Knowledge Systems	3	-	-	-	3	-
25CE101706	Indian Knowledge System in Town Planning and Architecture	3	-	-	-	3	-
25LG101702	Quantitative Aptitude and Verbal Ability	3	-	-	-	3	-
25LG101703	Logical Reasoning and Recruitment Essentials	3	-	-	-	3	-
25EC101707	Quantum AI	3	-	-	-	3	-
25CA101702	Software Engineer for AI	3	-	-	-	3	-
25CB101703	Advanced Artificial Intelligence	3	-	-	-	3	Artificial intelligence -
25CA101704	Generative AI and Professional Practices	3	-	-	-	3	-
25LG101701	Business Communication and Career Skills	3	-	-	-	3	-
25SS101709	Stress Management and Wellbeing	3	-	-	-	3	-
25SS101710	Strategies for Sustainable Design	3	-	-	-	3	-

Note:

1. If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under University Elective.

The student can choose courses from other disciplines offered across the schools of MBU satisfying the Pre-requisite other than the above list.

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CA102001	PROGRAMMING FOR PROBLEM SOLVING	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on C Programming concepts, Operators and Expressions, Input and Output Functions, Control Structures, Problem Solving Aspects, Arrays and Strings, Functions, Pointers, Structures and Unions and File Handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Design algorithms using problem-solving techniques for given problems.
- CO2.** Apply functions and Arrays to enhance reusability and data manipulation.
- CO3.** Develop programs using pointers for efficient memory management.
- CO4.** Apply structures, unions and file handling concepts to develop societal applications.
- CO5.** Work independently or in team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	-	-	3	-	-
CO2	3	2	3	2	3	-	-	-	-	3	-	-
CO3	3	2	3	-	3	-	-	-	-	3	-	-
CO4	3	2	3	-	3	-	-	-	-	3	-	-
CO5	3	3	3	2	3	3	-	-	-	3	-	-
Course Correlation Mapping	3	2	3	2	3	3	-	-	-	3	-	-

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO C PROGRAMMING **(09 Periods)**

Basics of C Programming: Introduction, Structure of a C program, Concept of a variable,

Data types in C, Program statement, Declaration, Storing the data in memory, Tokens, Operators and expressions, Lvalues and Rvalues, Type conversion in C.

Input and Output: Basic screen and keyboard I/O in C, Non-formatted input and output, formatted input and output functions.

Module 2: CONTROL STATEMENTS AND INTRODUCTION TO PROBLEM SOLVING **(08 Periods)**

Control Statements: Specifying test condition for selection and iteration, Writing test expression, Conditional execution and selection, Iteration and repetitive execution, goto statement, Special control statements, Nested loops.

Introduction to Problem Solving: Algorithms, Flowcharts, Problem solving aspect, Top-down design, Implementation of algorithms, program verification and efficiency of algorithms.

Module 3: ARRAYS & STRINGS AND FUNCTIONS **(10 Periods)**

Arrays and Strings: One-dimensional array – Declaration, Initialization, Accessing elements, operations; Multi-dimensional arrays – Declaration, Initialization, Working with 2D arrays; Strings – Declaration, Initialization, Printing strings, String input, Character manipulation, String manipulation; Arrays of strings – Initialization, manipulating string arrays.

Functions: Concept of function, Using functions, Call by value mechanism, working with functions, passing arrays to functions, Scope and extent, Storage classes, Recursion.

Module 4: POINTERS **(08 Periods)**

Introduction to Pointers: Understanding memory addresses, Address operator (&), Pointer – declaration, Initialization, Indirection operator and dereferencing, Void and Null pointers, Use of pointers, Arrays and pointers, Pointers and strings, Pointer arithmetic, Pointers to pointers, Array of pointers, Pointers to an array, Two-dimensional arrays and pointers, Pointers to functions, Dynamic memory allocation.

Module 5: USER-DEFINED DATA TYPES AND FILES **(10 Periods)**

User-Defined Data Types: Structures - Declaration, Accessing the members, Initialization, typedef and its use, Arrays of structures, Arrays within structure, Structures and pointers, Structures and functions; Unions, Enumeration types, Bitfields.

Files: Using files in C, Working with text and binary files, Direct File Input and Output, Files of records, Random access to files of records.

Total Periods: 45

EXPERIENTIAL LEARNING

1. a) Write a C program to perform the arithmetic operations on two integer numbers.
b) Write a program to evaluate the following expressions by reading the necessary values from the keyboard.
 - i. $(ax + b)/(ax - b)$
 - ii. $2.5 \log x + \cos 32^\circ + |x^2 + y^2|$
 - iii. $ax^5 + bx^3 + c$
 - iv. ae^{kt}
2. a) Write a C program to find the roots of a quadratic equation.
b) In a town, the percentage of men is 52. The percentage of total literacy is 48 and the total percentage of literate men is 35 of the total population. Write a C program to find the total number of illiterate men and women if the population of the town is 7000.
3. a) Write a C Program to compute an electricity bill based on the following slab rates.

Consumption units	Rate (in Rupees/unit)
0-100	4.0
101-150	4.6
151-200	5.2
201-300	6.3
Above 300	8.0

Consumption units	Rate (in Rupees/unit)
0-100	4.0
101-150	4.6
151-200	5.2
201-300	6.3
Above 300	8.0

(Hint: Take current and old meter readings from the user to get consumption units)

- b) An insurance company computes the premium amount based on the following;
 - i. If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city, and is a male then the premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.
 - ii. If a person satisfies all the above conditions and is female then the premium is Rs.3 per thousand and the policy amount cannot exceed Rs.1 lakh.
 - iii. If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then premium is Rs.6 per thousand and the policy cannot exceed Rs. 10000.
 - iv. In all other cases the person is not insured.

Write a C program to determine whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.

c) Write a C Program to find the grade for a student using a Switch case. The user needs to enter a subject score (varies from 0 to 100) and then display the grade as described below.

Score	Grade	Score	Grade
$> = 90$	O	$>=50$ to < 60	D
$>=80$ to < 90	A	$>=40$ to < 50	E
$>=70$ to < 80	B	< 40	Fail
$>=60$ to < 70	C		

4. a) A Fibonacci sequence is defined as follows:

The first and second terms in the sequence are 0 and 1. Sub-sequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

b) Write a C program to find the sum of individual digits of a positive integer.

c) Write a C program to read two numbers x and n , and then compute the sum of the geometric progression: $1+x+x^2+x^3+\dots+x^n$. Show appropriate error message for $n < 0$. (Example: if n is 3 and x is 5, then the sum is: $1+5+25+125$)

d) Write a C program to print the following pattern.

			1					
		1	2	1				
	1	2	3	2	1			
1	2	3	4	3	2	1		
1	2	3	4	5	4	3	2	1

5. a) Write a C program to find both the largest and smallest numbers in a list of integers.

b) Write a C program that uses function to perform the following:

i) Addition of Two Matrices ii) Multiplication of Two Matrices

6. a) Write a C program to insert a sub-string in to a main string at a given position.

b) Write a C program to count the lines, words and characters in a given text.

7. a) Write a C program to generate all the prime numbers between 1 and n , where n is

8. a value entered by the user. Define a separate function to generate prime numbers.

b) Write C program that uses recursive function to find the following.
i) Factorial of a given integer ii) GCD of two given integers

9. a) Write a C program to print the elements of an array in reverse order using pointers.

b) Write a C program to count the number of vowels and consonants in a string using pointers.

c) Write a C program to store n elements in an array and print the elements in sorted order using pointers.

9. a) Write a C program that performs the following operations:

i. Reading a complex number ii. Writing a complex number
iii. Addition of two complex numbers iv. Multiplication of two complex numbers
(Note: Represent complex number using a structure.)

b) Define a structure to store employee details include *Employee-Number*, *Employee-Name*, *Basic-pay*, *Date-of-Joining*. Write a C program for the following.

i) A function to store 10 employee details.

ii) A function to implement the following rules while revising the basic pay.
If Basic-pay \leq Rs.5000 then increase it by 15%.
If Basic-pay $>$ Rs.5000 and \leq Rs.25000 then it
increase by 10%. If Basic-pay $>$ Rs.25000 then there
is no change in Basic-pay.

iii) A function to print the details of employees who have completed 20 years of
service from the Date-of-Joining.

10 a) Write a C program to reverse the first n characters of a given text file.

b) Write a C program to merge two files into a new file.

11 Develop a phone book application to save users contact information include name, mobile number and email id as well as to edit and delete contact details.

RESOURCES

TEXT BOOKS:

1. PradipDey and Manas Ghosh, "Programming in C," Oxford University Press, New Delhi, 2ndEdition, 2013.
2. R. G. Dromey, "How to Solve it by Computer," Pearson Education, 1stEdition, 2013.

REFERENCE BOOKS:

1. Byron S Gottfried and Jitender Kumar Chhabra, "Programming with C," 4thEdition, McGraw Hill Education, 2019.
2. YashavantKanetkar, "Let Us C," 5thh Edition, BPB Publications, 2017.
3. E. Balagurusamy, "Programming in C," McGraw Hill Education Pvt, Ltd, New Delhi, 7thEdition, 2017.
4. Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C," Cengage Learning, 3rd Edition,2008.

SOFTWARE/TOOLS:

1. Software: Turbo C++/Dev C++

VIDEO LECTURES:

1. <https://www.digimat.in/nptel/courses/video/106105171/L03.html>
2. <https://nptel.ac.in/courses/106104128>

WEB RESOURCES:

1. Learn C Programming - <https://www.programiz.com/c-programming>
2. Learn C Programming - <https://www.tutorialspoint.com/cprogramming/index.htm>
3. C Programming Exercises, Practice, Solution - <https://www.w3resource.com/c-programming-exercises/>
4. Basic programming exercises and solutions in C - <https://codeforwin.org/2015/05/basic-programming-practice-problems.html>
5. C Programming Exercises, Practice, Solution - <https://www.w3resource.com/c-programming-exercises/>
6. Basic programming exercises and solutions in C - <https://codeforwin.org/2015/05/basic-programming-practice-problems.html>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MM105001	IT WORKSHOP	-	1	2	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: The IT Workshop for undergraduates is a training lab course modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, and PowerPoint and Advance AI tools.

COURSEOUTCOMES: After successful completion of the course ,students will be able to:

- CO1.** Perform Hardware troubleshooting
- CO2.** Understand Hardware components and inter dependencies
- CO3.** Safeguard computer systems from viruses/worms
- CO4.** Document/ Presentation preparation
- CO5.** Perform calculations using spreadsheets

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	2	2	-	-	3	-	3	-	-
CO2	3	3	3	-	3	-	-	3	-	3	-	-
CO3	3	-	3	3	2	-	-	3	-	3	-	-
CO4	3	-	3	2	3	-	-	3	-	-	-	-
CO5	3	3	3	3	3	-	-	3	-	-	-	-
Course correlation Mapping	3	3	3	2	2	-	-	3	-	3	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

LIST OF EXERCISES:

PC Hardware

- 1 Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral.
- 2 Demonstrate the steps involved in disassembling and reassembling a personal computer.
- 3 Demonstrate the procedure for installing the Windows Operating System / Linux / Dual boot with both on a Desktop or PC.

Internet & World Wide Web

- 1 Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email.
- 2 Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
- 3 Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.
- 4 Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

MS-WORD

- 1 Word Orientation: The mentor needs to give an overview of Microsoft (MS) office : Importance of MS office, Details of the tasks and features that would be covered in each, Using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.
- 2 Using Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.
- 3 Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
- 4 Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.
- 5 AI Tool Using Copilot in Word / ChatGPT plugins for drafting, grammar suggestions, and formatting assistance.

AI Additions: Using ChatGPT / Grammarly AI for abstract writing, language enhancement,

and plagiarism checking.

AI Additions: Using Microsoft Copilot in Word to generate draft newsletters, summaries, and creative layouts.

MS- Excel

- 1 Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text
- 2 Calculating GPA -Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP
- 3 Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting
- 4 AI Tools Usage: Excel Copilot: Auto-generate schedules, fill missing values, and suggest formulas. ChatGPT API + Excel: Smart formula generation and schedule optimization.
Excel Copilot: Automatically calculate GPA using natural language ("calculate GPA for these scores").
Data Analysis AI: Generate trend charts, detect anomalies.
- 5 AI Tools Usage:Excel Copilot / Power BI AI: Perform advanced analytics and create AI-driven dashboards.
ChatGPT for Excel: Suggest dynamic formulas and automate repetitive tasks.

MS- PowerPoint

- 1 Students will be working on basic power point utilities and tools which help them create basic powerpoint presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.
- 2 Interactive presentations - Hyperlinks, Inserting -Images, Clip Art, Audio, Video, Objects, Tables and Charts.
- 3 Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.
- 4 AI Tools Usage: PowerPoint Copilot: Generate entire slides from text prompts.
Beautiful.ai / Canva AI: Create engaging slide templates automatically.
- 5 AI Tools Usage: Copilot in PPT: Suggest visuals, charts, and images based on content.
ChatGPT + DALL·E: Generate AI-based graphics and icons.
- 6 AI Tools Usage: Design Ideas (PPT AI): Auto-suggest professional layouts.
Tome AI: Generate storytelling-style presentations with visuals and narration.

RESOURCES

TEXT BOOKS:

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech

REFERENCE BOOKS:

1. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dreamtech
2. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
3. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
4. LaTeX Companion – Leslie Lamport, PHI/Pearson.
5. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
6. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan – CISCO Press, Pearson Education.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=nBAhSHgGSM4>
2. <https://www.youtube.com/watch?v=4XTtgWM4yeU>
3. <https://www.youtube.com/watch?v=xRprtJyQvoo>

WEB RESOURCES:

1. <https://www.youtube.com/watch?v=dv3k1e9F1Wk>
2. <https://www.youtube.com/watch?v=V3gY3Z4SPnE>
3. <https://www.youtube.com/watch?v=If60SaJ2qfU>
4. <https://www.youtube.com/watch?v=e4qUXyq3fs8>
5. <https://www.youtube.com/watch?v=HcZ8wxYwQY4>
6. <https://www.youtube.com/watch?v=1I8yE5gBV0>
7. <https://www.youtube.com/watch?v=9NUjHBNWe9M>
8. <https://www.youtube.com/watch?v=XF34-Wu6qWU>
9. <https://www.youtube.com/watch?v=MjcO2Exthso>
10. <https://www.youtube.com/watch?v=VhmklrOjLsw>
11. <https://www.youtube.com/watch?v=ysTqS1wJx04>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MM101410	DISCRETE MATHEMATICS FOR COMPUTER SCIENCE	3	-	-	-	3
Pre-Requisite		-				
Anti-Requisite		-				
Co-Requisite		-				

COURSE DESCRIPTION: This course will discuss fundamental concepts such as sets, proof techniques, functions, relations, counting principles, mathematical logics and graph theoretical approaches with applications to computer science.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Identify the mathematical logic through the algebraic skills of expressions, tables and normal forms.
- CO2.** Demonstrate the basic concepts of Mathematical systems to analyse the proof techniques in mathematical induction.
- CO3.** Apply the techniques of counting, permutations and combinations for solving various practical problems.
- CO4.** Apply the concepts of graph theory to solve structural and graphical designs.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	-	-						

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: MATHEMATICAL LOGIC

(08 Periods)

Propositions and Logical Operations, Truth Tables, Equivalence, Implications, Laws of Logic, Normal Forms: Conjunctive Normal Form, Disjunctive Normal Form, Principle Disjunctive Normal Form, Principle Conjunctive Normal Form.

Module 2: SET THEORY

(09 Periods)

Sets and Elements, Subsets, Venn Diagrams, Set Operations, Algebra of Sets, Finite Sets, Counting Principle, Classes of Sets, Power Sets, Partitions, Mathematical Induction.

Module 3 RELATIONS AND FUNCTIONS

(10 Periods)

Relations, Operations on Relations, Equivalence Relation, Partitions and Equivalence Classes, Functions, One-One and Onto Functions, Special Type of Functions, Invertible Functions, Compositions of Functions, Recursively Defined Functions.

Module 4 TECHNIQUES OF COUNTING

(09 Periods)

Basic Counting Principles, Permutations, Combinations, Generalized Permutations and Combinations, Pigeonhole Principle, Generalized Pigeonhole Principle, Inclusion Exclusion Principle.

Module 5 GRAPHS

(09 Periods)

Definition of a Graph, Graph Terminology and special Types of Graphs, Handshaking Theorem, Finite and Infinite graphs, Incidence and Degree, Null graph, Sub graphs, Walks, Paths and Circuits in a graph, Connected graphs.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Let $a > 1$ be a positive integer. Pretend you want to divide n people into some number of teams, each of size a or $a + 1$. Show that this is possible provided n is larger than values in the Fibonacci polynomial $a^2 - a - 1 = a(a-1) - 1$.
2. Identify the relations on the set of bits $B = \{0, 1\}$ that are partial orders and those that are equivalence relations.
3. Pretend you are writing traffic accident software and want to categorize accidents by the day of the week on which they occur. Pretend there are n accident reports to categorize.
 - (a) What is the size of the sample space? That is, in how many ways can the n accident reports be distributed over 7 days?

- (b) In how many ways can all n accidents occur on one single day?
- (c) In how many ways can all n accidents occur on only two days?
- (d) Let's looks at the other end: In how many ways can all n accidents occur on seven, and no less, days.

RESOURCES

TEXT BOOKS:

1. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, Tata McGraw Hill, 8th Edition, 2019.
2. Jon Pierre Fortney, Discrete Mathematics for Computer Science, CRC Press, Taylor & Francis Group, 1st Edition, 2021.

REFERENCE BOOKS:

1. Richard Johnsonbaugh, Discrete Mathematics, Prentice Hall, 8th Edition, 2019.
2. Narasimha Deo, Graph Theory with application to Engineering and Computer Science, Prentice Hall India 2016.
3. J.P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill, 37th Edition, 2017

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106106183>
2. <https://nptel.ac.in/courses/106106094>

WEB RESOURCES:

1. <https://www.coursera.org/learn/discrete-mathematics>
2. <https://people.cs.pitt.edu/~milos/courses/cs441/>
3. <https://web.stanford.edu/class/cs103x/cs103x-notes.pdf>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MM102001	DIGITAL LOGIC DESIGN	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Foundations in design and analysis of the operation of digital gates, Concepts of Boolean algebra, Minimization of logic circuits, Design and implementation of combinational and sequential logic circuits, Analysis and design of flip-flops, registers, and counters and comparison of their behavior and characteristics, Design digital systems using Programmable Logic.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Apply knowledge of binary systems, logic gates and Boolean functions to represent a given problem using Boolean logic.
- CO2.** Minimize and implement Boolean functions to build combinational logic circuits.
- CO3.** Design combinational and sequential logic circuits for digital systems.
- CO4.** Design digital systems using programmable logic to solve engineering problems.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	3	3	-
CO2	3	2	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	3	2	-	-	-	-	-	3	3	-
Course Correlation Mapping	3	3	3	2	-	-	-	-	-	3	3	3

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT:

Module 1: BINARY SYSTEMS AND BOOLEAN ALGEBRA (10 Periods)

Introduction, Binary Numbers, Number Base Conversions, Complements of Numbers, Binary Codes, Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

Module 2: GATE LEVEL MINIMIZATION (09 Periods)

K-Map, Four Variable K-Map, Product-of-Sums and Sum-of-Products Simplification, Don't Care Conditions, NAND and NOR Implementations, Other Two Level Implementations, Exclusive-OR function.

Module 3: COMBINATIONAL LOGIC (09 Periods)

Combinational Circuits, Analysis of Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Magnitude Comparator, Decoders, Encoders, Multiplexers, De-Multiplexers.

Module 4: SEQUENTIAL LOGIC (10 Periods)

Latches, Flip-Flops, Design of Synchronous Sequential Circuits, Registers, Shift Registers, Ripple Counters, Ring Counter.

Module 5: PROGRAMMABLE LOGIC (07 Periods)

RAM, ROM, Programmable Logic Array, Programmable Array Logic, Sequential Programmable Devices.

Total Periods: 45

EXPERIENTIAL LEARNING:**Lab Exercise:**

1.	Write a program to convert a given decimal number to binary, octal, and hexadecimal.
2.	Implement a program to find 1's complement and 2's complement of a binary number.
3.	Write a program to evaluate a Boolean function (e.g., $F = A'B + AB'$) for all possible input combinations.
4.	Develop a program to simplify Boolean expressions using K-map (Sum of Products / Product of Sums).
5.	Write a program to implement AND, OR, NOT, XOR logic functions using only NAND or NOR gates.
6.	Design and simulate a 4-bit binary adder-subtractor circuit using full adders and control logic.
7.	Create a program to simulate an 8-to-1 MUX and 1-to-8 DEMUX using logic gates or Boolean expressions.
8.	Implement and simulate SR, JK, D, and T flip-flops to verify their truth tables.
9.	Write a program to design a 4-bit synchronous binary counter and display the state transitions.
10.	Simulate a Programmable Logic Array (PLA) to realize given Boolean functions.

RESOURCES

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th edition, Pearson, 2018.
2. A. Anand Kumar, Switching Theory and Logic Design, 3rd edition, PHI Learning Private Limited, India, 2016.

REFERENCE BOOKS:

1. Charles H. Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design, 7th edition, Cengage Learning, 2015.
2. Alan B. Marcovitz, Introduction to Logic Design, 3rd edition, McGraw Hill, 2010

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106/108/106108099/>
2. <https://nptel.ac.in/courses/106105185>

WEB RESOURCES:

1. <https://www.rapidtables.com/convert/number/base-converter.html>
2. <https://learnabout-electronics.org/Digital/dig10.php>
3. <https://coderstoolbox.net/number/>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CA105001	COMPUTER HARDWARE AND SYSTEM ESSENTIALS		-	1	2	-
Pre-Requisite	-					2
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on internal components of a computer, assemble a computer system, install an operating system, and troubleshoot using system tools and diagnostic software. Students will also be able to understand various network cables, connectors and TCP/IP networks, and work group.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Identify different hardware components on personal computer and peripheral devices.
- CO2** Create network architecture using TCP and UDP protocols for data transmission.
- CO3** Devise the solutions for the problems occurred in personal computer in Operating Systems.
- CO4** Implement the functionalities of different peripheral devices and networks by configuring multi-functional devices.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	1	1	-	-	-	-	-	-	3
CO2	3	-	3	-	1	-	-	-	-	-	-	3
CO3	3	-	3	1	2	-	-	-	-	-	-	3
CO4	3	2	3	1	-	-	-	-	-	-	-	3
Course Correlation Mapping	3	3	3	1	1	-	-	-	-	-	-	3

Correlation Levels:

3: High;

2: Medium;

1: Low

EXPERIENTIAL LEARNING

HARDWARE CONFIGURATION

1. Peripherals of the computer
2. Implement the following activities:
 - a) Configure settings using BIOS/UEFI tools on a PC.
 - b) Identify different components of mother board
 - c) Analyze various RAM types, PC extensions cards and storage devices
3. Implement the following activities:
 - a) Identify various CPU's, cooling methods and PC connection interfaces
 - b) Identification of various power supply, display devices and common PC Connectors
 - c) Install and configure common peripheral devices and SOHO multi-function device

PC Networking using Packet Tracer

Network Types and Components, Topologies, Wired and Wireless Transmission, Protocols.

4. a) Identify various types of network cables and connectors and characteristics
- b) Implement the following characteristics of TCP/IP
 - i)IPv4 and IPv6
 - ii)Client side DNS Settings
5. a) Identify following TCP and UDP Ports
 - i)21-FTP
 - ii)443-HTTPS
 - iii)80-HTTP
 - iv)Telnet
- b) Analyze the following TCP and UDP protocols
 - i)SMD
 - ii)SNMP
 - iii)DHCP
6. a) Configure the following network types
 - i) LAN
 - ii) WAN
 - iii) WLAN
- b) Configure network architecture using the following
 - i) HUB
 - ii) Switch
 - iii) Router

OPERATING SYSTEMS

Introduction to Operating System, Characteristics of Operating System, Types of Operating System and its components

7. Installation of Windows Operating System
8. Installation of Application and Device Drivers management

TROUBLESHOOTING

Introduction to trouble shooting, Hardware and Software Trouble shooting

9. a) Study the common problems related to the following
 - i) Mother Board
 - ii) RAM
 - iii) CPU
 - iv) Power
- b) Troubleshoot the following failures
 - i) Read/Write Failure
 - ii) Slow Performance
 - iii) Failure to boot
10. Trouble Shoot the following symptoms of Video, projector and display issues
 - i) VGA Mode
 - ii) No Image of Screen
 - iii) Dead Pixels
 - iv) Color patterns
11. Trouble shoot the following issues of wired, wireless and mobile devices
 - i) No Connectivity
 - ii) IP conflict
 - iii) Ghost Cursor
 - iv) Stiking Keys

RESOURCES

REFERENCES:

1. David Anfinson, Allan Johnson and Kathleen Czurda, *IT Essentials v7 Companion Guide*, CISCO Press, 2020
2. Brian W. Kernighan, *Understanding the Digital World: What You Need to Know about Computers, the Internet, Privacy, and Security*, Second Edition, Princeton University Press, 2021
3. Kavin Wilson, *Exploring Computer Systems: The Illustrated Guide to Understanding Computer Systems, Hardware & Networks*, Elluminent Press, 2019

SOFTWARE/TOOLS:

1. Windows 8/10 operating systems
2. Cisco Packet Tracer

VIDEO LECTURES:

1. <https://www.edx.org/course/computer-hardware-and-operating-systems>
2. <https://www.coursera.org/learn/computer-hardware-software>

WEB RESOURCES:

1. <https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/configuration/15-s/ir-15-s-book.pdf>
2. <https://www.certexams.com/comptia/a+/cert-notes-aplus-networking.htm>
3. <https://www.rcboe.org/cms/lib/GA01903614/Centricity/Domain/4399/Network%20n10-007.pdf>
4. <https://www.tutorialsweb.com/CertNotes/CompTIA-cert/A+/aplus-prac-10.htm>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CA101003	BASICS OF VIRTUALIZATION AND CLOUD TECHNOLOGY	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course gives students an insight into the basics of cloud computing along with virtualization. It will provide the students basic understanding about cloud and virtualization.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate basic concepts of Virtualization and Cloud Technology of Cloud Computing.
- CO2.** Analyze desktop virtualization, providers with traditional IT service providers, Roots of cloud computing, hardware virtualization and Regularity issues for cloud technology.
- CO3.** Use Microsoft's Virtualization solutions for cloud virtualization
- CO4.** Adapt architectural influences using High-performance computing, Utility and Enterprise grid computing for the performance in Cloud environment.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	2	3	2	3	-	-	-	-	-	-	3
CO4	3	3	3	-	3	-	-	-	-	-	-	3
Course Correlation Level	3	3	3	3	3	2	-	-	-	-	-	3

Correlation Levels: **3: High** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: BASICS OF VIRTUALIZATION **(09 Periods)**

Virtualization and cloud computing: Need of virtualization, cost, administration, fast deployment, reduce infrastructure cost, limitations.

Types of hardware virtualization: Full virtualization, partial virtualization, para virtualization

Desktop virtualization: Software virtualization, Memory virtualization, Storage virtualization, Data virtualization, Network virtualization

Module 2: HYPERVISORS AND VIRTUAL MACHINES **(10 Periods)**

Server Virtualization: Understanding Server Virtualization, types of server virtualization, Virtual machine basics, types of virtual machines, hypervisor concepts and types.

Module 3: VIRTUALIZATION SOLUTIONS **(09 Periods)**

Understanding Microsoft's Virtualization solutions: Microsoft's Infrastructure Optimization Model, Virtualization and the Infrastructure Optimization Model, Benefits of Virtualization, Achieving the Benefits of Datacenter Virtualization, Achieving the Benefits of Client Virtualization, Achieving the Benefits of Cloud Virtualization.

Module 4: BASICS OF CLOUD COMPUTING **(09 Periods)**

Origins of Cloud computing, Cloud components, Essential characteristics, On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

Module 5: CLOUD INSIGHTS **(08 Periods)**

Architectural influences: High-performance computing, Utility and Enterprise grid computing; Cloud scenarios, Benefits: scalability, simplicity, vendors, security, Limitations, Sensitive information, Application development, security level of third party, security benefits, Regularity issues: Government policies.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Creating Virtualized Environment using VM ware.
2. Deploying an WebApp/MobileApp in Public Cloud.
3. Invoke an operating System in an Virtualized environment.

RESOURCES

TEXT BOOKS:

1. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center," Auerbach.
2. Anthony T. Velte, Toby J. Velte Robert Elsenpeter "Cloud computing a practical approach", TATA McGraw- Hill, 2010.

REFERENCE BOOKS:

1. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate," 2008.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing (Principles and Paradigms)", John Wiley & Sons, Inc. 2011
3. Judith Hurwitz , Robin Bloor , Marcia Kaufman , Fern Halper, "Cloud computing for Dummies", Wiley Publishing Inc., 2010

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=Jph3H1wZTKM>
2. <https://www.digimat.in/nptel/courses/video/106105167/L07.html>

WEB RESOURCES:

1. <https://www.knowledgehut.com/blog/cloud-computing/virtualization-in-cloud-computing>
2. <https://www.analyticssteps.com/blogs/what-virtualization-cloud-computing-characteristics-benefits>
3. <https://www.javatpoint.com/virtualization-in-cloud-computing>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25LG102402	GENERAL ENGLISH	2	-	2	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course deals with selected literary works of eminent writers, conversation practice, listening skills, reading comprehensions, writing techniques, vocabulary building and functional grammar.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze the texts using effective reading techniques.
- CO2.** Apply grammatically correct English in writing
- CO3.** Develop ability to understand various accents by developing listening skills.
- CO4.** Apply general and technical vocabulary in effective communication.
- CO5.** Apply different communication styles in various situations.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	2	2
CO2	3	2	-	-	-	-	-	2	2
CO3	2	3	-	-	-	-	-	2	2
CO4	2	3	-	2	-	-	-	2	2
CO5	2	2	-	3	-	-	-	2	2
Course Correlation Mapping	2	3	-	3	-	-	-	2	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

MODULE 1: 'A SNAKE IN THE GRASS' SHORT STORY BY R.K. NARAYAN (FROM THE PRESCRIBED TEXT BOOK) (06 Periods)

Reading 'A Snake in the Grass' short story by R.K. Narayan (from the prescribed text book)

Speaking Common Everyday Conversations

Listening Listening for specific information (from the selected audios and videos)

Writing Paragraph Writing: Sentence Structures- use of phrases and clauses - proper punctuation- introducing, logical order, coherence, unity and summarizing.

Grammar Parts of Speech: Nouns, Pronouns, Verbs, Adjectives and Adverbs, Prepositions, Conjunctions and Interjections

MODULE 2:	ON SAYING PLEASE 'SHORT ESSAY BY A. G. GARDINER (FROM THE PRESCRIBED TEXT BOOK)	(06 Periods)
Reading	On saying Please 'short essay by A. G. Gardiner (from the prescribed text book)	
Listening	Listening for understanding concepts (from the selected audios and videos)	
Speaking	Tongue twisters practice	
Writing	Letter Writing: Parts of a Letter - Formats of Letters- Types of Letters(enquiry, Complaints, seeking permission, seeking internship etc.)	
Grammar	Basic sentence structures, word order in sentences, verb agreement, Pronoun Agreement	
MODULE 3:	BECAUSE I COULDN'T STOP FOR DEATH BY EMILY DICKINSON	(06 Periods)
Reading	Because I couldn't Stop for Death by Emily Dickinson	
Listening	Listening for understanding concepts (from the selected audios and videos)	
Speaking	Communication at Work Place	
Writing	Descriptions: Writing introduction- defining – classifying -describing technical/specific features of an Automobile / gadget/ product or the process-installation manuals	
Grammar	Usage of Articles and omission of Article, Prepositions and phrasal prepositions	
MODULE 4:	'AFTER THE SUNSET' SHORT STORY BY BHOOPAL (FROM THE PRESCRIBED TEXT BOOK)	(06 Periods)
Reading	'After the Sunset' short story by Bhoopal (from the prescribed text book)	
Listening	Listening to short audio texts and answering a series of questions	
Speaking	Reviewing a book or movie/ summarizing or reporting any incident	
Writing	Email Communication- Etiquette – Format- Writing Effective Business Email	
Grammar	Tenses- Active Voice & Passive Voice; Conditional Sentences	
MODULE 5:	'MAN'S PERIL' A SPEECH MADE BY BERTRAND RUSSELL (FROM THE PRESCRIBED TEXT BOOK)	(06 Periods)
Reading	'Man's Peril' a speech made by Bertrand Russell (from the prescribed text book)	
Speaking	Prepared or extempore speeches	
Writing	Essay Writing: Writing structured essays on specific topics- Introducing, analyzing and concluding an issue-creating coherence-Usage of proper punctuation.	
Vocabulary	Antonyms, Synonyms, Idioms and Phrases, One-word substitutes	
Grammar	Common Errors: Identifying and correcting common errors (articles, prepositions, tenses, subject verb agreement, pronoun agreement etc.)	

Total Periods: 30

EXPERIENTIAL LEARNING:

LIST OF EXERCISES

1. In rainy seasons a lot of snakes are found crawling around. Prepare a write-up on the reactions of people when they found snakes.
2. India is now for entrepreneurs and the government announced a lot of startup programs for that. Prepare a presentation on recent entrepreneurs.
3. Small courtesies play a major role in creating an impression on other people. List out a few examples.
4. Prepare a PowerPoint presentation on the present scenario in higher education and jobs in India.
5. Being a shopkeeper and persuading a customer to buy a product which is introduced newly in the market. Prepare a conversation.
6. The English language has a rich vocabulary. List out the homophones and homonyms and write down the pronunciation and meaning of those words.
7. Describe a situation in your college where teamwork is needed and explain the strategies to manage the team effectively.
8. India is a country of unity in diversity. List out the existence of different racial and religious people and bring out reasons for the harmonious relationship among the people.
9. Forget and forgive are the most important quality of any human being. Prepare a write-up on any two experiences which come across in your life where you forgive or forget to maintain good relationships with friends or relatives.
10. Make a case study on the problems of second language learners of English and suggest solutions to overcome them.
11. Read the story "The Third and Final Continent" written by Jhumpa Lahiri. How does "The Third and Final Continent" portray immigration experiences?
12. Read the popular essay "Google Making us Stupid" written by Nicholas Chor. Do you think that the title of the essay is appropriate?
13. Listen to the audio speeches made in the UNO by several eminent speakers on the theme "The Climate Crisis is human Rights Crisis". Summarize their speeches in your own words and explain how the Mother Earth is getting spoiled with a number of pollutants.

RESOURCES

TEXTBOOK:

- 1 G. Damodar "English Language for Undergraduate Students", Cambridge University-2019

REFERENCE BOOKS:

1. *Word Power Made Easy* by Norman Lewis, Goyal Publishers, 2020.
2. *A Communicative Grammar of English*, Geoffrey Leech and Prof Jan Svartvik, Pearson Publication, 2013
3. *Grammar in Use Intermediate with Answers*, Raymond Murphy, Cambridge University Press, 2019.
4. *How to Speak Effectively: A Guide to Engaging Conversations, Presentations*, Patrik King, Penguin,

VIDEO LECTURES:

- 1 <https://www.youtube.com/watch?v=WnOOKO0CdaM>
- 2 <https://www.youtube.com/watch?v=-ITLiZO85YM>
- 3 <https://www.youtube.com/watch?v=048YjXwgHWE>
- 4 <https://www.youtube.com/watch?v=XLLQm7Grmcc>

WEB RESOURCES:

1. <https://englicist.com/topics/be-the-best>
2. <https://inspiration624.wordpress.com/wp-content/uploads/2018/01/on-saying-please.pdf>
3. <https://englishlanguage-lit.blogspot.com/2021/05/after-sunset-short-story-by-bhoopal.html>
4. <https://www.taylorfrancis.com/chapters/mono/10.4324/9781003090359-31/man-peril-bertrand-russell?context=ubx&refId=1d767e2d-ceb1-4537-9de5-6417eab47d1e>
5. <https://learnenglish.britishcouncil.org/grammar/english-grammar-reference>
6. <https://www.usengenglish.com/reference/grammar/>
7. https://www.englishclub.com/esl-activities/#google_vignette
8. <https://eslvault.com/word-association-games/>
9. <https://testbook.com/english-grammar/tongue-twisters>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25LG101402	తెలుగు	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: తుమ్మిల సీతారామమూర్తి-ఎక్స్ప్రెస్, తిక్కన-నాడీషంఫూపాభ్యాసం, పోతన-ట్రువోపాభ్యాసం, దుఖ్యారి రామిర్డి - కృషీ వలుడు, మరియు తెలుగు వ్యాకరణం మీద అవగాహన.

COURSE OUTCOMES: కోర్సునిజయవంతంగాపూర్తిచేసినతర్వాత, విద్యార్థులు వీటినిచేయగలరు:

- CO1.** విద్యార్థులలో మానవీయ విలువలు పెరిగి నైతిక వలువలతో జీవించడం
- CO2.** సమాజంలో మనకు చేతనైన సాయం చెయ్యడం ప్రతి మనిషి బాధ్యత అనే సందేశం
- CO3.** త్రికరణ శుద్ధితో కృషీ చేస్తే ఏదైనా సాధించ వచ్చు అనే సందేశం
- CO4.** వ్యవసాయ రంగం గూర్చి విద్యార్థులలో అవగాహన కలగడం
- CO5.** తెలుగు వ్యాకరణం

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	-	-	-	-	-	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

తెలుగు భాష యొక్క మూలాలను తెలుసుకోవడం.

Total Periods: 30

పార్య ప్రణాళిక

Module 1: ఎక్కుట్లు – తుమ్ముల సీతారామమూర్తి

(06 Periods)

సత్త్వవర్తన, సచ్చిలత, సున్మార్గం, సమసమానత్వం గూర్చి వివరించడం.

Module 2: నాడీంఘూపాభ్యాసం – తిక్కన

(06 Periods)

సహాయం చేసినివారిని మరచి పోరాదు. చేసిన మేలు మరచిన వారి జీవితం ఎంత హినంగా ఉంటుందీ తెలియజేయడం.

Module 3: ధ్రువేపాభ్యాసం – పోతన

(06 Periods)

ఎటువంటి కష్టాలకు సమస్యలకు కుంగి పోకుండా దీక్షతే పట్టుదలతే కృపితే అనుకున్నది సాధించాలని తెలియజేయడం.

Module 4: కృపీ వలుడు – దుప్పురి రామిరద్ది

(06 Periods)

సమాజానికి వెన్నెముక అయిన రైతు యొక్క కష్టాలను త్యాగాలను వివరించడం.

RESOURCES

TEXT BOOKS:

1. ఎక్కులు – కవి తుమ్ముల సీతారామమూర్తి చౌదరి.
2. నాడీంఘూపాభ్యాసం – కవి తిక్కన. (మహారాతం – శాంతి పర్వం – తృతీయ శ్యాసం – 472 నుండి 511 పద్యాల వరకు).
3. ధ్రువేపాభ్యాసం – కవి పోతన (అంద్ర మాహాగవతం – చతుర్థ స్క్రింధం – 216 నుండి 277 పద్యాల వరకు)
4. కృపీ వలుడు – కవి దుప్పురి రామిరద్ది

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=5jX20h6HWzg>
2. <https://www.youtube.com/watch?v=FFtPSPByBmk>
3. https://www.youtube.com/watch?v=nQHF_pgTfL8
4. <https://www.youtube.com/watch?v=IEERKL3Q2Cs>

Web Resources:

1. http://teluguvignanamvinodam1.blogspot.com/2021/06/maha-bharatam-in-telugu-pdf-free-download_25.html
2. <https://www.freegurukul.org/blog/ramayanam-pdf/>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25LG101404	SANSKRIT	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: अस्मिन् पाठ्यक्रमे संस्कृत गद्य, पद्य, व्याकरणे सह महाभारतम् अपि च रामायणस्य कान्धन खण्डानां मेलनं भवति । अयं पाठ्यक्रमः छात्राणां कृते विभिन्न संस्कृत ग्रन्थानां अपि च साहित्यस्य समालोचनात्मक विश्लेषण करणमपि शिक्षयति । संपूर्ण पाठ्यक्रमे अस्मिन्, छात्राः देवनागरी लिपे: लिखनं अधिगच्छति, संस्कृतस्य शब्दानां उच्चारणं तथा हृदिस्थं करिष्यति, अपि च प्राथमिक व्याकरण पठिष्यति तेन ते संस्कृते सरल वाक्यानां निर्माणं कर्तुं प्रभवन्ति ।

COURSE OUTCOMES: पाठ्यक्रमस्य सफलसमाप्ते: अनन्तरं छात्राः

- CO1** कर्तव्यपरक शैक्षणिक वृत्तिपरक तथा शोधकर्तृणां निर्माणार्थं छात्राणां संज्ञानात्मक, प्रभावशाली तथा व्यवहारिक क्षमतानां आकार प्रदानार्थं सहायतां करोति ।
- CO2** सामाजिक परिवर्तने भाग्यरहणार्थं सक्षमाः भवितुं छात्रेषु सेवायाः धारणा संचारः करोति ।
- CO3** समकालीन समस्या-समाधान स्थितिषु प्राचीन भारतीय ज्ञानस्य अनुप्रयोगस्य ज्ञानप्राप्तिः । सामान्य रूपेण तथा विशेष रूपेण अभ्यसने तथा तस्य मूल्यांकनस्य संदर्भे च नैतिक उपयुक्ततायाः एकः द्वितीय भावनायाः विकासनार्थम् ।
- CO4** प्राचीन साहित्यतः प्राथमिक जीवनं तथा अवधारणानां ज्ञानप्रदानं यत् कालातीतः जातः तथापि इदानीमपि समाजाय अनुवर्तते । आवेदनस्य प्रमुख क्षेत्रेषु प्राथमिक कौशलस्य अधिग्रहणे सुगमकरणम् उदा- नेतृत्वे, संचारे, अनुसंधान योग्यतायां, व्यवहार संशोधने इत्यादि ।
- CO5** सामाजिक विविधतायाः कृते सम्मान-विकसितं करनं तथा सामाजिक अपि च सांस्कृतिक प्रासंगिकतायाः अध्ययने अभिवृद्धि करनम् ।

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	-	-	-	-	-	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module-1: प्राचीन पद्यसाहित्यम् (06 Periods)

1. आर्य पादुका पट्टाभिषेकः - वल्मीकिः – श्रीमद्रामायणम्
2. यक्षप्रश्नाः - वेदव्यासः – महाभारतम्

Module-2: चम्पूकाव्यम् & आधुनिक पद्यकाव्यम्	(06 Periods)
3. गङ्गावतरणम्	- भोजराजः - चम्पूरामायणम्
4. मोहापनोदः	- श्री पमिडिपाटि पट्टाभिरामारावः - मूलकथा-‘धर्मसौहृदम्’ इति संस्कृत पद्यकाव्यम्
Module-3: गद्यसाहित्यम्	(06 Periods)
5. अत्युक्तैः पापपुण्यैः इहैव फलमश्रुते	- नारायणपण्डितः - हितोपदेशः
6. शूद्रकवीरवरकथा	- हितोपदेशः
Module-4: शब्दाः	(6 Periods)
देव, कवि, भानु, पितृ, धातृ, गो, रमा, मति	
Module 5: महाकवि, शास्त्रकाराः	(6 Periods)
1. पाणिनिः 2. कौटिल्यः 3. भरतमुनिः 4. भारविः 5. माघः 6. भवभूतिः	
7. शङ्कराचार्यः 8. दण्डी	

Total Periods: 30

RESOURCES

TEXT BOOKS:

1. विश्वभारती 2. संस्कृत भारती 3. अमृतवाणी

REFERENCE BOOKS:

1. रामायणम् 2. महाभारतम् 3. अष्टाध्यायी 4. अमरकोशः

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=bh-14xfMeYk>
2. <https://www.youtube.com/watch?v=6xFkoOpzsvs>

Web Resources:

1. <https://www.forum.universityupdates.in/threads/ou-sanskrit-2nd-semester-study-material.33659/>
2. https://cbpbu.ac.in/study_mat_sanskrit.php

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CB107601	ESSENTIALS OF CYBER SECURITY	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Cybercrime, Cyber offenses, Phishing, Identity theft, Cybercrime in mobile and wireless devices, Organizational measures for handling mobile devices, Security implications on using mobile devices, Tools and methods used in cybercrime, Forensics of computer and handheld devices.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze methods of cybercrime, cyber offenses to maintain cybersecurity.
- CO2.** Investigate tools used for cybercrime to protect computational assets.
- CO3.** Apply appropriate authentication mechanisms to reduce attacks on mobile and wireless devices.
- CO4.** Use appropriate cyber forensics tools and techniques to maintain cybersecurity.
- CO5.** Recognize the need for cybersecurity and practice ethics to protect privacy, property rights in cyberspace.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-		-	-	-	-
CO2	3	2	-	-	2	-	-	-	-
CO3	3	2	1	-		-	-	-	-
CO4	3	2	-	-	2	-	-	-	-
CO5	-	-	-	-		2		2	-
Course Correlation Mapping	3	2	1	-	2	2		2	-

Correlation Levels: **3: High; 2: Medium; 1: Low**

COURSE CONTENT

Module 1: CYBERCRIME

(05 Periods)

Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, How criminals plan the attacks, Social engineering

Module 2: CYBER OFFENSES

(07 Periods)

Cyber stalking, Cybercafe and cybercrimes, Botnets, Attack vector, Cloud computing, Phishing – Methods, Techniques, Spear phishing, Phishing scams, Phishing toolkits, Spy phishing, Countermeasures; Identity Theft – Personally identifiable information, Types, Techniques, Countermeasures, Effacing online identity.

Module 3: CYBERCRIME IN MOBILE AND WIRELESS DEVICES

(06 Periods)

Proliferation of mobile and wireless devices, Trends in mobility, Credit card frauds in mobile and wireless computing era, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication service security, Attacks on mobile/cell phones, Security implications of mobile devices for organizations, Organizational measures for handling mobile devices related security issues.

Module 4: TOOLS AND METHODS USED IN CYBERCRIME

(06 Periods)

Proxy servers and anonymizers, Password cracking, Keyloggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.

Module 5: CYBER FORENSICS

(06 Periods)

Cyber forensics, Cyber forensics and digital evidence, Forensics analysis of e-mail, Forensics and social networking sites, Forensics of handheld devices – Smartphone forensics

Total Periods:30

EXPERIENTIAL LEARNING

1. Think of a recent cybercrime news report you read.

- What type of cybercrime was it?
- Who do you think were the cybercriminals behind it, and what might have been their motive?
- How could this attack have been prevented?

2. Analyze a phishing email sample.

- What were the clues indicating it was a phishing attempt?
- How could an ordinary user fall for it?
- Suggest three preventive actions users can take against phishing.

3. Reflect on your online presence.

- List down all Personally Identifiable Information (PII) you share publicly.
- What risks does this pose for identity theft?

- What changes will you make to protect your online identity?

4. Our organization allowing BYOD (Bring Your Own Device).

- What security challenges can arise?
- Suggest practical measures to ensure device security in such an environment.

RESOURCES

TEXT BOOKS:

1. Nina Godbole, SunitBelapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley, 2013.

REFERENCE BOOKS:

1. Nilakshi Jain, Ramesh Menon, *Cyber Security and Cyber Laws*, Wiley, 2020.
2. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, *Cybersecurity Essentials*, 1stEdition, Sybex, 2018.
3. ErdalOzkaya, *Cybersecurity: The Beginner's Guide*, 1stEdition, Packt Publishing, 2019.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106106129>
2. <https://www.coursera.org/specializations/intro-cyber-security>

WEB RESOURCES:

1. <https://www.interpol.int/en/Crimes/Cybercrime>
2. <https://owasp.org/www-project-mobile-top-10/>
3. <https://www.netacad.com/courses/cybersecurity-essentials?courseLang=en-US>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25LG107601	PROFESSIONAL ETHICS AND HUMAN VALUES	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course deals with personal conviction, and ethics and describes the accepted principles and standards of conduct regarding moral duties and virtues as applied to an organization. Codes of professional ethics guide the stakeholders of an organization about the desirable and undesirable acts related to the profession.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate the principles of ethics, professional values, and social responsibility.
- CO2.** Analyze the problems in the implementation of moral autonomy and use ethical theories in resolving moral dilemmas.
- CO3.** Develop suitable strategies to resolve problems that arise in practicing professional ethics and Industrial standards.
- CO4.** Function as a member, consultant, manager, advisor and leader in multi-disciplinary teams.
- CO5.** Provide solutions to complex problems associated with professional ethics using analysis and interpretation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	2	2	2	2
CO2	2	3	2	-	2	2	2	2	2
CO3	2	-	3	-	2	2	2	2	2
CO4	2	-	-	-	-	2	2	2	2
CO5	2	2	3	2	-	3	2	2	2
Course Correlation Mapping	2	3	-	-	2	2	2	2	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: PROFESSIONAL ETHICS

(06 Periods)

Scope and significance of ethics, varieties of moral issues, types of ethical inquiry, moral dilemmas, moral autonomy — Kohlberg's theory; Gilligan's theory of moral development.

Module2: PROFESSIONAL IDEALS AND VIRTUES

(06 Periods)

Theories of virtues and professional ideals; professional responsibility and accountability; self-respect and integrity; role of customs and religion in ethics; religion and divine command theory; resolving moral dilemmas; moral leadership.

Module 3: SOCIAL EXPERIMENTATION

(06 Periods)

Social experimentation and its similarities to standard scientific experiments; learning from the past and knowledge gained; responsibilities of engineers as experimenters; the Challenger's case study; role of industrial standards; issues and limitations in engineering law

Module 4: RESPONSIBILITIES AND RIGHTS

(06 Periods)

Collegiality and professional loyalty; respect for authority; collective bargaining and employee rights; confidentiality and trust; occupational crime and ethical misconduct; rights and responsibilities of engineers; whistle-blowing and its implications; the BART case study.

Module 5: HARMONY WITH PROFESSIONALETHICS

(06 Periods)

Acceptance and practice of human values; ethical human conduct in personal and professional life; transition from the present state to a universal human order; role of engineers and technologists in promoting social and ecological responsibility; contribution to enriching institutions and organizations.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Demonstrate orally using your experiences of what is naturally acceptable in a relationship — Feeling of respect or disrespect and what is naturally acceptable is to nurture or exploit others.
2. Identify community partners and discuss with a community partner or organization. Prepare a report by identifying and analysing the issues or opportunities.
3. Field experiences may be directed to include a range of time-intensive endeavours that require varying levels of student interaction. Prepare a report on visiting a Juvenile home.
4. Students read a speech in the classroom by former United Nations Secretary-General Kofi Annan on human values.
5. Students are encouraged to bring a daily newspaper to class or to access any news related to the need for human values and note down the points.
6. Bring out the relevance of engineering ethics theory and practice with relevance to current trends.
7. Professional ideals and virtues are important to everyone. Prepare a case study on the professional ideals and virtue of any one of the famous sports personalities from India.

8. Compare the present to the past in engineering experimentations concerning the change in professionalism.
9. Make a study on occupational crime and the role of modern technology in finding solutions.
10. Prepare a case study on how to maintain harmony with different cultural people using professional ethics.

(It's an indicative one. The course instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXTBOOKS:

1. Gaur R R, Sangal R & G P Bagaria, *Human Values and Professional Ethics*, Excel Books, New Delhi, 2010.
2. Govindarajan, M., Nata Govindarajan, M., Natarajan, S. and Senthilkumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.
3. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd Edition, 2007.

REFERENCE BOOKS:

1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.
2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.
3. Charles F. Fledderman, *Engineering Ethics*, Pearson Education, 2nd Edition, 2004.
4. R. Subramanya, *Professional Ethics*, Oxford Higher Education, 2013.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=jfGIq_EiXzI
2. <https://www.youtube.com/watch?v=QFHOTH54oUc>
3. <https://www.youtube.com/watch?v=JJshY11nX14>
4. <https://www.youtube.com/watch?v=TyP09S0UEzA>
5. https://www.youtube.com/watch?v=0QMwjV_ZVtc

WEB RESOURCES:

1. <https://siiet.ac.in/wp-content/uploads/2020/09/7.1.10-professional-ethics-manual.pdf>
2. <https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf>
3. <https://india.oup.com/productPage/5591038/7421214/9780199475070>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CE107601	ENVIRONMENTAL SCIENCE	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on natural resources, ecosystems, biodiversity, environment pollution and control, social issues and environment, human population and environment.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze natural resources to solve complex environmental problems and natural resource management considering society, environment and sustainability.
- CO2.** Analyze ecosystems and biodiversity to solve complex environmental problems by following environmental ethics considering society, environment and sustainability besides communicating effectively in graphical form.
- CO3.** Analyze various types of pollution and their control measures to solve environmental problems through appropriate tools and techniques following latest developments considering society, ethics, environment and sustainability.
- CO4.** Analyze social issues and its impact on environment, environmental acts to solve complex environmental problems considering society, environment and sustainability besides communicating effectively in graphical form.
- CO5.** Analyze human population and its impact on environment to solve complex environmental problems through team work and using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	2	-	1	1	-	-
CO2	3	3	-	2	-	1	1	1	-
CO3	3	3	-	2	1	1	1	1	-
CO4	3	3	-	3	-	1	1	1	-
CO5	3	3	-	2	1	1	1	1	1
Course Correlation Mapping	3	3	-	3	1	1	1	1	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: NATURAL RESOURCES

(07 Periods)

Multidisciplinary nature of environment; Natural Resources: Renewable and non-renewable resources; Forest, Water, Mineral, Food and Energy resources -Causes, Effects, Remedies, Case studies; Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

Module 2: ECOSYSTEMS AND BIODIVERSITY

(07 Periods)

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids - Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity: Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity - In-situ and ex-situ.

Module 3: ENVIRONMENTAL POLLUTION AND CONTROL

(06 Periods)

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management - Urban waste, industrial waste; Latest developments in pollution control, Hazards and disaster management - Floods, Earthquakes, Tsunamis, Case studies.

Module 4: SOCIAL ISSUES AND THE ENVIRONMENT

(06 Periods)

Sustainable development, Urban problems related to energy, Environmental ethics -Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of green technologies, Environment justice: National Green Tribunal and its importance; Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

Module 5: HUMAN POPULATION AND THE ENVIRONMENT

(04 Periods)

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health; Case studies - Field Work/Assignment/Seminar on Environmental assets - Water bodies/Forest/Grassland/Hill/Mountain.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING:

1. Visit a nearby villages and know the status of availability of local resources that can be improved through proper education.
2. Make an awareness program in the villages for the development of natural resources, ecosystems and biodiversity.
3. Prepare a document by visiting a local urban waste dumping yard near to the Tirupati city.
4. Visit a local village and find a barren land and make the land into a useful land by planting plants or providing the soil and fertilizers required to improve the soil.
5. Visit a local zoological park and identify the species variety and variability.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Anubha Kaushik and Kaushik, C.P., *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publications, 6th Edition, 2018.
2. Erach Barucha, *Environmental Studies*, Orient Blackswan, 3rd Edition, 2021.

REFERENCE BOOKS:

1. Cunningham, W. P. and Cunningham, M. A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition, 2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. Anji Reddy, M., *Text Book of Environmental Science and Technology*, BS Publications, Revised Edition, 2014.
4. Rajagopalan, R., *Environmental Studies*, Oxford University Press, 3rd Edition, 2015.

VIDEO LECTURES:

1. <http://nptel.ac.in/courses/109/104/109104047>
2. <https://www.youtube.com/watch?v=mIPBPG-5dUw>

WEB RESOURCES:

1. <https://nptel.ac.in/courses/122102006>
2. <https://www.flame.edu.in/academics/ug/program-structure/major-minor-courses/environmental-studies>
3. https://www.tutorialspoint.com/environmental_studies/environmental_studies_environment.htm

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CE107602	DISASTER MITIGATION AND MANAGEMENT	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on disasters, earthquakes, floods, cyclones, droughts, landslides and disaster management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze the vulnerability of an area to natural and man-made disasters/hazards as per the guidelines to solve complex problems using appropriate techniques ensuring safety, environment and sustainability.
- CO2.** Propose appropriate mitigation strategies for earthquake and tsunami impacts as per code of practice using suitable techniques ensuring safety, environment and sustainability besides communicating effectively in graphical form.
- CO3.** Analyze the causes and impacts of floods, cyclones and droughts using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability besides communicating effectively in graphical form.
- CO4.** Analyze the causes and impacts of landslides using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability.
- CO5.** Design disaster management strategies to solve pre, during and post disaster problems using appropriate tools and techniques following the relevant guidelines and latest developments ensuring safety, environment and sustainability besides communicating effectively in graphical form.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	2	2	2	2	2	-
CO2	3	3	3	3	2	2	1	2	2
CO3	3	3	-	2	2	2	2	-	2
CO4	3	3	-	3	2	2	2	-	-
CO5	3	2	3	2	2	2	1	2	1
Course Correlation Mapping	3	3	3	3	2	2	2	2	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: DISASTERS

(06 Periods)

Types of disasters - Natural disasters; Impact of disasters on environment, infrastructure and development; Concepts of hazards and vulnerability analysis, Hazard Assessment, Guidelines for hazard assessment and vulnerability analysis, Basic principles and elements of disaster mitigation.

Module 2: EARTHQUAKES

(06 Periods)

Introduction to earthquake, Intensity scale (MSK-64), Seismic zones and activity in India, Action plan for earthquake disaster preparedness, Elements at risk, Recovery and rehabilitation after earthquake, Concepts of Earthquake resistant design and construction of buildings; Tsunami – Onset, Types and causes, Warning, Elements at risk, Typical effects, Specific preparedness and mitigation strategies, Case studies.

Module 3: FLOODS, CYCLONES AND DROUGHTS

(07 Periods)

Floods and Cyclones: Onset, Types, Causes, Warnings, Elements at risk, Typical effects, Indian floods and cyclones, Hazard zones, Potential for reducing hazards, Mitigation strategies and community based mitigation, Case studies.

Droughts: Onset, Types and warning; Causes, Impact, Early warning and response mechanisms, Mitigation strategies, Droughts in India, Case studies.

Module 4: LANDSLIDES

(06 Periods)

Onset, Types and warning; Causes, Elements at risk, Indian landslides, Hazards zones, Typical effects, Mitigation strategies and community based mitigation, Case studies.

Module 5: DISASTER MANAGEMENT

(05 Periods)

Disaster management organization and methodology, Disaster management cycle, Disaster management in India – Typical cases and Cost-benefit analysis, Disaster management programs implemented by NGOs and Government of India, Usage of GIS and Remote sensing techniques in disaster management, Leadership and Coordination in Disaster management, Emerging trends in disaster management.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING:

1. Perform hazard assessment and vulnerability analysis for any nearby town/city and prepare a detailed report of possible impacts of various disasters on environment, infrastructure and development.
2. Prepare a detailed report on the causes and effects of Tsunami that was occurred in the year B.Sc. – Computer Science

2004. Also discuss various advancements in Tsunami warning systems.

3. Identify the major causes of urban floods in cities like Chennai, Hyderabad & Mumbai and submit a report along with various mitigation strategies to reduce the impact of floods.
4. Prepare a detailed report on how various man-made activities are directly/indirectly related to the occurrence of landslides that occurred in recent days in India.
5. Visit AP State Disaster Response and Fire Services Department and record about various methods used by them in mitigating disasters and their management.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

3. Sharma V. K., *Disaster Management*, Medtech Publishing, 2nd Edition, 2013.
4. Anand S. Arya, Anup Karanth, and Ankush Agarwal, *Hazards, Disasters and Your Community: A Primer for Parliamentarians*, GOI-UNDP Disaster Risk Management Programme, Government of India, National Disaster Management Division, Ministry of Home Affairs, New Delhi, Version 1.0, 2005

REFERENCE BOOKS:

1. Donald Hyndman and David Hyndman, *Natural Hazards and Disasters*, Cengage Learning, USA, 5th Edition, 2015.
2. *Disaster Management in India*, A Status Report, Ministry of Home Affairs, Govt. of India, May 2011.
3. Rajendra Kumar Bhandari, *Disaster Education and Management: A Joyride for Students, Teachers, and Disaster Managers*, Springer India, 2014.
4. Singh R. B., *Natural Hazards and Disaster Management*, Rawat Publications, 2009.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/105104183>
2. <https://www.digimat.in/nptel/courses/video/124107010/L01.html>

WEB RESOURCES:

1. <https://egyankosh.ac.in/handle/123456789/25093>
2. <https://www.egyankosh.ac.in/handle/123456789/25912>
3. <https://www.nios.ac.in/media/documents/333courseE/12.pdf>
4. <https://ndmindia.mha.gov.in/images/public-awareness/Primer%20for%20Parliamentarians.pdf>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25CE107603	RURAL TECHNOLOGY	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on technology for rural development, nonconventional energy, technologies for rural development, community development and it in rural development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Compare various technologies for rural development by solving rural problems through different schemes by considering ethics, society, environment and sustainability.
- CO2.** Analyze non-conventional energy sources using appropriate tools and techniques to solve rural energy problems considering society, environment and sustainability besides communicating effectively in graphical form.
- CO3.** Select appropriate technologies in different areas of rural development to solve rural issues following latest developments considering society, environment and sustainability.
- CO4.** Relate water conservation, health, safety and rural employment issues for community development to solve rural problems through appropriate technologies considering ethics, society, environment and sustainability.
- CO5.** Analyze the impact of IT, public and private partnership on rural development to solve complex rural problems using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	-	3	2	1	1	1	-
CO2	2	3	-	2	2	1	1	-	-
CO3	2	3	-	2	2	1	1	-	1
CO4	2	3	-	2	2	1	2	1	-
CO5	2	3	-	3	2	1	1	1	-
Course Correlation Mapping	2	3	-	3	2	1	2	1	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO RURAL DEVELOPMENT

(06 Periods)

India - Technology and rural development, Pre and post-independence period, Rural India Life, Indian farmer, Role of science and technology in rural development, Rural technology and poverty eradication, Rural business hubs, Technology in improving rural infrastructure, Various organizations related to innovation, Issues of technology transfer - CAPART, NABARD, CSIR, NIF.

Module 2: NON CONVENTIONAL ENERGY

(06 Periods)

Definition of energy, Types of alternative sources of energy, Sources of non-conventional energy – Solar energy: Solar pump in agriculture, Solar dryer, Solar cooker, Solar heater; Biogas, Recycling and management, Wastes conservation, Assessment and production of biomass products and their utilization.

Module 3: TECHNOLOGIES FOR RURAL DEVELOPMENT

(06 Periods)

Food and agro based technologies, Tissue culture, Nursery, Building and construction technologies, Cultivation and processing of economic plants, Cottage and social industries, Latest developments in rural technologies.

Module 4: COMMUNITY DEVELOPMENT

(06 Periods)

Water conservation, Rain water Harvesting, Drinking water Standards and simple treatments used, Environment and Sanitation, Bio fertilizers, Medical and aromatic plants, Employment generating technologies – Apiculture, Pisciculture, Aquaculture.

Module 5: IT IN RURAL DEVELOPMENT

(06 Periods)

Role of information technology (IT) in rural areas, Impact of IT in rural development, Need and necessity of technology, Corporate social responsibilities, Private sector participation (Activities in different spheres: Employment, Education, Health, Agriculture and service sectors) and Saansad Adarsh Gram Yojana (SAGY), Village adoption schemes.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Visit a nearby village and know the status of small-scale industries which are implanted and to be established based on the availability of the local resources.
2. Visit a local village and make an awareness program on energy utilization using biomass products.

3. Make a awareness program in the villages for the rural development in terms of home-made products.
4. Construct rain water harvesting structures in nearby villages where water scarcity is more and prepare a document.
5. Develop a small IT application the village area which will be used for the growth of the village.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES

TEXT BOOKS:

1. Virdi, M. S., *Sustainable Rural Technologies*, Daya Publishing House, 2nd Edition 2018.
2. Prabhath, S. V. and P. Ch. Sita Devi, *Technology and Rural India*, Serials Publications, 1st Edition, 2012.

REFERENCE BOOKS:

1. Chakravarthy, R., and Murthy, P. R. S., *Information Technology and Rural Development*, Pacific Book International, 1st Edition, 2012.
2. Shivakanth Singh, *Rural Development Policies and Programmes*, Northern Book Centre, 1st Edition, 2002.
3. Katar Singh, and Anil Shishodia, *Rural Development: Principles, Policies, and Management*, SAGE Publications India Private Limited, 4th Edition, 2016.
4. Vinayak Reddy, A. and Yadagira Charyulu, M., *Rural Development in India: Policies & Initiatives*, New Century Publications, 1st Edition, 2008.

VIDEO LECTURES:

1. <http://nptel.ac.in/courses/109/104/109104047>
2. https://www.youtube.com/channel/UCEZxAQu3ZBuIN-pYMYO2i_A/videos
3. <https://www.youtube.com/watch?v=HnrIB-QmvlQ>

WEB RESOURCES:

1. en.wikibooks.org/wiki/Technologies_for_Rural_Development/Complete
2. <https://www.oecd-ilibrary.org/sites/ae6bf9cd-en/index.html?itemId=/content/component/ae6bf9cd-en>
3. <https://crdt.iitd.ac.in/>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25LG107603	SPOKEN ENGLISH	-	1	2	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course deals with the development of fluency and intelligibility in spoken English. Through individual and group activities, students work on improving pronunciation, practicing conversation strategies, and delivering oral presentations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge of functional English for effective communication.
- CO2.** Analyze different types of vocabulary for fluency in communication
- CO3.** Apply correct usage of English grammar in writing and speaking.
- CO4.** Apply speaking strategies in terms of usage of English with accuracy, appropriacy, and fluency.
- CO5.** Analyze techniques to use communication skills for effective presentation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	2	-	3
CO2	2	3	-	-	-	-	2	-	3
CO3	2	-	3	-	3	-	2	-	3
CO4	2	-	-	-	3	-	2	-	3
CO5	2	3	2	-	3	-	2	-	3
Course Correlation Mapping	2	3	-	-	3	-	2	-	3

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: FUNCTIONAL ENGLISH

(06 Periods)

Concepts of Functional Spoken English, Self Introduction; Listening and Speaking: Do's and Don'ts; Expressions: Ability, Admiration, Agreement, Annoyance, Appreciation, Pleasure, Sarcasm, Satisfaction, Surprise, Approval, Certainty, Doubt, Gratitude, Possibility, Fear, Worry, Condolences; Asking for: Advice, Clarification, Direction, Information, Permission; Making: Predictions, recommendations

Module 2: VOCABULARY BUILDING

(06 Periods)

Vocabulary for day-to-day conversations: Vegetables, Groceries, Fruits, Weather, Parts of a Human body, Dresses, Furniture; Relations: Birds, Cries of Animals, Food, Hospitality, Houses, Rooms, Tools, Airport, News Paper, Books, Gems, Corporate Vocabulary, Jobs, Occupations, Diseases; British and American spelling; Slang Words and Technical Jargons.

Module 3 FUNCTIONAL GRAMMAR - I

(06 Periods)

English Grammar and the Indian Student, Parts of Speech, Verb forms: Tenses, Voice and Speech.

Module 4 FUNCTIONAL GRAMMAR -II

(06 Periods)

Universal Auxiliaries: Sentence Structure, WH Questions, framing of Questions with answers; Question Tags, Subject and verb agreement, Spotting Errors.

Module 5 COMMUNICATION SKILLS:

(06 Periods)

Polite, Courteous and diplomatic expressions, Good manners and Etiquette, Conversation Techniques, Narrating Stories.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Critically analyse the value of Indian money and its impact on the common man and Prepare a PowerPoint Presentation.
2. Prepare a conversation between you and a sanitary officer regarding sanitary conditions in your locality.
3. The English Language has a rich vocabulary and it increases day by day. Present a seminar on the norms adhered to in adding new words and list out the words added in the last five years with their meaning.
4. Enact roleplays in different situations.
5. Participate in group discussions and debate on present issues
6. A conversation is an exchange of ideas, thoughts, and feelings between two or more persons.

Explain it with suitable examples

7. Prepare a schedule and identify various committees to be formed for celebrating the Annual Day of a college and explain team involvement in the celebration.
8. Gather various ideas on discussing with parents the role of higher education and job opportunities.
9. Imagine you see a person wasting water. Write a dialogue objecting to such wastage of natural resources.
10. Since social media offers a wide reach easily, it becomes easier for bullies to spread gossip or issue threats. How do you think Cybercrime is a menace brought about by social media?

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXTBOOKS:

1. L. Adinarayana and V. Prakasam, "Spoken English", Neelkamal Publications Pvt. Ltd., New Delhi, 2008.
2. Ram Bhasker Raju, "The Complete Book on Spoken English" Goutham Buddha Publications, Hyderabad, 2002.

REFERENCE BOOKS:

1. Sabina Pillai, Spoken English for my World, Oxford University Press, New Delhi, 2016.
2. K. R. Lakshminarayanan, Speak in English, Scitech Publications, Chennai, 2009.

VIDEO LECTURES:

1. <https://www.britishcouncil.in/programmes/english-partnerships/state/skills-projects/AP-English-Skills>
2. <https://www.fluentu.com/blog/english/websites-to-learn-english/>

WEB RESOURCES:

1. https://study.sagepub.in/kakarla_fec
2. <https://www.theconfidentteacher.com/2018/04/five-useful-vocabulary-websites/>
3. <https://ling.sprachwiss.uni-konstanz.de/pages/home/lfg/resources.html>
4. <https://www.makeuseof.com/tag/improve-communication-skills-7-websites/>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25LG107602	ESSENTIAL LIFE SKILLS FOR HOLISTIC DEVELOPMENT	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course deals with different types of thinking skills, self-awareness, coping with stress and emotion, transformational skills, group and team dynamics, and leadership.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand different life skills required in personal and professional life.
- CO2** Analyse well-defined techniques to cope with emotions and stress.
- CO3** Apply appropriate thinking and problem-solving methods to solve problems.
- CO4** Function effectively in a team and as an individual.
- CO5** Demonstrate the qualities of an effective leader.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	2	-	2
CO2	2	3	-	-	2	-	2	-	2
CO3	2	3	-	-	2	-	2	-	2
CO4	2	2	-	-	2	-	2	-	2
CO5	2	2	-	-	-	-	2	-	3
Course Correlation Mapping	2	3	2	-	2	-	2	-	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low** **COURSE**

CONTENT

Module 1: OVERVIEW OF LIFE SKILLS

(06 Periods)

Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem-solving, Effective Communication, interpersonal relationships, coping with stress, coping with emotion. Ethics, Moral & Professional Values: Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE.

Module 2: STRESS MANAGEMENT

(06 Periods)

Stress Management: Stress, reasons, and effects, identifying stress, stress diaries, the four A's of stress management, techniques,

Approaches: action-oriented, emotion-oriented, acceptance oriented, resilience, Gratitude Training,

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

Module 3 **TRANSFORMATIONAL SKILLS** **(06 Periods)**

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

Module 4 **GROUP AND TEAM DYNAMICS** **(06 Periods)**

Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, and Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.

Module 5 **LEADERSHIP** **(06 Periods)**

Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING:

1. Prepare an attitude test and measure the attitudes of your class.
2. Prepare a Case study on the Campus Interview pressure and stress of students using SWOT analysis.
3. Record and prepare videos of various cultural people and make a comment on their accents.
4. Prepare a short film of a leader of your choice and list out the best qualities.
5. Prepare a presentation on the impact of social media on leadership management.
6. 'Knowledge of present technologies helps us to live a harmonious life.' Make a video to justify the statement.
7. Identify life skills needed in our day-to-day life and explain their importance.
8. Come up with strategies to become successful in professional life.
9. Find methods and solutions to overcome the self-pity of a person.
10. Identify the persons who are irregular to class. Find out their problems and come up with solutions.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXTBOOK:

- 1 Dr. K Alex, "Soft Skills". S Chand & Company Pvt.Ltd.2013.
- 2 Monmohan Joshi, "Soft Skills". Bookboon.com, First Edition, 2017.

REFERENCE BOOKS:

1. Barun K. Mitra. "Personality Development & Soft Skills", First Edition; Oxford Publishers. 2011.
2. Kalyana. "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd. 2015.
3. Shalini Verma. "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company, 2014.
4. John C. Maxwell. "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc. 2014.
5. Daniel Goleman, "Emotional Intelligence"; Bantam, 2006.
6. Remesh S., Vishnu R.G. "Life Skills for Engineers", Ridhima Publications, First Edition, 2016.
7. Butterfield Jeff. "Soft Skills for Everyone", Cengage Learning India Pvt Ltd; 1 edition, 2011.
8. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India; 6 edition, 2015.
9. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=xM0fajUI7Bg>
2. <https://www.youtube.com/watch?v=HwLK9dBQn0g>
3. <https://www.youtube.com/watch?v=sxX5LoojdJw>
4. <https://www.youtube.com/watch?v=xJBgqW9-lzc>
5. <https://www.youtube.com/watch?v=QVwTVM1v1c>

WEB RESOURCES:

1. <https://www.clarke.edu/campus-life/health-wellness/counseling/articles-advice/developing-a-positive-attitude/>
2. <https://www.skillsyouneed.com/ps/personal-swot-analysis.html>
3. <https://ecampusontario.pressbooks.pub/profcommsontario/chapter/cross-cultural-communication/>
4. <https://thepeakperformancecenter.com/educational-learning/thinking/#:~:text=There%20are%20several%20core%20thinking,storing%20and%20then%20retrieving%20information.>
5. <https://www.webmd.com/anxiety-panic/guide/stage-fright-performance-anxiety>
6. <https://www.ktunotes.in/ktu-syllabus-life-skills/>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25MG107601	INNOVATION, INCUBATION AND ENTREPRENEURSHIP	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: To sensitize students on the prospects, opportunities, and challenges in entrepreneurship and the potential for value creation from prospective idea

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand the basics of generating new business ideas
- CO2** Explain the concept of design thinking and product innovation.
- CO3** Illustrate the roles of digital technology in entrepreneurship.
- CO4** Understand the need for startup economics and market conditions
- CO5** Evaluate the reasons for successful entrepreneurship.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	2	1	-	-	-	-	-
CO2	1	1	1	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	2	-
CO4	3	1	1	-	-	-	-	-	1
CO5	2	2	-	-	-	1	-	-	1
Course Correlation Mapping	2	2	1	1	-	1	-	2	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: Introduction (06 Periods)

Concept & Definition, Taking product or service ideas to creating value: Why should one choose to become an entrepreneur, Entrepreneurial mind-set, Intrapreneurship

Module 2: Product Innovation (06 Periods)

Product innovation process, engineering design process and the concept of frugal engineering for developing innovative affordable products, effective user-interface.

Module 3: Digital Technology Entrepreneurship (06 Periods)

Industry 4.0 landscape and innovations using digital technologies like AI, IOT, AR/VR, Cloud, SAAS, User Applications.

Module 4: Startup Economics & Market considerations (06 Periods)

Economic consideration for starting a venture, Understanding Feasibility analysis, understanding market, targeting customer and positioning product

Module 5: Successful Business Incubation (06 Periods)

Business model innovation, Business process management, competitive advantages, Business model canvas, Bootstrapping.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING:

1. Create and present a prototype of a new product of your choice.
2. Present at least three cases of successful business Ideas in recent times
3. Discuss in the group Entrepreneurship opportunities in terms of Orientation and Development.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES**TEXT BOOKS:**

1. Robert D. Hisrich, *Entrepreneurship*,
2. Kuratko & Hodgetts, *Entrepreneurship- Theory, Process & Practice*, Thompson South-Western Publication

REFERENCE BOOKS:

1. Peter Drucker, *Innovation and Entrepreneurship*, Harper Collins
2. Thomas N. Duening, Robert D. Hisrich and Michael A. Lechter, *Technology Entrepreneurship Taking Innovation to the Marketplace*, Elsevier
3. Prof. Nigel Cross, *Bloomsbury Design Thinking Understanding How Designers Think and Work*, 2019 Edition

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_mg63/preview
2. https://onlinecourses.nptel.ac.in/noc22_de08/preview

Web Resources:

1. <https://ciie.iitism.ac.in/files/CIIE-POLICY.pdf>
2. https://www.nios.ac.in/media/documents/249_Enterpreneurship/English_pdf/249_Enterpreneurship_Lesson_16.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25EE107601	INTELLECTUAL PROPERTY RIGHTS	2	-	-	-	2
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: The course is designed to provide comprehensive knowledge to the students regarding the general principles of intellectual property rights, Concepts and Theories, Criticisms of Intellectual Property Rights, and International Regime Relating to IPR. The course provides awareness on how to protect one's unique creation, claim ownership, knowledge of what falls under the purview of someone's rights and what doesn't, and safeguard their creations and gain a competitive edge over their peers.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

- CO1** Understand the need and the concepts of intellectual property right and avenues for fulfilling intellectual property rights.
- CO2** Understand the legislative practices and protocols for the acquisition of trademarks and the judicial consequences for violating laws of trademark protection.
- CO3** Understand the legislative practices and protocols for the acquisition of copyrights and the judicial consequences for violating laws of copyright protection.
- CO4** Understand the fundamentals of patent laws, legislative practices, and protocols for acquisition of trade secrets and the judicial consequences for violating laws of trade secrets protection.
- CO5** Understand the importance of geographical indications and various laws and protocols for protecting geographical indications.

CO-PO Mapping Table:

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	--	--	--	--	--	--	--	2
CO2	3	--	--	--	1	--	--	3	2
CO3	3	--	--	--	1	--	--	3	2
CO4	3	--	--	--	1	--	--	3	2
CO5	3	--	--	--	1	--	--	3	2
Course Correlation Level	3	--	--	--	1	--	--	3	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (06 Periods)

Introduction and the need for intellectual property rights (IPR); types of intellectual property- Design; International organizations, agencies, and treaties.

Module 2: TRADEMARKS (06 Periods)

Introduction to trademark, Purpose, and function of trademarks, acquisition of trademark rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

Module 3: LAW OF COPYRIGHTS (06 Periods)

Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, a notice of copyright, and international copyright law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Module 4: TRADESECRETS (06 Periods)

Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

Module 5: GEOGRAPHICAL INDICATIONS (06 Periods)

The Geographical indications law in India, The objectives and features, the registry of geographical indications powers and functions. Types of goods offered. Protection: Agriculture goods, manufactured goods, and natural goods. Registration of indications and the requirements. Prohibition of misleading use of indications of geographical origins, prohibition of dilution of geographical origins.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Should conduct a survey based on the real scenario, where IPR is misused or unethically used and present an article.
2. Prepare an article on the registration processes of IPR practically (copy right/trade mark/ patents).
3. Should study a case of conflict on trademarks/patents and should produce an article mentioning the circumstances and remedial measures.
4. Prepare an article on the latest development in the international intellectual

property rights.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Deborah, E. Bouchoux, *Intellectual property: The law of Trademarks, Copyright, Patents, and Trade Secrets*, Cengage learning, 4th Edition, 2013.
2. Prabuddha Ganguli, *Intellectual property right - Unleashing the knowledge economy*, Tata McGraw Hill Publishing Company Ltd.
3. Marsha Aechols; *Geographical Indications for Food Products*, Wolters, 2008

REFERENCE BOOKS:

1. Neeraj P., & Khusdeep D. Intellectual Property Rights. India, IN: PHI learning Private Limited. 1st Edition 2019.
2. Nithyananda, K V. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited. 2019

VIDEO LECTURES:

- 1 <https://nptel.ac.in/courses/110105139>

Web Resources:

1. Subramanian, N., & Sundararaman, M. (2018). *Intellectual Property Rights – An Overview*. Retrieved from <http://www.bdu.ac.in/cells/ipl/docs/ipl-eng-ebook.pdf>
2. World Intellectual Property Organization. (2004). *WIPO Intellectual property Handbook*. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf
3. Cell for IPR Promotion and Management (<http://cipam.gov.in/>)
4. World Intellectual Property Organization (<https://www.wipo.int/about-ip/en/>)
5. Office of the Controller General of Patents, Designs & Trademarks (<http://www.ipindia.nic.in/>)

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
25EE107602	FUNDAMENTALS OF RESEARCH METHODOLOGY	2	-	-	-	2
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: The course is developed for the students to understand the underlying concepts of research methodology and a systematic approach for carrying out research in the domain of interest. The course is emphasized on developing skills to recognize and reflect on the strength and limitations of different types of research; data collection methods, and methods of Processing and analyzing data. The course also emphasizes interpreting the findings and research articulating skills.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understands the underlying concepts of research methodology, types of research and the systematic research process.
- CO2** Understand the philosophy of research design, types of research design and develop skills for a good research design.
- CO3** Understand the philosophy of formulation of a research problem, methods of data collection, review of literature and formulation of working hypothesis.
- CO4** Understand various data processing and analyzing techniques and their significance in the research.
- CO5** Develop skills to interpret the findings and research articulating skills along with the ethics of research.

CO-PO Mapping Table:

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	-	-	-
CO3	3	-	-	-	2	1	-	-	-
CO4	3	2	-	-	3	1	-	-	-
CO5	3	-	-	-	-	-	-	3	3
Course Correlation Level	3	2	1	-	3	1	-	3	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO RESEARCH METHODOLOGY (06 Periods)

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research.

Module 2: RESEARCH DESIGN (06 Periods)

Research design—Basic Principles, Need of research design, Features of good design, Important concepts relating to research design, Different research designs, Basic principles of experimental designs, Developing a research plan.

Module 3: RESEARCH FORMULATION (06 Periods)

Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem - Data collection - Primary and secondary sources; Critical literature review - Identifying gap areas from literature review, Development of working hypothesis.

Module 4: PROCESSING AND ANALYSIS OF DATA (06 Periods)

Processing Operations, Elements/Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Relationship, Simple Regression Analysis.

Module 5: INTERPRETATION AND REPORT WRITING (06 Periods)

Interpretation: Meaning of interpretation; Techniques of interpretation; Precautions in Interpretation.

Report Writing: Significance, Different Steps, Layout, Types of reports, Mechanics of Writing a Research Report, Precautions in Writing Reports.

Total Periods: 30

EXPERIENTIAL LEARNING:

1. Should conduct a survey based on a hypothesis, analyze the data collected and draw inferences from the data.
2. Should review the literature on the given topic and should identify the scope/gaps in the literature and develop a research hypothesis.
3. Should study a case, formulate the hypothesis and identify an appropriate testing technique for the hypothesis.
4. Study an article and submit a report on the inferences and should interpret the findings of the article.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCE

TEXT BOOKS:

1. C.R. Kothari, *Research Methodology: Methods and Techniques*, New Age International Publishers, 2nd revised edition, New Delhi, 2004.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.

REFERENCE BOOKS:

1. R. Panneerselvam, *Research Methodology*, PHI learning Pvt. Ltd., 2009.
2. Singh, Yogesh Kumar. *Fundamental of research methodology and statistics*. New Age International, 2006.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/121106007>
2. https://onlinecourses.nptel.ac.in/noc22_ge08/preview
3. <https://www.youtube.com/watch?v=VK-rnA3-41c>

WEB RESOURCES:

1. <https://www.scribbr.com/category/methodology/>
2. <https://leverageedu.com/blog/research-design/>
3. <https://prothesiswriter.com/blog/how-to-formulate-research-problem>
4. <https://www.formpl.us/blog/hypothesis-testing>
5. <https://www.datapine.com/blog/data-interpretation-methods-benefits-problems/>
6. <https://leverageedu.com/blog/report-writing/>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA104001	OBJECT ORIENTED PROGRAMMING THROUGH C++			3	-	2
Pre-Requisite	25CA102001-PROGRAMMING FOR PROBLEM SOLVING					
Anti-Requisite						
Co-Requisite						

COURSE DESCRIPTION: This course provides a detailed discussion on basic characteristics of Object Oriented Programming through C++. It covers basic Object Oriented Programming paradigms like Classes and Objects in custom application development. The OOP concepts types of overloading and inheritance are also covered. It provides hands-on experience in implementation of OOP features and other programming concepts like handling pointers, file and exceptions.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate the concepts of Object oriented programming.
- CO2.** Apply function and operator overloading techniques for code optimization.
- CO3.** Apply inheritance and virtual functions to implement dynamic binding.
- CO4.** Develop robust applications using exception handling mechanism and file I/O.
- CO5.** Develop reliable applications to solve real world problems using Object oriented programming constructs.
- CO6.** Work independently or in team to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	2	3	2	-	-	-	-	3	-	3
CO3	3	2	2	3	2	-	-	-	-	3	-	3
CO4	3	2	3	3	2	-	1	-	-	3	-	3
CO5	3	2	3	3	2	-	1	-	-	3	-	3
CO6	-	-	-	-	-	-	-	3	3	3	-	3
Course Correlation Mapping	3	2	3	3	2	-	1	3	3	3	-	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: C++ FUNDAMENTALS **(10 Periods)**

Need of Object-Oriented Programming - Comparison of procedural programming and Object-Oriented Programming - Characteristics of Object-Oriented Languages - C++ Programming Basics: Basic Program Construction - Data Types, Variables, Constants - Type Conversion, Operators, Library Functions - Loops and Decisions, Structures - Functions : Simple Functions, Passing arguments, Returning values, Reference Arguments. - Recursion, Inline Functions, Default Arguments - Storage Classes - Arrays, Strings.

Module 2: OOP FUNDAMENTALS **(09 Periods)**

Classes and Objects: Classes, Friend functions, Friend classes, Inline functions, Parameterized constructors, Static Class Members, The Scope resolution operator, nested and local classes, Passing Objects to functions, returning objects, object assignment. Arrays, Pointers, References: Array of Objects, Pointers to objects, the This pointer.

Module 3 FUNCTION AND OPERATOR OVERLOADING **(09 Periods)**

Function Overloading: Copy Constructors, and Default Arguments: Function Overloading, Overloading Constructors, Copy constructors, Default Function Arguments.

Operator Overloading: Creating a member operator function, operator overloading using a friend function, overloading new and delete, overloading some special operators, and comma operator.

Module 4 INHERITANCE AND VIRTUAL FUNCTIONS **(09 Periods)**

Inheritance: Base Class Access Control, Inheritance and protected members, inheriting multiple base classes, constructors, destructors, and inheritance, granting access, virtual base classes.

Virtual Functions: Pointers to objects, Pointers to derived classes, Virtual Functions, Pure Virtual Functions.

Module 5 FILE I/O AND EXCEPTIONS **(08 Periods)**

Files: File Pointers - Error handling in File I/O - File I/O with member Functions - Overloading the extraction and Insertion Operators - Multi File Programs

Exceptions: Need of Exceptions, keywords, Simple and Multiple Exceptions - Re-throwing Exception and Exception Specifications, Custom Exception

Total Periods: 45

EXPERIENTIAL LEARNING

1. a. Write a C++ program to identify appropriate data types and variables to find the size of various datatypes. Display the variables along with their size.
- b. Write a C++ program to take name, address as character array, age as int, salary as float and contains inline functions to set the values and display it.
2. a. Write a C++ program to display names, roll no and grades of 3 students who have appeared in examination. Declare the class of name, roll no and grade. Create an array of class objects, read and display the contents of array.
- b. Create a class TIME with members hours, minutes, seconds. Take input, add two time objects passing objects to function and display the resultant time in hours, minutes & seconds.
3. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).

POLYMORPHISM

4. a. Create a base class basic_info with data members name, roll no, sex and two member functions getdata and display. Derive a class physical_fit from basic_info which has data members height and weight and member functions getdata and display. Display all the information using object of derived class.
- b. Consider two complex number in the form $a+bi$ and $c+di$, Write a program overload binary + operator to perform addition of the complex numbers.

INHERITANCE

5. a. Write a C++ Program to calculate the area and perimeter of rectangles using concept of Hierarchical inheritance. Area class is derived from base class Rectangle. Perimeter class is also derived from base class Rectangle.
- b. Write a C++ program to create Employee and Student inheriting from Person using Hierarchical Inheritance. The Person class should contain the common attributes of Employee and Student class.
6. Design three classes STUDENT, EXAM and RESULT. The STUDENT class has data members such as rollno, name. Create a class EXAM by inheriting the STUDENT class. The EXAM class adds data members representing the marks scored in six subjects. Derive the RESULT from the EXAM class and has its own data members such as total marks. Write a C++ program to model this relationship.
7. Create a base class called SHAPE. Use this class to store two double type values. Derive two specific classes called TRIANGLE and RECTANGLE from the base class. Add to the base class, a member function getdata() to initialize base class data members and another member function display to compute and display the area of figures. Make display a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes design a program that will accept driven of a

TRIANGLE or RECTANGLE interactively and display the area.

FILE I/O

8. a. Write a C++ program named store_temps.cpp that creates a file named raw_temps.txt with temperature data. Fill thefile with at least 50 temperature readings.
- b. Assuming that a text file named FIRST.TXT contains some text written into it, write a function named copyupper() in C++, that reads the file FIRST.TXT and creates a new file named SECOND.TXT contains all words from the file FIRST.TXT in uppercase.
9. Write a C++ program that accepts two file names and produces a new file that is thecontents of the first file followed by the contents of the second; that is, the programconcatenates the two files.

EXCEPTION HANDLING

10. Add an exception handler (try/catch/throw) to the class that throws an error message (e.g. "value out of range") in the getValue function that is caught and handled in the main program. Implement two version of the program. In version1, throw the error in getValue, catch the error in the main, display an error message in the main, and then allow the program to terminate. In the second version, perform the same basic actions (throw and catch) but keep re-invoking the getValue function from the main program until the user enters a valid value.

PROJECT BASED LEARNING:

Faculty shall provide Projects relevant to the contents of the course.

Sample Projects:

1. Bookshop inventory system

The project is to build the bookshop inventory system in C++ that helps to keep track of all the book records in a shop. Below are the features to be implemented:

- Add new book and the details of the book are:
 - Book ID
 - Name of book
 - Name of Author
 - Number of books
- Delete a book
- Update anexistingbook detail
- Display summary of all the books

Search a book

2. Online Examination Management System

The project is to build the online examination management system in C++ that helps to conduct online proctored examinations. Below are the features to be implemented:

- Add New Students

- Student Login
 - Registration for examination
 - Attempting the questions
- Faculty Login
 - Uploading the questions
- Proctor Login
 - Online monitoring of students
- Admin View
 - Consolidation of marks
 - Release of results

RESOURCES

TEXT BOOKS:

1. Herbert Schildt, "C++ - The Complete Reference", 4th edition, Tata McGraw Hill, 2018.
2. E.Balaguruswamy "Object Oriented Programming with C++", 6th edition, Tata McGraw Hill Education, 2015.

REFERENCE BOOKS:

1. Cohoon and Davidson, "C++ Program Design: An introduction to Programming and object - Oriented Design", 3rd Edition, Tata McGraw Hill, 2003.
2. Robert Lafore, "Object-Oriented Programming in C++", 4th edition, Pearson Education, 2008.
3. Walter Savitch, "Problem Solving with C++", 9th edition, Pearson Education, 2015.

SOFTWARE/TOOLS:

1. Software: Dev C++

VIDEO LECTURES:

1. <https://www.coursera.org/learn/c-plus-plus-a#syllabus>
2. <https://www.udemy.com/free-learn-c-tutorial-beginners/>
3. https://onlinecourses.nptel.ac.in/noc21_cs02/preview

WEB RESOURCES:

1. <http://www.cplusplus.com/files/tutorial.pdf>
2. <http://mazonka.com/shared/Straustrup4th.pdf>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM101020	COMPUTER ORGANIZATION AND ARCHITECTURE					3
Pre-Requisite	--					
Anti-Requisite	--					
Co- Requisite	--					

COURSE DESCRIPTION: This course deals with basic function, structure and components of computer system, Central Processing Unit, Control Unit and I/O Unit. This course also imparts knowledge on different types of Memory Systems, Parallel Processing techniques and Multicore architectures with its issues.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge on computer organization, architecture and interconnection structures of a digital computer.
- CO2.** Analyze Arithmetic Operations, Addressing Modes, Instruction Formats, Processor and Register organization.
- CO3.** Design digital circuits for the given functional description of microoperations and memory elements.
- CO4.** Investigate the performance of Input /Output Systems, Memory systems, parallel processors, Multicore architectures to evaluate the cost-performance trade-offs.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2		-	-	-	-	-	-	3	-	-	-
CO3	3	2	1	-	-	-	-	-	-	3	-	-	-
CO4	3	2	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	3	2	1	-	-	-	-	-	-	3	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO COMPUTER SYSTEM (08 Periods)

Organization and architecture, Structure and function, IAS computer structure, Computer function, Interconnection structures, Bus interconnection.

Module 2: CENTRAL PROCESSING UNIT (09 Periods)

Arithmetic logic unit, Integer multiplication- Booth's algorithm; Floating point representation principles, Machine instruction characteristics, Addressing modes, Instruction formats – Instruction length, Allocation of bits; Processor organization, Register organization – User visible registers, Control and status registers; Instruction cycle.

Module 3: CONTROL UNIT AND INPUT/OUTPUT (10 Periods)

Control Unit: Micro operations, Control of the processor – Functional requirements, Control signals, Internal processor organization; Hardwired implementation, Microinstructions, Micro programmed control unit, Micro instruction sequencing – Design considerations, sequencing techniques, Address generation; Micro instruction execution- A taxonomy of microinstructions, Microinstruction encoding.

Input/Output: External devices, I/O modules, Direct memory access function, I/O Channels and Processors, PCI Physical and Logical Architecture.

Module 4: MEMORY SYSTEMS (09 Periods)

Semiconductor Memories: Computer Memory System overview, Semiconductor Main Memory- Organization, DRAM and SRAM, Types of ROM, Chip logic, Chip packaging, Module organization, Interleaved memory; DDR DRAM, Flash Memory, Newer Nonvolatile Solid-State Memory Technologies.

Cache Memory: Cache Memory Principles, Elements of Cache Design- Cache Addresses, Mapping Functions.

External Memory: Solid State Drives.

Module 5: PARALLEL ORGANIZATION (09 Periods)

Parallel Processing: Multiple Processor Organizations, Instruction Pipelining, Symmetric Multiprocessors, Non uniform Memory Access, Multicore Organization.

Multicore Computers: Hardware performance issues, Software performance issues, Multicore organization, Intel Core i7-990X.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a report on Product Specifications such as CPU, Memory, Processor Graphics and advanced technologies of Intel Core i9-12900K -New performance hybrid architecture. The World's Best Gaming Processor: Available with up to 16 cores and 24 threads, the new 12th Gen Intel Core processor family includes the world's best gaming processor, the Core i9-12900K, unleashing gaming experiences across top titles. (<https://ark.intel.com/content/www/us/en/ark/products/134599/intel-core-i912900k-processor-30m-cache-up-to-5-20-ghz.html>)

2. Write a report on OpenCL(Open Computing Language) framework used for writing programs that execute across heterogeneous platforms consisting of central processing units, graphics processing units, digital signal processors, field-programmable gate arrays and other processors or hardware accelerators. (<https://www.khronos.org/api/opencl>)

RESOURCES

TEXT BOOKS:

1. William Stallings, Computer Organization and Architecture: Design for performance, Pearson, 11th Edition, 2020.

REFERENCE BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, McGraw Hill Education, 2013.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design - A Hardware software interface, 5th Edition, Morgan Kaufmann, 2014.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs37/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs47/preview
4. <https://freevideolectures.com/course/2277/computer-organization>
5. <https://www.youtube.com/watch?v=4TzMyXmzL8M>

WEB RESOURCES:

1. <https://www.javatpoint.com/computer-organization-and-architecture-tutorial>
2. <https://www.geeksforgeeks.org/last-minute-notes-computer-organization/>
3. <https://gateoverflow.in/blog/9728/some-good-resources-for-computer-organisation-architecture>
4. <https://tutorialspoint.dev/computer-science/computer-organization-and-architecture/>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM101003	DESIGN AND ANALYSIS OF ALGORITHMS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: The primary objective of this course is to introduce the concept of algorithm as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Identify various Time and Space complexities of various algorithms
- CO2.** Understand Tree Traversal method and Greedy Algorithms
- CO3.** Apply Dynamic Programming concept to solve various problems
- CO4.** Apply Backtracking, Branch and Bound concept to solve various problems
- CO5.** Implement different performance analysis methods for non deterministic algorithms

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	3	2	-
CO3	2	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	3	2	-
Course Correlation Mapping	3	2	3	-	-	-	-	-	-	3	2	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO ALGORITHMS **(10 Periods)**

INTRODUCTION: Algorithm, pseudo code for expressing algorithms, performance analysis- space complexity, time complexity, asymptotic notation- big (O) notation, omega notation, theta notation and little (o) notation, recurrences, probabilistic analysis, disjoint set operations, union and find algorithms.

Module 2: DIVIDE AND CONQUER AND GREEDY METHOD **(08 Periods)**

DIVIDE AND CONQUER: General method, applications-analysis of binary search, quick sort, merge sort, AND OR Graphs.

GREEDY METHOD: General method, Applications-job sequencing with deadlines, Fractional knapsack problem, minimum cost spanning trees, Single source shortest path problem.

Module 3 GRAPHS AND DYNAMIC PROGRAMMING **(09 Periods)**

GRAPHS (Algorithm and Analysis): Breadth first search and traversal, Depth first search and traversal, Spanning trees, connected components and bi-connected components, Articulation points.

DYNAMIC PROGRAMMING: General method, applications - optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

Module 4 BACKTRACKING AND BRANCH AND BOUND **(10 Periods)**

BACKTRACKING: General method, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles.

BRANCH AND BOUND: General method, applications - travelling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.

Module 5 NP-HARD AND NP-COMPLETE PROBLEMS **(08 Periods)**

NP-HARD AND NP-COMPLETE PROBLEMS: Basic concepts, non-deterministic algorithms, NP-hard and NP-complete classes, Cook's theorem.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Design and develop shortest paths algorithm.
2. Demonstrate Warshall's algorithm.
3. Implement 0/1 Knapsack problem using Dynamic Programming.
4. Find Minimum Cost Spanning Tree for a given undirected graph using Kruskal's algorithm.
5. Demonstrate Tree Traversal and Graph Traversal .

RESOURCES

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, 2 nd Edition, Universities Press, 2008.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms,3rd Edition, MIT Press, 2009.

REFERENCE BOOKS:

1. Michael T. Goodrich and Roberto Tamassia, Algorithm Design and Applications, Wiley, 2014.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Pearson, 2006.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106/106/106106131/>
2. <https://archive.nptel.ac.in/courses/106/101/106101060/>
3. https://onlinecourses.nptel.ac.in/noc19_cs47/preview

Web Resources:

1. <https://www.coursera.org/lecture/analysis-of-algorithms/resources-jMWPY>
2. <https://www.udemy.com/course/design-and-analysis-of-algorithms/>
3. <https://courses.cs.duke.edu/fall08/cps230/Book.pdf>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA102006	JAVA PROGRAMMING	3	-	2	-	4
Pre-Requisite	25CA104001-Object Oriented Programming with C++					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION

Representation of Java Classes and methods; Inheritance and Polymorphism using Java, Creation of Packages and Interfaces; Implementation of Utility Classes and Input/output; Exception handling mechanism and multithreading; Event handling techniques and GUI applications by using AWT.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the basic concepts of classes, objects, methods of JAVA Programming to build Java applications.
- CO2.** Analyze inheritance and polymorphism to solve real world problems.
- CO3.** Design and develop GUI Applications using AWT.
- CO4.** Apply utility classes, Java collections, exception handling and multithreading concepts to develop real time applications.
- CO5.** Work together to customize the real world applications. Communicate effectively about complex computing activities by writing documentation.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	3	-
CO3	1	2	3	-	-	-	-	-	-	-	3	-
CO4	1	2	2	3	3	-	-	-	2	-	-	3
CO5	-	-	-	-	-	-	2	-	2	3	-	-
Course Correlation Mapping	3	3	2	2	2	-	-	-	2	2	2	2

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: JAVA BASICS, OPERATORS, OBJECT AND CLASS CONCEPT (09 Periods)

Java Basics : JAVA environment, JAVA program structure, Tokens, Statements, JVM, Constant and Variables, Data Types, Declaration of variables, Scope of variables, Symbolic constants, Type Casting.

Operators: Arithmetic, Relational, Logical assignments, Increment and Decrement, Conditional, Bitwise, Special, Expressions and its evaluation.

Object and Class Concept: Defining a Class, Adding variables and Methods to classes, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, and Nesting of Methods.

Module 2: INHERITANCE, ARRAYS AND INTERFACE (09 Periods)

Inheritance: Extending a Class, Overriding Methods, Final Variables and Methods, Final Classes, Finalize Methods, Abstract Methods and Classes, Visibility Control.

Arrays: One Dimensional and Two Dimensional, Strings, Vectors, Wrapper Classes.

Interface: Defining Interface, Extending Interface, Implementing Interface, Accessing Interface Variable.

Module 3 EXCEPTION HANDLING , THREADS AND .PACKAGES (09 Periods)

Exception Handling: Concepts of Exceptions, Types of Exception, Try and Catch keyword, Nested Try and Catch.

Threads: Creating Threads, Extending Threads Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization.

Packages: System Packages, Using System Package, Adding a Class to a Package, Hiding Classes.

Module 4 UTILITY CLASSES AND INPUT/OUTPUT (09 Periods)

Utility Classes: Introduction to Java Collections, Overview of Java Collection Frame Work, Commonly used Collection Classes: Hash Set, Linked Hash Set, Linked List, Stack, Array List, Vector, Hash table;

Input/output: Introduction, Concept of Streams, Stream Classes, Byte Stream Classes, Character Stream Classes, Using Streams, Other Useful I/O Classes, Using the File Class, Input / Output Exceptions, Creation of Files, Reading / Writing Characters, Reading / Writing Bytes.

Module 5 EVENT HANDLING AND GUI PROGRAMMING WITH JAVA (09 Periods)

Event Handling: Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces.

GUI Programming with Java: Graphics Programming, Input/Output: Graphics programming: Introduction, The Graphics Class, Lines and rectangles, circles, and Ellipses, Drawing Arcs, Drawing Polygons, Lines Graphs, Using Control Loops in Applets, Drawing Bar Charts.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a Java program that prints all real solutions to the quadratic equation $ax^2 + bx + c = 0$. Read in a , b , c and use the quadratic formula. If the discriminant $b^2 - 4ac$ is negative, display a message stating that there are no real solutions.
2. Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer.
3. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use StringTokenizer class of java.util)
4. Write a Java program to illustrate method overloading.
5. Write a Java program to implement the matrix ADT using a class. The operations supported by this ADT are:
 - a) Reading a matrix.
 - b) Printing a matrix.
 - c) Addition of matrices.
 - d) Subtraction of matrices.
 - e) Multiplication of matrices.
6. Write a Java program that uses functions to perform the following operations:
 - a. Inserting a sub-string in to the given main string from a given position.
 - b. Deleting n characters from a given position in a given string.
7. Write a Java program that illustrates the following:
 - a) Creation of simple package.
 - b) Accessing a package.
8. Write a Java program that illustrates the following:
 - a) Handling predefined exceptions
 - b) Handling user defined exceptions
9. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
10. Write a java program to demonstrate various GUI components in java (AWT) with appropriate Event Handling.

11. Develop an applet in Java that displays a simple message.
12. Write a Java program that works as a simple calculator. Use a grid layout to buttons for the digits and for the +, -, *, % operations. Add a text field to display the result.

RESOURCES

TEXT BOOK:

1. Herbert Schildt, "The Complete Reference Java", Tata McGraw-Hill, 7th Edition, 2007.

REFERENCE BOOKS:

1. B. Eswar Reddy, T. V. Suresh Kumar and P. Ragavan, "Object Oriented Programming th Java," Pearson Sanguine Publications, 2nd Edition, 2011.
2. H. M. Dietel and P. J. Dietel, "Java How to Program," Pearson Education/ PHI, 5th Edition, 2009.

VIDEO RESOURCE:

1. <https://nptel.ac.in/courses/106105191>
2. <https://www.udemy.com/course/java-tutorial/>
3. <https://www.udemy.com/course/java-the-complete-java-developer-course/>
4. <https://www.udemy.com/course/the-complete-java-development-bootcamp/>

WEB RESOURCE

1. https://www.tutorialspoint.com/java/java_tutorial.pdf
2. <https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf>
3. <https://book.huihoo.com/goalkicker.com/JavaBook/JavaNotesForProfessionals.pdf>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM102002	WEB TECHNOLOGIES	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Hyper Text Markup Language (HTML); Features of HTML5; Cascading Style Sheets (CSS); JavaScript; JQuery; Bootstrap; Hypertext Preprocessor (PHP); MySQL.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge on web page design elements, dynamic content and database connection.
- CO2.** Analyze user requirements to develop web applications.
- CO3.** Design client-server applications using web technologies.
- CO4.** Demonstrate problem solving skills to develop enterprise web applications.
- CO5.** Apply HTML, CSS, JavaScript, JQuery, Bootstrap and PHP technologies for device independent web application development.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	3	2	-	3	-	-	-	3	-	-	-	3

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: HTML (09 periods)

Introduction: Fundamentals of HTML, Working with Text, Organizing Text in HTML, Working with Links and URLs, Creating Tables, Working with Images, Canvas, Forms, Frames and Multimedia.

Module 2: MORE ON HTML (09 Periods)

Introduction, HTML5 Document Structure, Creating Editable Content, Checking Spelling Mistakes, Exploring Custom Data Attributes, Client-Side Storage, Drag and Drop Feature, Offline Web Applications, Web Communications, Cross-Document Messaging and Desktop Notifications

Module 3: CSS AND JAVASCRIPT (10 Periods)

CSS: Introduction, CSS Selectors, Inserting CSS in an HTML document, Backgrounds, Fonts, and Text Styles, Creating Boxes, Displaying, Positioning and Floating Elements, Features of CSS3, Media Queries.

Java script: Overview of JavaScript, JavaScript Functions, Events, Image Maps and Animations, JavaScript Objects, Working with Browser and Document Objects, JQuery - Introduction, JQuery Selectors, Events, Methods to access HTML elements and attributes, Introduction to AJAX.

Module 4: INTRODUCTION TO PHP (09 Periods)

Introduction, Data Types, Variables, Constants, Expressions, String Interpolation, Control Structures, Functions, Arrays, Embedding PHP Code in Web Pages, Object Oriented PHP.

Module 5: PHP WEB FORMS AND MYSQL (08 Periods)

PHP Web forms: PHP and Web Forms, Sending Form Data to a Server, Working with Cookies and Session Handlers

PHP with MySQL: Interacting with the Database, Prepared Statement, Database Transactions.

Total Periods: 45

LIST OF EXPERIMENTS

Design the following static web pages of an online book store web application.

a. Home Page:

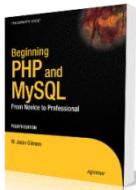
Logo	Name of the Book Store				
	Home	Latest Arrivals	Best Sellers	Contact Us	Search
Computers Electronics Electrical Bio-Tech	Description of the Book Store (Images, Scroll Text, etc)			<input type="text" value="Username"/> <input type="text" value="Password"/> <input type="button" value="Sign-in"/> New User Create an Account	

b. Catalogue Page:

The catalogue page should display the following details of available books.

- i. Snap shot of cover page
- ii. Title of the text book
- iii. Author name
- iv. Publisher
- v. Price
- vi. More details link.

1.

Logo	Name of the Book Store				
	Home	Latest Arrivals	Best Sellers	Contact Us	Search
Computers Electronics Electrical Bio-Tech	<hr/> HTML5 Black Book  Kogent Learning Solutions Dreamtech Press Rs. 570/- <hr/> Beginning PHP and MySQL  4th Edition W Jason Gilmore Apress Rs. 520/-				More Details

c. Registration Page:

Design the Registration page with the following fields and navigate it with create an account link.

i. First Name	ii. Last Name	iii. Gender
iv. Date of Birth	v. Username	vi. Password
vii. Confirm Password	viii. Address	ix. Postal Code
x. Mobile No.	xi. Email-Id	

2.
 - a. Design a web page to store username and password information using the local storage concept.
 - b. Design a web page to store employee information including Name, Emp. Id, Department, Salary and Address on a client's machine using a real SQL database.
3. Apply the following styles to all web pages of online book store web application.
 - a. Fonts and Styles: font-family, font-style, font-weight and font-size
 - b. Backgrounds and colors: color, background-color, background-image and background-repeat
 - c. Text: text-decoration, text-transformation, text-align and text-indentation, text-align
 - d. Borders: border, border-width, border-color and border-style
 - e. Styles for links: A: link, A: visited, A:active, A:hover
 - f. Selectors, Classes, Layers and Positioning elements.
4. Write a JavaScript/JQuery code to validate the following fields of the Registration web page.
 - a. First Name/Last Name - should contain only alphabets and the length should not be less than 8 characters.
 - b. Username - It should contain combination of alphabets, numbers and underscore. It should not allow spaces and special symbols.
 - c. Password - It should not less than 8 characters in length and it contains one uppercase letter and one special symbol.
 - d. Date of Birth - It should allow only valid date; otherwise display a message stating that entered date is invalid. Ex. 29 Feb. 2009 is an invalid date.
 - e. Postal Code: It must allow only 6 digit valid number.
 - f. Mobile No. - It should allow only numbers and total number of digits should be

equal to 10.

- g. e-mail id - It should allow the mail

5. Design a web page with the following features using HTML5, JavaScript and JQuery

- a. Displaying of images with Custom animated effects
- b. Playing of selected video from the list of videos
- c. Showing the animated text in increasing and decreasing font size
- d. Changing the size of the area in a web page using DIV tag
- e. Hiding and Showing elements in a web page.

6. Design a web page with the following features using Bootstrap and Media Query.

- a. Components
- b. Responsive tables
- c. Responsive images and videos
- d. Toolbars, Buttons and Lists

7. a. Deploy and navigate web pages of online book store using WAMP/XAMPP web server.

b. Write a PHP program to read user name and favorite color from the HTML form. Display the name of the user in green color and sets user favorite color as a background for the web page.

8. Write a PHP code to read the username and password entered in the Login form of the online book store and authenticate with the values available in cookies. If user enters a valid username and password, welcome the user by username otherwise display a message stating that, entered details are invalid.

9. Write a PHP code to read user details entered through the registration web page and store the same into MySQL database.

10. Write a PHP code for storing books details like Name of the book, author, publisher, edition, price, etc into MySQL database. Embed a PHP code in catalogue page of the online book store to extract books details from the database

RESOURCES

TEXTBOOKS:

1. Kogent Learning Solutions Inc, *HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery*, Dreamtech Press, First Edition, 2011.
2. W. Jason Gilmore, *Beginning PHP and MySQL*, APress, Fourth Edition, 2011.

REFERENCE BOOKS:

1. Snig Bahumik, *Bootstrap Essentials*, PACKT Publishing, First Edition, 2015 (e-book).
2. Thomas A. Powell, *The Complete Reference: HTML and CSS*, Tata McGraw Hill, Fifth Edition, 2010.
3. Andrea Tarr, *PHP and MySQL*, Willy India, First Edition, 2012.
4. Kogent Learning Solutions Inc, *HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery*, Dreamtech Press, First Edition, 2011.

VIDEO LECTURES:

1. [Introduction to Web Technologies - Part 1 | Web Technologies Tutorial - YouTube](#)

WEB RESOURCES:

1. <https://www.w3schools.com/php/DEFAULT.asp>
2. <https://www.w3schools.com/js/>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA101006	SOFTWARE ENGINEERING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on concepts of Software Engineering, Software Process Models, Conventional and Agile Process Models, Software Requirements Engineering Process, System Analysis, Architectural Design, User Interface Design and Re-engineering, Software Testing, Risk and Quality Management

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate concepts of software engineering and analyze process models required to develop a software system.
- CO2.** Analyze software requirements and model requirements for the given scenario.
- CO3.** Apply design concepts and metrics for software development.
- CO4.** Apply testing strategies and techniques for quality software.
- CO5.** Analyze risks in software development life cycle and apply risk strategies to mitigate risks.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	
CO1	2	3	3	-	-	-	-	-	-	3	-	-	-
CO2	2	3	-	-	-	3	3	2	2	3	-	-	-
CO3	2	3	3	2		2	2	-	3	3	-	-	-
CO4	2	-	-	-	2	3	-	-	-	3	-	-	-
CO5	2	3	-	-	2	3	-	-	-	3	-	-	-
Course Correlation Mapping	2	3	3	2	2	3	3	2	3	3	-	-	-

Correlation Levels:

3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: SOFTWARE PRODUCT AND SDLC (11 Periods)

Software Engineering Fundamentals, Definition of Software Products, Phases of Software Development Life Cycle, Software Development Paradigm, Software Life Cycles Models: Build and Fix Model, Waterfall Model, Prototype Model, Iterative Model, Evolutionary Model, Spiral Model.

Module 2: SOFTWARE REQUIREMENT SPECIFICATION (SRS) (07 Periods)

Need for SRS-Requirement process, Problem Analysis using UML (Unified Modelling Language) and Data dictionary, Characteristics of SRS, Components of an SRS. IEEE standard for SRS.

Module 3 SOFTWARE DESIGN PRINCIPLES (09 Periods)

Software Design, Design Process, Design Principles: Abstraction, Refinement, Modularity, Information Hiding, Modular Design: Effective Modular Design and Functional Independence, Cohesion, Coupling, Top down and Bottomup Strategies, Coding: Coding Standard and Guidelines, Testing: Black Box Testing and White Box Testing.

Module 4 SOFTWARE RELIABILITY AND REUSABILITY (08 Periods)

Software reliability metrics , Software reliability Specification , Statistical testing ,Reliability Growth modeling, Fault avoidance & tolerance, Exception handling & defensive programming , Software development with reuse, Software' development for reuse , Generator based reuse, Application System Portability.

CASE TOOLS AND PROJECT MANAGEMENT

Module 5 FUNDAMENTALS: (10 Periods)

Relevance of CASE Tool, Building block for CASE Tools, Integrated Case Tool Environment, Generation of CASE Tool, High End and Low End CASE Tools.

Definition of Project, Project Specification and Parameters, COCOMO model, Principles, of Project Management, Project Management Life Cycle, Program Management Plan: Concept, Elements, Planning Issues, Benefits of Program Management..

Total Periods: 45

EXPENTIAL LEARNING

1. Identify Functional and Non-Functional Requirements for:
 - a. Online Ticket Reservation for Railways
 - b. Recruitment Procedure for Software Industry

2. **Online Ticket Reservation for Railways**

Problem Statement: Computer plays an integral part of the day in today's life. It makes the entire job easier and faster, every job is computerized so as the ticket reservation we can book over the online ticket reservation system. During the booking of the ticket reservation passenger has to select origin, date of journey, destination, class of train etc. The reservation counter keeps track of passenger's information. Thus the system will have all the details about the trains and facilities provided by them. There are various trains with the different level of convenience for the passengers. The whole database will be maintained by database administrator. There are varieties of trains where the passengers can select the train according to the convenience for their destination journey. The journey could be within the state or across the India. Each train has the three types of classes i.e. Sleeper class, First class and the AC compartment. Design the application for the above problem description. Model using Visual modelling tools in different views i.e. component view, Deployment view.

3. **Recruitment Procedure for Software Industry**

Problem Statement: In the software industry the recruitment procedure is the basic thing that goes in the hand with the requirement as specified by the technical management team. HR first gives an advertisement in leading Newspapers, Journals, Weeklies and Websites. The job seekers can apply for it through by Post or by e-mail to the company. The technical skill and the experience of the candidates are reviewed and the short listed candidates are called for the interview. There may be different rounds for interview like the written test, technical interview, and HR interview. After the successful completion of all rounds of interview, the selected candidates' names are displayed. Meanwhile HR gives all the details about the salary, working hours, terms and conditions and the retirement benefit to the candidate.

Model using Visual modelling tools in different views i.e. Use case view, logical view

RESOURCES

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering - A Practitioner's Approach," McGraw-Hill International Edition, 8th Edition, 2015
2. Ian Sommerville, "Software Engineering," Pearson Education, 9th Edition, 2011.

REFERENCE BOOKS:

1. Grady Booch, James Rum Baugh and Ivar Jacobson, "The Unified Modeling Language User Guide," 2nd Edition, Pearson Education, 2009.
2. K. K. Aggarwal and Yogesh Singh, "Software Engineering," New Age International Publishers, 3rd Edition, 2007.
3. Shelly Cashman Rosenblatt, "Systems Analysis and Design," Thomson Publications, 6th Edition, 2006.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106105087/>
2. <https://nptel.ac.in/courses/106105182/>

WEB RESOURCES:

1. Agile Modelling
<https://www.techtarget.com/searchsoftwarequality/definition/agile-software-development>
2. Functional and Non-Functional Requirements:
<https://www.linkedin.com/learning/software-design-developing-effective-requirements/functional-vs-non-functional>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM102003	OPERATING SYSTEMS	3	-	2	-	4
Pre-Requisite						
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Operating Systems Operations; Process Scheduling; Process Synchronization, Deadlocks; Paging and Segmentation, Disk Scheduling; File Concepts, I/O Interface; Concepts of Protection and Security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze performance of CPU scheduling algorithms.
- CO2.** Design solutions for process synchronization problems by using semaphores and monitors.
- CO3.** Devise solutions for deadlocks using deadlock handling mechanisms.
- CO4.** Solve memory management problems using page replacement and disk scheduling algorithms.
- CO5.** Identify efficient file allocation methods for optimal disk utilization & analyse services of I/O subsystems and mechanisms of security & protection.
- CO6.** Work independently or in team to solve problems with effective communication

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	-	-	-	-	3	-	-
CO2	2	2	3	-	2	-	-	-	-	3	-	-
CO3	2	2	3	-	2	-	-	-	-	3	-	-
CO4	2	2	3	-	2	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	3	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	2	2	3	3	2	-	-	-	3	3	-	3

Correlation Levels:

3: High;

2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO OPERATING SYSTEM AND PROCESS MANAGEMENT (08 Periods)

Introduction: Definition, Operating System Structure and Services, System Calls.

Process Management: Process Scheduling, Process Control Block, Inter Process Communication, Threads, Multithreading Models, CPU Scheduling Criteria, Scheduling Algorithms, Multiprocessor Scheduling.

Module 2: PROCESS SYNCHRONIZATION AND DEADLOCKS (10 Periods)

Process Synchronization: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Synchronization Problems, Monitors.

Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Prevention, Detection, Avoidance, Recovery from deadlock.

Module 3: MEMORY MANAGEMENT AND SECONDARY STORAGE (10 Periods)

Memory Management: Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging.

Virtual Memory: Demand Paging, Page Replacement Algorithms, Copy-on-Write, Thrashing.

Secondary Storage Structure: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management.

Module 4: FILE AND I/O SYSTEMS (08 Periods)

File System: File concept, Access Methods, Directory Structure, File System Structure, i-node, File System Implementation, Directory Implementation, Allocation Methods.

I/O System: I/O Hardware, Application I/O Interface, Kernel I/O subsystem.

Module 5: PROTECTION AND SECURITY (09 Periods)

Protection: Goals, Principles, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights.

Security: Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications.

Total Periods: 45

EXPERIENTIAL LEARNING

1.
 - a) Write a program to implement Process System Calls.
 - b) Write a program to implement I/O System Calls.
2. Write a program to implement named and unnamed pipes.
3. Demonstrate File Permissions.
4. Analyze the following CPU Scheduling Algorithms:
 - a) FCFS
 - b) SJF (Preemptive)
 - c) Priority
 - d) Round Robin

5. Design solutions for the following synchronization problems:
 - a) Producer Consumer Problem b) Dining Philosophers Problem.
6. Design Banker's Algorithm for Deadlock Avoidance. Find the safe sequence. If Maximum request of any one process is changed, detect whether a deadlock has occurred or not. Consider the number of resources are three and Jobs are five.
7. Implement the following Algorithms:
 - a) First Fit b) Best Fit c) Worst Fit
8. Implement the following Page Replacement Algorithms
 - a) FIFO b) LFU c) LRU d) Optimal
9. Implement the following Disk Scheduling Algorithms
 - a) FCFS b) SSTF c) SCAN d) CSCAN
10. Implement the following file allocation strategies:
 - a) Contiguous Allocation b) Linked Allocation

RESOURCES

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Wiley India Edition, 9th Edition, 2016.

REFERENCE BOOKS:

1. William Stallings, Operating Systems, Internals and Design Principles, Pearson Education, 7th Edition, 2013.
2. Andrew S. Tanenbaum, Modern Operating Systems, PHI, 3rd Edition, 2009.

SOFTWARE/TOOLS:

1. **Software: Windows, Linux OS, Fedora OS, Ubuntu OS**

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs72/preview
2. <https://www.udemy.com/course/operating-systems-from-scratch-part1/>

WEB RESOURCES:

1. operating-systems · GitHub Topics · GitHub
2. Operating System Introduction (w3schools.in)
3. What is Operating System (OS)? Definition and Functions - javatpoint
4. Operating System Tutorial - GeeksforGeeks

PROGRAM CORE

Course code	Course Title	L	T	P	S	C
25CA101012	COMPUTER NETWORKS	3	-	-	-	3
Pre-Requisite	25MM101001- Introduction to Data Communication and Networks					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION

Concepts of Computer Networks, The Physical Layer, The Data Link Layer, The Network Layer, The Transport Layer, The Application Layer.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand the concepts of Networking, reference models, transmission media.
- CO2** Apply error and flow control techniques and implement congestion control mechanisms and transport protocols for reliable data communication.
- CO3** Analyze design issues of layers, techniques for quality of service, elements of transport and application Protocols ensuring the communication procedures.
- CO4** Examine the layered and e-mail architectures, networking protocols and e-mail message formats in compliance with communication standards.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	2	2	3	1	3	1	-	-	-	-	-	3
CO3	2	3	3	-	2	2	-	-	-	-	-	3
CO4	-	1	1	-	-	2	-	-	-	-	-	2
Course Correlation Mapping	2	2	3	1	3	2	-	-	-	-	-	3

Correlation Levels: **3: High;** **2: Medium;1: Low**

COURSE CONTENT

Module 1: NETWORK CONCEPTS AND PHYSICAL LAYER (09 Periods)

Network Concepts: Uses of Computer Networks, Network Hardware, Network Software, Reference Models-OSI, TCP/IP. **The Physical Layer:** Guided Transmission media-Magnetic Media, Twisted Pairs, Coaxial Cable, Fiber Optics. Wireless Transmission-The Electromagnetic Spectrum, Radio Transmission, Infrared Transmission and Light Transmission

Module 2: THE DATA LINK LAYER (09 Periods)

The Data Link Layer: Data Link layer design issues, Error Detection and Correction, Elementary Data Link Protocols - Unrestricted simplex protocol, Simplex stop-and-wait protocol, Simplex protocol for a noisy channel. Sliding Window protocols - One-bit sliding window protocol, Protocol using Go back N, Protocol using Selective Repeat.

Module 3: THE NETWORK LAYER (10 Periods)

Network layer design issues, Routing Algorithms-Optimality principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Congestion Control Algorithms, Internetworking, The Network layer in the Internet-The IP Version 4 protocol, IP Addresses.

Module 4: THE TRANSPORT LAYER (10 Periods)

The Transport service, Elements of Transport protocols -Addressing, Connection Establishment, Error Control and Flow Control, Multiplexing and Crash recovery, Remote Procedure Call, Connectionless Transport: UDP, Principles of Reliable Data transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.

Module 5: THE APPLICATION LAYER (07 Periods)

DNS - The Domain name space, Resource records and Name servers; Electronic Mail-Architecture and services, the user agent, message formats, message transfer and Final Delivery.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a C program to implement the algorithm for parity method for error control.
2. Write a C program to implement the algorithm on hamming method for error correction (both single and block errors).
3. Write a C program to implement the algorithm for check sum computation

RESOURCES

TEXT BOOK:

1. Andrew S. Tanenbaum and David J. Wetherall, "*Computer Networks*," Pearson Education, 5th Edition, 2015.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "*Data Communications and Networking*," The McGraw-Hill, 4th Edition, 2011.
2. James F. Kurose and Keith W. Ross, "*Computer Networking: A Top-Down Approach*," Pearson Education, 6th Edition, 2017.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106/105/106105081/>
2. https://www.youtube.com/watch?v=6_PINy02_g0

WEB RESOURCES:

1. <https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/networking-basics.html>
2. <https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf>
3. [https://www01.ibm.com/servers/resourcelink/svc0302a.nsf/pages/zVMV7R1sc246333/\\$file/kijl0_v7r1.pdf](https://www01.ibm.com/servers/resourcelink/svc0302a.nsf/pages/zVMV7R1sc246333/$file/kijl0_v7r1.pdf)
4. <http://ns2simulator.com/ns2-tcp-congestion-control/>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM102004	BIG DATA TECHNOLOGIES USING R	3	-	2	-	4
Pre-Requisite	25CA102002-Database Management Systems					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to Big Data, Data analysis using big data tools, data frames and charts and graphs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand data and classification of digital data.
- CO2** Understand Big Data Analytics.
- CO3** Load data in to R.
- CO4** Organize data in the form of R objects and manipulate them as needed.
- CO5** Perform analytics using R programming.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	3	2	-	3	-	-	-	3	-	-	-	3

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO BIG DATA **(09 Periods)**

Data, classification Of Digital Data--structured, unstructured, semi-structured data, characteristics of data, evaluation of big data, definition and challenges of big data, what is big data and why to use big data ?, business intelligence Vs big data.

Module 2: BIG DATA ANALYTICS **(08 Periods)**

What is and isn't big data analytics? Why hype around big data analytics? Classification of analytics, top challenges facing big data, importance of big data analytics, technologies needed to meet challenges of big data.

Module 3: INTRODUCTION TO R AND GETTING STARTED WITH R **(09 Periods)**

What is R? Why R? , advantages of R over other programming languages, Data types in R- logical, numeric, integer, character, double, complex, raw, ls() command, expressions, variables and functions, control structures, Array, Matrix, Vectors.

Module 4: EXPLORING DATA IN R **(09 Periods)**

Data frames-data frame access, ordering data frames, R functions for data frames dim(), nrow(), ncol(), str(), summary(), names(), head(), tail(), edit() .Load data frames—reading from .CSV files, reading from tab separated value files, reading from tables.

Module 5: DATA VISUALIZATION USING R **(10 Periods)**

Reading and getting data into R (External Data): XML files, Web Data, JSON files, Databases, Excel files.

Working with R Charts and Graphs: Histograms, Bar Charts, Line Graphs, Scatter plots, Pie Charts.

Total Periods: 45

LIST OF EXPERIMENTS

LIST OF EXERCISES

1. Create a vector in R and perform operations on it.
2. Create integer, complex, logical, character data type objects in R and print their values and their class using print and class functions.
3. Write code in R to demonstrate sum(), min(), max() and seq() functions.
4. Write code in R to manipulate text in R using grep(), toupper(), tolower() and substr() functions.
5. Create data frame in R and perform operations on it.
6. Import data into R from text and excel files using read.table () and read.csv () functions.
7. Write code in R to find out whether number is prime or not.
8. Print numbers from 1 to 100 using while loop and for loop in R.
9. Write a program to import data from csv file and print the data on the console.
10. Write a program to demonstrate histogram in R.

RESOURCES

TEXTBOOKS:

1. Seema Acharya , Subhashini Chellappan, Big Data And Analytics, Wiley, second edition, 2019.
2. Seema Acharya, Data Analytics using R, McGraw Hill education (India) Private Limited, First edition, 2018.

REFERENCE BOOKS:

1. W. N. Venables, D.M. Smith, An Introduction to R, Network theory Limited, second edition, 2009.

VIDEO LECTURES:

1. [Data Analytics Using R | Introduction To Data Analytics | Data Analytics For Beginners | Simplilearn - YouTube](#)
2. [Data Analytics Using R | Introduction To Data Analytics | Data Analytics For Beginners | Simplilearn - YouTube](#)

WEB RESOURCES:

1. [columbia.edu/~sjm2186/EPIC_R/EPIC_R_BigData.pdf](#)
2. [Big Data Analytics - Introduction to R \(tutorialspoint.com\)](#)

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM102005	PHP AND MYSQL PROGRAMMING	3	-	2	-	4
Pre-Requisite	25CA102002-Database Management Systems					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course is designed to understand advanced Scripting languages like PHP and MYSQL in web technologies to develop interactive, dynamic and scalable web applications for societal needs.

COURSEOUTCOMES: After successful completion of the course ,students will be able to:

- CO1.** To understand basic Bundle server installation & functionality.
- CO2.** To understand the basic Web Programming: including PHP programming
- CO3.** Apply PHP technologies for handling device independent web application development.
- CO4.** To understand the PHP web forms for sending data across server.
- CO5.** To understand the database programming using PHP and MYSQL.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	3	3	-
CO3	3	3	2	3	-	-	-	-	-	3		3
CO4	3	3	3	3	3	3	-	3	-	3	3	3
CO5	3	3	3	3	3	3	-	3	-		3	3
CO6	3	3	3	3	3	3	-	3	-	3	3	3
Course correlation Mapping	3	3	3	3	-	-	-	-	-	3	3	3

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module1: BASICS OF HTML AND BASICS OF PHP (10 Periods)

HTML-Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames; Cascading Style Sheet- Levels of style sheets, style specification formats, selector forms, Property Value - Forms, Font Properties, List Properties, color, Alignment of Text, The Box Model, The and tags.

BASICS OF PHP: Introduction to PHP. PHP Features, installation of XAMPP/WAMP, Benefits of using PHP MYSQL, Server Client Environment. Web Browser, Web Server Installation & Configuration Files.

OOPS with PHP, language basics, syntax, comments, variables, constants and data types, expressions and operators, flow control statements, looping structures, Arrays Including html code in PHP, Embedding PHP in web pages.

Module2: FUNCTIONS AND STRINGS IN PHP (09 Periods)

FUNCTIONS & STRINGS in PHP: Defining a function, Calling a function, variable scope, Function parameters, return values, User Defined Function, System Defined Function, Parameterized Function. Date & Time Function, Hash Function. Mail Function, predefined functions.

Strings: Creating & accessing string, searching and replacing strings, encoding and escaping, comparing strings, formatting strings, regular expression.

Module 3: Data AND File Handling (06Periods)

Data & File Handling: PHP Forms: \$ GET,\$ POST,\$ REQUEST, \$_FILES, \$ SERVER, \$CLOBALS, \$_ENV, input/output controls, validation, Cookies and Sessions.

File Handling: File and directory. open, close, read, write, append, delete, uploading and downloading files. File exists. File Size, Rename. Reading and display all/selected files present in a directory.

Module 4: MYSQL AND WORKING WITH PHPMYADMIN (10 Periods)

MySQL an Overview: introduction, What is a Database. Understanding an RDUMS. Tables. Record & Fields. SQL language.

Working with phpmyadmin: Creating and using a database. Selecting a database. creating/dropping a table. Loading data into a table, Retrieving Information from a table. Selecting all data. Selecting particular rows. Selecting particular columns, writing queries. Sorting. date, calculations, working with NULL values, pattern matching, counting rows, using more than one tables, using table and column aliases.

Module 5: MYSQL DATABASES IN PHP AND CONTENT (10 Periods) MANAGEMENT SYSTEM

MySQL DATABASES IN PHP: introduction, Connecting to a MySQL database, querying the database, Retrieving and displaying the results, modifying data and deleting data through font end. Designing applications using PHP & MySQL.

Building a Content Management System (CMS): Blueprinting the application, Building the CMS database. Establishing your work area, Creating and styling the first page, Making page assets reusable, Connecting the application to the database.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Get name of the user from a form and show greeting text.
2. Write a php program to check whether given number is palindrome or not.
3. Write a php program to check whether given number is Armstrong or not.
4. Write a php program to find largest values of two numbers using nesting of function.
5. Write a Mathematical calculator program.
6. Write a Age calculator program.
7. Write a php program to check whether given number is String palindrome or not.
8. Write a php program using function.
9. Create a PHP page for login page without sql connection.
10. Write a php program to Array manipulation.
11. Write a php program to design personal information
12. Create a PHP page for login page with sql connection.
13. Write a php program to Read from existing file.
14. Write a php program to Write a file
15. Write a php program to calculate Date and Time function .
16. Write a php program to design Curriculum Vitae.
17. Write a php program hit counter using cookies.
18. Create a web page to advertise a product of the company using images and audio.
19. Create a web page for Travel agency.
20. Create a web page for software company websites.
21. Create a PHP page for login system using session.

RESOURCES

TEXT BOOKS:

1. Kogent Learning Solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery, Dreamtech Press, First Edition, 2011
2. W. Jason Gilmore, Beginning PHP and MySQL, APress, Fourth Edition, 2011.

REFERENCE BOOKS:

1. Snig Bahumik, Bootstrap Essentials, PACKT Publishing, First Edition, 2015. (e-book)
2. Thomas A. Powell, The Complete Reference: HTML and CSS, Tata McGraw Hill, Fifth Edition, 2010.
3. Andrea Tarr, PHP and MySQL, Willy India, First Edition, 2012.

SOFTWARE/TOOLS:

1. Apache Tomcat
2. Eclipse

VIDEO LECTURES:

1. https://onlinecourses.swayam2.ac.in/aic20_sp32/preview
2. <https://www.coursera.org/courses?query=php>

WEB RESOURCES:

1. <https://www.tutorialspoint.com/php/index.htm>
2. <https://www.javatpoint.com/php-tutorial>
3. <https://www.geeksforgeeks.org/php-tutorials/>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA101010	INTERNET OF THINGS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION

Basic concepts of IoT, evolution, characteristics, advantages and disadvantages of IoT, ADC and DAC Principle, IoT sensors and actuators, working with arduino board, applications of IoT in different domains.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the basic concepts of IoT to work with IoT environment.
- CO2.** Analyze the principles of ADCs and DACs to implement in the development of devices.
- CO3.** Design IoT devices with sensors and actuator technologies for effective results.
- CO4.** Make use of the Arduino board to develop IoT devices for different domains.
- CO5.** Develop various IoT related used cases and applications to solve real world problems.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	3	3	-
CO2	3	3	3	3	-	-	-	-	-	3	3	-
CO3	3	3	2	3	-	-	-	-	-	3	3	-
CO4	3	3	3	3	-	-	-	-	-	3	3	-
CO5	3	3	3	3	-	-	-	-	-	3	3	3
Course Correlation Mapping	3	3	3	3	-	-	-	-	-	3	3	3

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: BASICS OF IOT (08 Periods)

Definition of "Internet of Things", Technological trends which have led to IoT, impact of IoT on society, History of IOT, How IOT works, IOT Applications, Characteristics of IoT, Challenges of IoT, Advantages of IoT, Disadvantages IOT, evolution of IOT.

Module 2: ADCS AND DACS (11 Periods)

DAC principle, weighted register DAC, R L1,L2,L3 -2R ladder DAC, performance characteristics of DAC, ADC principle, flash ADC, successive approximation ADC, counter type ADC, dual slope ADC, performance characteristics of ADC.

Module 3: IOT SENSORS AND ACTUATORS (09 Periods)

Various IOT Sensors and actuators and technologies, Temperature sensors, Moisture sensors, Light sensors, Acoustic and noise sensors, Water level sensors, Proximity sensors, motion sensors, Gyroscope, Chemical sensors, Image sensors.

Module 4: ARDUINO BOARD (07 Periods)

Introduction to Arduino board, interfacing sensors and actuators to Arduino board.

Module 5: IOT USE CASES AND APPLICATIONS (10 Periods)

Smart homes, wearables, smart city, smart grid, industrial internet, connected cars, connected health, smart retail, smart supply chain, smart farming.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Compare and contrast different communication protocols used in IoT.
2. Discuss how sensor data is collected, processed, and transmitted to a central hub.
3. Identify potential security risks in an IoT ecosystem and propose strategies to mitigate these risks.

RESOURCES

TEXT BOOKS:

1. Internet of Things: A Handson Approach Arshdeep Bahga and Vijay Madisetti Universities Press 2nd Edition.
2. Internet of Things: Architecture and Design Principles Rajkamal McGraw Hill Education 1st edition.

REFERENCE BOOKS:

1. IoT Fundamentals Networking Technologies, Protocols and Use Cases for Internet of Things David Hanes , Gonzalo Salgueiro Cisco Press Kindle Edition 2017

2. Designing the Internet of Things Adrian McEwen, Hakim Cassimally Paperback 1st edition
3. Analytics for the Internet of Things(IoT) Andrew Minteer Kindle Edition 1st edition

VIDEO LECTURES :

1. <http://www.nptel.ac.in/> (https://youtu.be/WUYAjxnwjU4?list=PLaxu2gn9WXMf_ln5pMvxjf043jzof4-i&t=13)
2. <http://www.iitk.ac.in/> (<https://youtu.be/p7kYStiASLo?list=PLbRMhDVUMngdcL>)

WEB RESOURCES:

1. <http://www.nptel.ac.in/> (<https://nptel.ac.in/courses/108108098/>)
2. <http://www.edureka.com/> (<https://youtu.be/LihmzVL5bm8?list=PL9ooVrP1hQOGccf>)

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA102002	DATABASE MANAGEMENT SYSTEMS	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This Course provides theoretical concepts and hands-on experience on Database systems, Database design, Relational model, Relational algebra, SQL queries, Constraints and triggers, PL/SQL, Schema refinement and normal forms, Transaction management, Concurrency control, Overview of storage and indexing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze and apply the concepts of ER-modelling and normalization to design viable data models for a given problem.
- CO2.** Formulate relational database schemas, apply suitable integrity constraints, for querying databases.
- CO3.** Use SQL to store, query, and manipulate data in relational databases.
- CO4.** Develop PL/SQL blocks to centralize database applications for maintainability and reusability.
- CO5.** Analyze transaction processing, concurrency control and storage methods for database management.
- CO6.** Work Independently and Communicate Effectively in Oral and Written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	2	3	-
CO4	2	3	3	3	3	2	-	-	-	3	2	-
CO5	3	3	-	-	-	-	-	-	-	2	3	-
CO6	-	-	-	-	-	-	3	-	3	-	-	-
Course Correlation Mapping	2	3	3	2	3	2	3	-	3	2	3	-

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: Introduction to Database Systems (08 Periods)

Introduction to Database : Advantage of Database System, File ,systems vs. DBMS View of Data, When not to use a DBMS, Database System Concepts and Architecture, When not to use a DBMS, The database system Environment, Classification of DBMS. Data Models, Schemas, Instances and schemas, Database languages and interfaces, The database system Environment, Different people behind DBMS.

Module 2: Entity-Relationship Model (08 Periods)

Entity-Relationship Model: Basic Concepts, Constraints, Keys: Primary Key, Super key, Candidate key, Entity Types, Entity Sets, Design issues, Entity-Relationship Diagram, Relations, Relationship types, Roles and Structural Constraints, Weak Entity sets, Extended ER Features, Design of E-R Database Schema, Reduction of an E-R Schema to tables.

Module 3: Relational Model and Constraints (9 Periods)

Relational Model and Constraints: Relational model Concepts, Structure of Relational Databases, Constraints: Entity integrity, Referential Integrity, Domain Constraints, Assertions, Triggers, Security and Authorization, Authentication and Encryption.

Module 4: Relational Database Languages (10 Periods)

SQL AND PL/SQL: Data definition in SQL, Queries in SQL, Insert, Delete and Update Statements in SQL, Views in SQL, Specifying General Constraints as Assertions, specifying indexes, Embedded SQL. PL /SQL: Introduction.

Module 5: The Relational Algebra and Transaction Management and Recovery Techniques (10 Periods)

The Relational Algebra: Tuple Relational Calculus, Data Normalization: Functional dependencies, Normal form concepts up to 3rd Normal form.

Transaction Management and Recovery Techniques: Introduction to Transaction Processing, Transaction Concepts and Properties, Schedules, Serializability of Schedules, Conflict and view serializable schedules, Recovery Concepts, Recovery from Transactions, Introduction to Concurrency Control Techniques.

Total Periods: 45

EXPERIENTIAL LEARNING

- 1) Design and analyze an ER-Model for the following use case.

Roadway Travels is in business since 1977 with several buses connecting different places in India. Its main office is in Hyderabad. The company wants to computerize its operations in the following areas:

- a) Reservations
- b) Ticketing
- c) Canc

ellations Reservations:

Reservations are directly handled by booking office. Reservations can be made 60 days in

advance in either cash or credit. In case the ticket is not available, await listed ticket is issued to the customer. This ticket is confirmed against the cancellation.

Cancellation and Modification:

Cancellations are also directly handed at the booking office. Cancellation charges will be charged. Waitlisted tickets that do not get confirmed are fully refunded.

- 2)
 - a) Implement Single Row functions-Character, Numeric and Date functions.
 - b) Implement Data Definition Language commands-Create, Alter, Drop, Truncate, and Rename.
 - c) Implement Data Manipulation Language commands-Insert, Select, Update, and Delete.
- 3) Implement various types of integrity constraints-NOT NULL constraint, DEFAULT constraint, UNIQUE constraint, PRIMARY key, FOREIGN key, CHECK constraint.
- 4)
 - a) Implement group functions with different operators such as aggregate operators, group by, having and order by.
 - b) Implement nested and correlated nested queries using set operators and set comparison operators.
- 5)
 - a) Creation of views, synonyms, sequence, indexes and save point
 - b) Implement various types of joins-outer join and inner join.

Basic PL/SQL:

- 6) Construct PL/SQ block for the following:
 - a) To determine whether a number is palindrome
 - b) To determine whether a number is an Armstrong number
 - c) To find greatest of three numbers
 - d) To display Fibonacci series

Control Structures:

- 7)
 - a) Write a programming PL/SQL to update the salary of a specific employee by 8% if the salary exceeds the mid-range of the salary against this job and update up to mid-range if the salary is less than the mid-range of the salary, and display a suitable message.
 - b) Write a PL/SQL program to display the description against a student's grade using CASE statement.

Exception Handling:

- 8)
 - a) Develop a PL/SQL program that displays the name and address of a student whose ID is given. If there is no student with the given student ID in the database, the program should raise a run-time exception NO_DATA_FOUND, which should be captured in the EXCEPTION block.
 - b) Construct the user-defined exceptions to get the salary of an employee and check it with the job's salary range. If the salary is below the range, raise an exception BELOW_SALARY_RANGE. If the salary is above the range, raise the exception

ABOVE_SALARY_RANGE.

Functions:

9) a) Write a function that accepts two numbers A and B and performs the following operations.

- o Addition
- o Subtraction
- o Multiplication
- o Division

b) Write a PL/SQL block that updates salary of an employee in Employee table by using in cr function which takes employee number as argument and calculates increment and returns increment based on the following criteria.

- o If salary <= 3000, increment = 30% of salary
- o If salary > 3000 and <= 6000, increment = 20% of salary
- o Else increment = 10% of salary

Procedures:

10) a) Write a procedure that accepts two numbers and displays their sum

b) Write procedures to demonstrate IN, IN OUT and OUT parameters

Cursors:

11) a) Write a block in PL/SQL to create a Cursor that displays the employee name and number of jobs he/she has done in the past.

b) Write a program in PL/SQL to create a cursor to display the name and salary of each employee in the EMPLOYEES table whose salary is less than that' specified by a passed-in parameter value.

Triggers:

12) Develop a suitable student database application by considering appropriate attributes. Couple of attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled and internal assessment Using TRIGGERS for the following:

a) Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the concerned head of the department.

b) Whenever, the marks in an internal assessment test are entered, check if the marks are less than 40%; if so, notify the concerned head of the department.

RESOURCES

TEXT BOOKS:

1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems," McGrawHill,3rd Edition,2014.
2. Abraham Silberschatz, Henry. F. Korth, S. Sudarshan, "Database System Concepts," McGrawHill,7thedition,2019.

REFERENCE BOOKS:

1. Ivan Bayross,SQL,PL/SQL:"The Programming Language of Oracle,"BPB publications,4th Edition,2017.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson, 2015.
3. Thomas Connolly, Carolyn Begg, "Database Systems," Pearson, 6th edition, 2019.
4. S.K. Singh, "Database System Concepts, Design and Applications," 1st Edition, Pearson Education, 2006.
5. Satish Ansani, "Oracle Database 11g: Hands-on SQL and PL/SQL," PHI, 2010.
6. Dr. Rajiv Chopra, "Database Management Systems," Sultan Chand, 2016.
7. Pranab Kumar Das Gupta, P. Radha Krishna, "Database Management System Oracle SQL and PL/SQL," 2nd Edition, 2009.

VIDEO LECTURES:

1. https://swayam.gov.in/nd1_noc19_cs46/preview
2. <https://nptel.ac.in/courses/106105175>
3. https://onlinecourses.nptel.ac.in/noc21_cs04/preview
4. <https://www.youtube.com/watch?v=MDQxqYVXiVU>
5. <https://www.youtube.com/watch?v=c5H AwKX-suM>

WEB RESOURCES:

1. <https://www.classcentral.com/course/swayam-introduction-to-database-systems-17660>
2. <https://www.scaler.com/topics/dbms/>
3. https://www.academia.edu/27988617/Database_Management_System_DBMS_Tutorial
4. <https://nptel.ac.in/courses/106104135>
5. <https://downloads.mysql.com/docs/mysql-tutorial-excerpt-5.7-en.pdf>
6. https://docs.oracle.com/cd/E11882_01/server.112/e40540/intro.htm#CNCPT88786

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA102003	DATA WAREHOUSING AND DATA MINING	3	-	2	-	4
Pre-Requisite	-25CA102002-Database Management Systems					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION

Data Mining Fundamentals; Data Preprocessing; Operational Database Systems and Data Warehouses; Mining Frequent Patterns; Classification and Prediction; Clustering; Data warehousing and Mining tools, New Trends and Research Frontiers.

COURSE OUTCOMES: After successful completion of this course, the student will be able to:

- CO1.** Understand the concepts of Data Warehousing architecture, Multidimensional models and OLAP operations.
- CO2.** Analyze data preprocessing techniques to produce refined data.
- CO3.** Apply Association rules and classification techniques for data categorization.
- CO4.** Make use of clustering techniques for grouping similar data items and identify outliers.
- CO5.** Design and develop applications using Data Mining trends.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	3	3	2	-	3
Course Correlation Mapping	3	3	3	3	3	-	-	3	3	2	-	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO DATA WAREHOUSING ONLINE ANALYTICAL PROCESSING

(09 Periods)

Definition of Data warehouse, Differences between Operational Database and Data Warehouse - Multidimensional Data Model - From Tables to Data Cubes. Schemas, Measures, DW Implementation - Efficient Computation of Data Cubes.

Module 2: DATA MINING AND DATA PREPROCESSING

(08 Periods)

Data Mining – Motivation, Importance of DM Functionalities, Basic Data Mining Tasks, DM Applications, and Social Implications, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept of Hierarchy Generation.

Module 3: ASSOCIATIONS AND CLASSIFICATION

(10 Periods)

Basic Concepts, Frequent itemset Mining Methods, pattern evaluation methods- From Association Mining to Correlation Analysis, Classification, Decision Tree Introduction, Bayesian Classification Methods, Rule Based Classification, Prediction: Linear Regression.

Module 4: CLUSTER ANALYSIS

(9 Periods)

Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods -k-Means method, Agglomerative method, DBSCAN, STING, introduction to Outlier Analysis.

Module 5: Web, Temporal and Spatial Data Mining

(9 Periods)

Web Content Mining, Web Structure Mining, Web Usages Mining, Spatial Mining, Generalization and specialization, Spatial Rules, Spatial Classification and Clustering Algorithms, Temporal Mining, Modeling Temporal Events, Times Series, Pattern Detection, Sequences.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Design and implement data acquisition process to perform Source Qualifier Transformation
2. Design and implement data acquisition process to perform Filter Transformation
3. Design and implement data acquisition process to perform Joiner Transformation
4. Design and implement data acquisition process to perform Aggregator Transformation
5. Design and implement data acquisition process to perform Sorter Transformation

6. Design and implement data acquisition process to perform Router Transformation
7. Design and implement data acquisition process to perform Union Transformation
8. Design and implement data acquisition process to perform Transaction control Transformation
9. Design and implement data acquisition process to perform Rank Transformation
10. Design and implement data acquisition process to perform Normalizer Transformation
11. Implement the following Data mining techniques.
 - Data cleaning techniques
 - a) smoothing by bin means
 - b) smoothing by bin medians
 - c) smoothing by bin boundaries

RESOURCES

TEXT BOOK:

Jiawei Han, MichelineKamber and Jian Pei, "Data Mining: Concepts and Techniques," Elsevier, 3rd Edition, 2013.

REFERENCE BOOKS:

1. K.P. Soman, ShyamDiwakar and V. Ajay, Insight into Data mining Theory and Practice, Easter Economy Edition, Prentice Hall of India, 2006
2. G. K. Gupta, Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.
3. Tan P.N, Steinbach M. and Kumar V., Introduction to Data Mining, Addison-Weseley, 2006.

SOFTWARE/TOOLS:

Python

Library :Sci kit Learn;

Computing platform :Jupyter Notebook

VIDEO LECTURES:

1. <http://nptel.ac.in/courses/106106093/35>
2. http://nptel.ac.in/syllabus/syllabus_pdf/106106105.pdf
3. <http://nptel.ac.in/video.php?subjectId=106106093>
4. <http://textofvideo.nptel.iitm.ac.in/video.php?courseId=106106093&p=4>

WEB RESOURCES:

1. <http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/>
2. <https://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf>
3. <https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA102004	DATA STRUCTURES			3	-	2
Pre-Requisite	-					4
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on data structure concepts like arrays, stack, queues, trees, graphs and real-time applications of data structures. This course also examines algorithms for sorting, searching graphs, hashing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze and develop solutions using linear data structures such as arrays, linked lists for efficient data organization and manipulation.
- CO2.** Analyze, implement and conduct investigations on data structures such as trees, graphs, hash tables for efficient search and retrieval of data.
- CO3.** Select and apply appropriate techniques for searching and sorting problems.
- CO4.** Apply knowledge to select appropriate data structures for modelling information in data.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	2	-	3
Course Correlation Mapping	3	3	3	3	3	-	-	-	-	2	-	3

Correlation Levels:

3: High;

2: Medium; 1: Low

COURSE CONTENT

Module 1: LINKED LISTS **(07 Periods)**

Overview of data structures and algorithms, Linear and non-linear data structures, Big O notation, Linked lists Definition, Operations; Single linked lists, Circular linked lists, Doubly linked lists, Sorted lists, Linked lists efficiency, Applications of linked lists.

Module 2: STACKS AND QUEUES **(09 Periods)**

Stacks: Definition, Operations, Implementation using arrays and linked lists, Applications Reversing a word, Delimiter matching, Parsing arithmetic expressions.

Queues: Definition, Operations, Applications, Implementation using arrays and linked lists, Circular queue, Double-ended queues, Priority queues.

Module 3: BINARY TREES AND SEARCH TREES **(11 Periods)**

Tree terminology, Binary trees, Trees represented as arrays, Binary search trees - Concepts, Advantages, Operations, Finding maximum and minimum values, Efficiency; Balanced and unbalanced trees, AVL search trees Concepts, Operations; Red-Black trees Concepts, Rotations, Inserting a node, Efficiency.

Module 4: SEARCHING AND SORTING **(09 Periods)**

Searching: Linear search, Binary search.

Sorting: Bubble sort, Selection sort, Insertion sort, Sorting objects, Shell sort, Partitioning, Quick sort, Merge sort, Heap sort, radix sort, count sort, enumeration sort.

Module 5: GRAPHS AND HASHING **(09 Periods)**

Graphs: Concepts, Representation, Operations, Depth-first search, Breadth-first search, Minimum spanning trees.

Hashing: Introduction, Open addressing, Separate chaining, Characteristics of good hash functions - Quick computation, Random and Non-random keys, Folding; Hashing efficiency.

Total Periods: 45

EXPERIENTIAL LEARNING

1. A college has N number of students and the following details of all the students are maintained – register number, name, branch, phone number. Write a program to store the details of the students using a singly linked list. Develop functions to perform the following operations on the data.
 - a) Insert new student's details
 - b) Display the details of the students
 - c) Display the total number of students
 - d) Delete a given student's information
2. Department of CSE has readers club named 'Aalochana'. Students can be granted membership in readers club on their request. Similarly, one may cancel their membership of the club. Members of the club can rent books from the club. Write a program to create data structure to maintain readers club members information (Hall ticket number, name) using singly linked list. In singly linked list, the header node should store details of head of readers club and last node should store details of in-charge of readers club. Develop functions to perform the following operations on the data.
 - a) Store details of head and in-charge of the readers club
 - b) Grant and cancel memberships of students
 - c) Display total number of members
 - d) Display the details of the members
 - e) Display the sorted list of details of the members (sort based on their names in alphabetical order)
3. A company has N number of employees and it maintains the following details of each of its employees: ID, department, salary, phone number. Develop a menu driven program using doubly linked list to store the employees' data. Develop functions to perform the following operations on the data.
 - a) Add and delete employees
 - b) Display total number of employees
 - c) Display details of employees with salary more than Rs. 50,000
 - d) Display the phone number of the employee given the ID
4. a) Alexa has two stacks of non-negative integers, stack A and stack B where index denotes the top of the stack. Alexa challenges Nick to play the following game:
 - i. In each move, Nick can remove one integer from the top of either stack.
 - ii. Nick keeps a running sum of the integers he removes from the two stacks.
 - iii. Nick is disqualified from the game if, at any point, his running sum becomes greater than some integer max_sum given at the beginning of the game.
 - iv. Nick's final score is the total number of integers he has removed from the two stacks.b) Write a program to check whether a string is palindrome or not using stack data structure.

c) Mostly syntax errors in a computer program arise due to unbalanced braces (such as (), {}, []). Write a program using stack to check whether a given expression has balanced braces or not.

5. a) Develop a menu driven program to perform the following operations on a queue of characters (Array and linked list implementations of queue with maximum size MAX)

- i) Insert an element
- ii) Delete an element
- iii) Display the status
- iv) Demonstrate overflow and underflow situations (in array implementation)

b) A restaurant based on its human resources can accept a maximum of N number of food orders. The food orders are served in first come first serve basis. The food orders once placed cannot be cancelled. Write a program to simulate the food ordering and serving system in the restaurant using circular queue.

6. Write a program to perform the following operations on the binary search tree.

- a) Construct binary search tree by inserting the values {6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2} in the given order.
- b) Display the nodes of the tree using inorder, preorder and postorder traversal techniques.
- c) Display the smallest number stored in the tree.
- d) Search the tree for a given number.

7. There are train paths between cities. If there is a train between city A and city B then there is a route between the cities. The cost of the route is the distance between city A and city B. Represent the train travel route information as a graph. The node can be represented by the name of the city. Write a program to perform the following operations.

- a) Store the details of train travel route information using adjacency list or adjacency matrix representation.
- b) Traverse the graph and display the details of all trains between the cities along with the cost using breadth-first method.

Traverse the graph and display the details of all trains between the cities along with the cost using depth-first method.

8. Store register numbers of students who attended placement training program in a random order in an array. Write a function to search whether a student has attended placement training program or not using

- a) Linear search
- b) Binary search

9. A list of customer names could be sorted into alphabetical order by surname, or a list of people could be put into numerical order by age. Sorting a list of items can take a long time, especially if it is a large list. A computer program can be created to do this, making sorting a list of data much easier. Apply proper sorting mechanisms like quick and shell to sort the data.

10. a) Write a program to sort a given set of integers using merge sort.
- b) Write a program to read the marks obtained by students in a mathematics examination and store the data using a heap data structure. Find out the maximum and minimum marks obtained by the students.
11. Apply suitable data structure concepts (like hashing) for mapping large chunks of data into small tables.
 - a) Separate Chaining Method
 - b) Open Addressing Method
12. Consider an online movie ticket booking system through which customers can book tickets to watch movies at theatres. The database stores the details of each transaction of ticket booking with the details - ID, customer name, customer phone number, movie name, theatre name, date of show, time of show, number of tickets booked, starting seat number, total amount. Write a menu driven program to perform create the database and given an ID, display a client's phone number. Use a hash table implementation to quickly search through the database.

RESOURCES

TEXT BOOKS:

1. Robert Lafore, "*Data Structures & Algorithms in Java*," 2nd Edition, Pearson, 2007.
2. Goodrich, Tamassia, Goldwasser, "*Data structures & Algorithms in Java*," 6th Edition, Wiley, 2014.

REFERENCE BOOKS:

1. John R. Hubbard, "*Programming with Java*," McGraw Hill, 2nd Edition, 2009.
2. Debasis Samanta, "*Classic Data Structures*," Prentice Hall, 2nd Edition, 2009.

SOFTWARE/TOOLS:

1. Software: J2SDK 1.7
 - **Eclipse or Net beans**
2. Java compatible web browser

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106105175>
2. <https://www.edx.org/course/introduction-to-data-structures>
3. <https://github.com/suhassrivats/Udacity-Data-Structures-and-Algorithms>
4. <https://www.linkedin.com/learning/programming-foundations-algorithms>

WEB RESOURCES:

1. <https://www.javatpoint.com/data-structure-tutorial>
2. <https://medium.com/javarevisited/10-data-structure-and-algorithms-articles-programmer-should-read-this-week-585404a9403b>
3. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_algorithms_pdf_version.html
4. <https://www.w3schools.in/data-structures/intro>
5. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_algorithms_tutorial.pdf
6. <https://lecturenotes.in/subject/81/data-structure-using-c-ds>
7. <https://code.tutsplus.com/series/data-structures-succinctly-part-1--cms-551>
8. <https://www.geeksforgeeks.org/data-structures/>
9. <https://visualgo.net/en>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25CA102005	PYTHON PROGRAMMING	3	-	2	-	4
Pre-Requisite	-25CA102001 Programming For Problem Solving					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Basics of Python programming, Control structures, Sequences, Sets, Dictionaries, Regular expressions, Functions, File handling, Object-oriented programming, Exception handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge on Python constructs, sequences, sets and dictionaries to solve basic computational problems.
- CO2.** Apply the concepts of regular expressions for searching patterns in strings.
- CO3.** Develop and use Python modules to provide solutions to problems.
- CO4.** Apply the knowledge of file operations in Python for file processing.
- CO5.** Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism and exception handling.
- CO6.** Work independently to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	-	-	3	-	-
CO2	3	2	-	-	3	-	-	-	-	3	-	-
CO3	3	3	3	3	3	-	-	-	-	3	-	-
CO4	3	2	2	2	3	-	-	-	-	3	-	-
CO5	3	3	3	3	3	-	-	-	-	3	-	-
CO6	-	-	-	-	-	-	-	3	3	-	-	-
Course Correlation Mapping	3	3	3	3	3	-	-	3	3	3	-	-

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO PYTHON PROGRAMMING **(07 Periods)**

Introduction to Python, Tokens, Variables, Literals, Identifiers, Keywords, Special symbols, Operators, Fundamental datatypes, Expressions, Type conversions, Handling Input and output in Python.

Module 2: CONTROL STRUCTURES **(08 Periods)**

Selection Statements: if statement, if-else statement, if-elif-else statement, nested-if statement.

Iterative Statements: while loop, for loop, break statement, continue statement, pass and else statements used with loops.

Module 3 SEQUENCES, SETS, DICTIONARIES AND REGULAR EXPRESSIONS **(11 Periods)**

Sequences: Lists and operations – Creating, Inserting elements, Updating elements, Deleting elements, Searching and sorting, List comprehensions, Nested lists; Tuples – Creating, Searching and sorting, Nested tuples; Strings – Initializing a string and string operations, String handling methods.

Dictionaries: Operations on dictionaries, Dictionary methods

Regular Expressions: Regular expressions, Sequence characters in regular expressions, Special characters in regular expressions.

Module 4 FUNCTIONS AND FILE HANDLING **(09 Periods)**

Functions: Need for functions, Function definition, Function call, Variable scope and lifetime, Return statement, Positional arguments, Keyword arguments, Default arguments and variable length arguments, Recursive functions, Lambda functions, Generators.

File Handling: Types of files, Opening and closing files, Reading and writing data.

Module 5 OBJECT ORIENTED PROGRAMMING AND EXCEPTION HANDLING **(10 Periods)**

Object Oriented Programming: Introduction to object-oriented programming, Classes and objects, Inheritance and polymorphism, Abstract Classes and interfaces.

Exception Handling: Errors in a python program, Exceptions, Exception handling, Types of exceptions, Except block, Assert statement, User defined exceptions.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Design a python script to perform the various computations for the amount payable by the customer for Challenger Computers Store. A customer buying two numbers of SSD device, one SSD device cost is Rs. 3575/-. The stores offer 15% of the total cost. The customer has to pay 9% CGST, and 9% SGST. Prepare the Net Amount to be payable by the customer.
2. Design a python script to compute and generate the electricity bill as per the following slab rates. Collect the meter reading inputs, such as current unit and previous unit.

Consumption Units	Rate (in Rupees/Unit)
0-200	3.0
201-250	4.5
251-300	5.2
301-400	6.5
Above 400	7.0

3. Design a python script to display the sum of numbers divisible by 4. The code must allow the user to accept a number and add it to the sum if it is divisible by 4. It should repeatedly accepting numbers as long as the user wants to provide an input using an appropriate iterative statement and should display the final sum.
4. Food Corner home delivers vegetarian and non-vegetarian combos to its customer based on order. A vegetarian combo costs Rs.120 per plate and a non-vegetarian combo costs Rs.150 per plate. Their non-veg combo is really famous that they get more orders for their non-vegetarian combo than the vegetarian combo. Apart from the cost per plate of food, customers are also charged for home delivery based on the distance in kms from the restaurant to the delivery point. The delivery charges are as mentioned below:

Distance in kms	Delivery charge in Rs per km
For first 3kms	0
For next 3kms	3
For the remaining	6

Given the type of food, quantity (no. of plates) and the distance in kms

from the restaurant to the delivery point, write a python program to calculate the final bill amount to be paid by a customer. The below information must be used to check the validity of the data provided by the customer.

- Type of food must be 'V' for vegetarian and 'N' for non-vegetarian.
- Distance in kms must be greater than 0.
- Quantity ordered should be minimum 1.
- If any of the input is invalid, bill amount should be considered as -1.

5.

- a) A list has the AP City Names [Tirupati, Kurnool, Kadapa]. Design a python script and perform the operations like, add 3 more AP City names Chittoor, Nellore, Guntur, insert Hyderabad in 3rd position, delete any two city names, update all city names as in Uppercase. Displays the list data, whenever an operation completes.
- b) Design a python script for given an integer tuple, for each element in the tuple, check whether there exists a smaller element on the next immediate position of the tuple. If it exists print the smaller element. If there is no smaller element on the immediate next to the element then print -1.

Example: Input: 4 2 1 5 3 Output: 2 1 -1 3 -1

6.

- a) Sets n1 has the data {1, 3, 5, 7, 9}, n2 has the data {9, 5, 6, 8}, wd1=set(["Mon", "Tue", "Wed", "Thu", "Fri", "Sat", "Sun"]),
wd2=set(["Mon", "Tue", "Wed"]).

Design a python script to perform intersection, difference, and symmetric difference operations on the sets n1 and n2, and to perform superset, and subset operations on the sets wd1, and wd2.

- b) The dictionary city_pin has the data {'Tirupati': 517101, 'Hyderabad': 500002, 'Chittoor': 517001, 'Nellore': 524001}. Design a python script using lambda function to sort the dictionary on city name and produce the output and sort the dictionary on pincode and produce the output.

The string has the data, Wel_str = "Welcome to AI ML DS". Design a python script to search the pattern "AI" using regular expression search and display the three location numbers of the pattern. First shows the pattern starts location, second shows the pattern end location, and the last shows pattern span locations.

7.

- a) Design a python script for the mathematical puzzle, Towers of Hanoi. The puzzle has three rods and n disks. To move the entire stack to another rod, obeying the

three rules (i) Only one disk can be moved at a time, (ii) Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e., a disk can only be moved if it is the uppermost disk on a stack, (iii) No disk may be placed on top of a smaller disk.

b) Design a python script to display the numbers that do not appear in the Fibonacci series of n numbers where n is given by the user. (If n is 8 then up to 8 Fibonacci numbers has to be printed Ex: 1 1 2 3 5 8 13 21 and in this series missing numbers should be traced and printed, Ex: missing numbers are: 4 6 7 9 10 11 12 14 15 16 17 18 19.

8. a) Design a function Learner_Age_Days with two formal parameters name, age and it computes Learner's age in days, then displays learners name and age in days.

(i) Design a driver code to call the function using positional arguments, keyword arguments

(ii) Apply the necessary changes in Learner_Age_Days function, and design a driver code to call the function using default arguments.

Design a python script using lambda and filter functions to construct an odd numbers list from numbers 1 to 10, and construct a negative numbers list from range of numbers -7 to 7 and to find the biggest number from a numbers list.

9. a) Design a python script to create a new file Collect_Literals_Python.txt, collect the data from the keyboard about the contents of collection literals list, tuple, sets, dictionaries details, then write all the data into that file, and then close that file. Afterwards Open the Collect_Literals_Python.txt file in read mode, read the entire contents of the file Collect_Literals_Python.txt, then display all the contents of that file in monitor.

b) The file feat_python1.txt has the contents of features of the Python programming language. Design a python script to open that file feat_python1.txt in read mode, open the new file in feat_python2.txt in write mode, then read entire contents of the file feat_python1.txt, then copy all the contents of that file into the new file feat_python2.txt

10. Construct a Python script to implement the below requirements. Create a base class Basic_Info with data members name, rollno, gender and two member functions getdata() and display(). Derive a class Physical_Fit from Basic_Info which has data members height and weight and member functions getdata() and display(). Display all the information using object of derived class.

a) Design a Python script to implement the below specifications, compute, and produce required output. Define a class REPORT with the following specification

Private members

Admno : 4-digit
admission number Name : 20
characters
Marks : A list of 5 floating
point values Average: average marks
obtained
GETAVG() a function to compute the average obtained in five subjects.

Public members

READINFO() function to accept values for Adno, Name, Marks. Invoke the function GETAVG () .

DISPLAYINFO() function to display all data members of report on the screen. You should give function definitions. Write driver code to demonstrate all the functions.

1. The below scenarios will create Logical Error/Exception, and it will forcibly stop the execution in middle
of the program. Design a Python Script to handle these operations exceptions effectively, and avoid to stop the
script execution in the middle.
 - i. The variable num has the data 100, the value of num dividing by the value 0.
 - ii. To importing a library file matheqn, this library file not available in Python.
 - iii. A num_List has the values[10,20,30].To print the fifth value of num_List[5]
 - iv. A dictionary has the data, Dict_Univ = {'1':'MBU', '2':'Tirupathi', '3':'CSE'}. to print the fifth key value Dict_Univ[5]

2. Design a python script to collect the 10 students Python course mark. Check that entered mark is negative, then throw a user defined exception called Negative, otherwise store into the mark in the List Python_mark[].

RESOURCES

TEXT BOOKS:

1. R. Nageswara Rao, *Core Python Programming*, 3rd Edition, Dreamtech Press, 2021.
2. Paul J. Deitel, Harvey Deitel, *Python for Programmers with Big Data and Artificial Intelligence Case Studies*, Pearson, 2019.

REFERENCE BOOKS:

1. Charles Dierbach, *Introduction to Computer Science using Python: A Computational Problem Solving Focus*, Wiley India, 2016.
2. Christian Hil, Learning Scientific Programming with Python, 2nd Edition, Cambridge University Press, 2020.

SOFTWARE/TOOLS:

1. Python 3.10
2. Jupyter Notebook/JupyterLab/IDLE/Google CoLab

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview
2. <https://www.coursera.org/specializations/python>
3. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
4. <https://www.youtube.com/watch?v=WGJJIrtnfpk>
5. https://www.youtube.com/watch?v=_uQrJ0TkZlc
6. <https://www.udemy.com/topic/python/>
7. <https://freevideolectures.com/course/2512/python-programming>

WEB RESOURCES:

1. <https://www.w3schools.com/python/>
2. <https://www.programiz.com/python-programming>
3. <https://www.geeksforgeeks.org/python-programming-language/>
4. <https://www.javatpoint.com/python-lists>
5. <https://www.learnpython.org/>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
25MM101001	INTRODUCTION TO DATA COMMUNICATION AND NETWORKS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion Data Communications and networking. It familiarizes the students with the basics of data communications, OSI model and techniques, applications and control of modern data communications networks. Topics included are network models, digital and analog transmission, multiplexing, circuit and packet switching. This course will mainly focus to develop engineering skills in troubleshooting and designing data networks

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the basics of data communication, networking, internet and their importance.
- CO2.** Understanding of the basic concepts of data communications and networking. The purpose of network layered models, the Open System Interconnect (OSI) and the Internet Model using TCP/IP protocols.
- CO3.** Analyze the services and features of various protocol layers in data networks.
- CO4.** Identify the basic security threats of a network and recognize the different internet devices and their functions..

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	3	3	-
CO2	3	2	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	3	2	-	-	-	-	-	3	3	-
Course Correlation Mapping	3	3	3	2	-	-	-	-	-	3	3	3

Correlation Levels: **3: High;** **2: Medium; 1: Low**

COURSE CONTENT:

Module 1: BASICS OF COMPUTER NETWORK

(08 Periods)

Computer Network: Definition, Goals, Structure; Broadcast and Point-ToPoint Networks; Network Topology and their various Types; Types of Network: LAN, MAN, WAN; Server Based LANs & Peer-to-Peer LANs; Communications Types: Synchronous, Asynchronous; Modes of Communication: Simplex, Half Duplex, Full Duplex; Protocols and Standards.

Module 2: NETWORK MODELS

(09 Periods)

Network hardware - Network software - Network Architecture - Physical layer - Guided transmission media - Cable television.

Network Models Design Issues of the Layer, Protocol Hierarchy, ISO-OSI Reference Model : Functions of each Layer, Various Terminology used in Computer Network, Connection-Oriented & Connectionless Services, Internet (TCP/IP) Reference Model, Comparison of ISO-OSI and TCP/IP Model

Module 3: TRANSMISSION MEDIA

(10 Periods)

Transmission Media Transmission Media, Guided Media (Wired) : Coaxial Cable: Physical Structure, Standards, BNC Connector, Applications, Twisted Pair : Physical Structure, UTP vs STP, Connectors, Applications, Fiber Optics Cable: Physical Structure, Propagation Modes (Single Mode & Multimode), Fiber Sizes, Connectors , Applications , Advantages & Disadvantages; Unguided Media(Wireless): Electromagnetic Spectrum for Wireless Communication, Propagation Methods, (Ground, Sky, Line-of-Sight); Wireless Transmission: Radio Waves, Infrared, Micro-wave; Wireless LANs (IEEE 802.11), Architecture, MAC Sub Layer, Frame Format, Frame Types; Bluetooth, Architecture (Piconet, Scatternet, Bluetooth, Layers), Applications

Module 4: NETWORK CONNECTIVITY DEVICES

(08 Periods)

Categories of Connectivity Devices, Passive and Active Hubs, Repeaters, Bridges, Switches (2-Layer Switch, 3-Layer, Switch(Router), Gateways, Network Security Devices (Firewalls, Proxy Servers)

Module 5: COMPONENTS OF LAN AND INTERNET

(10 Periods)

Components of LAN Network Interface Card (NIC), Network Adapters, Components of NIC, Functions of NIC, Types of NIC; Ethernet : Basic Features, Types of Ethernet, Different Framer Format: IEEE 802.3, IEEE 802.4, IEEE 802.5

Internet Basics Internet: Growth, Architecture, Accessing, Internet Service Providers(ISP), Internet Addressing System:IP Address, DNS, URL; World Wide Web(WWW): Web Servers,Web Browsers, Search Engine; Concept of Intranet & Extranet.

Total Periods: 45

Experiential Learning

1. What is meant by Data Communication and explain its characteristics?
2. What are the components of Data communication?
3. Explain different Data flow directions.
4. What is Network and explain characteristics of Networks?

RESOURCES

TEXT BOOKS:

1. W. Stallings, "Data and Computer Communication", Pearson Education, 5th Edition, 2001
2. Behrouz A. Forouzan, "Data Communications and Networking", 4th Edition, McGraw Hill Education, 2007.

REFERENCE BOOKS:

1. William Stallings, "Local and Metropolitan Area Networks", 6th Edition, Pearson Education India, 2008.
2. Tannenbaum, A.S., "Computer Networks", 4th Edition, Prentice Hall, 2003.
3. Jim Kurose; Keith Ross, "Computer Networking: A Top-Down Approach", 6th Edition, Pearson Education, Inc, 2003.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=QY6K1G_UypM
2. <https://www.youtube.com/watch?v=sG6WGvzmVaw>

WEB RESOURCES:

1. <https://in.coursera.org/learn/fundamentals-network-communications>
2. <https://in.coursera.org/browse/information-technology/networking>
3. <https://www.classcentral.com/course/data-communication-network-services-9160>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA101015	CLOUD COMPUTING	3	-	-	-	3

Pre-Requisite-

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Virtualization, Cloud Computing Fundamentals, Deployment Models; Cloud Computing Architecture; Cloud Computing Mechanisms; Cloud Security; Working with Clouds; and Case Studies.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the importance of virtualization and how this has enabled the development of Cloud Computing.
- CO2.** Analyze the cloud computing models, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
- CO3.** Implement different types of Virtualization technologies and Service Oriented Architecture systems
- CO4.** Apply modern technologies & tools of Cloud Computing in solving resource sharing problems in industry.
- CO5.** Identify security and privacy issues in cloud computing.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes										Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	
CO1	3	2	-	-	-	-	-	-	-	-	3	-	
CO2	2	3	-	-	-	-	-	-	-	-	3	-	
CO3	2	3	2	1	-	-	-	-	-	-	3	-	
CO4	3	3	3	1	-	-	-	-	-	-	3	-	
CO5	2	3	2	-	-	2	-	-	-	-	3	-	
Course Correlation Mapping	2	3	2	1	-	2	-	-	-	-	3	-	

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO VIRTUALIZATION (07 Periods)

Virtualization: Introduction to Virtualization, objectives of virtualization, benefits of virtualized technology, Adding guest Operating system.

Virtualization Technologies: Ubuntu, VMware, Microsoft Hyper-V.

Module 2: DEFINING CLOUD COMPUTING (10 Periods)

Defining Cloud Computing: Defining Cloud Computing, Cloud Types - The NIST model, The Cloud Cube Model, Deployment models, Service models, Benefits of cloud computing, Disadvantages of cloud computing, Assessing the Role of Open Standards.

Understanding Cloud Architecture: Exploring the Cloud Computing Stack, Composability, Infrastructure, Platforms, Connecting to the Cloud.

Module 3: UNDERSTANDING SERVICES AND APPLICATIONS (10 Periods)

Understanding Services And Applications By Type : Defining Infrastructure as a Service (IaaS), IaaS workloads, Pods, aggregation, and silos, Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), SaaS characteristics.

Understanding Abstraction and Virtualization: Using Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Virtual machine types, VMware vSphere.

Module 4: EXPLORING PLATFORM AS A SERVICE (10 Periods)

Using Amazon Web Services: Understanding Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2), Amazon Machine Images, Pricing models, System images and software, Creating an account and instance on EC2.

Managing the Cloud: Administrating the Clouds, Management responsibilities, Lifecycle management, Emerging Cloud Management Standards, DMTF cloud management standards, Cloud Commons and SMI.

Module 5: UNDERSTANDING CLOUD SECURITY (08 Periods)

Understanding Cloud Security: Securing the Cloud, The security boundary, Security service boundary, Security mapping, Securing Data, Brokered cloud storage access, Storage location and tenancy, Encryption, Auditing and compliance, Establishing Identity and Presence, Identity protocol standards, Windows Azure identity standards, Presence.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Compare Cloud Delivery Models.
2. Compare Cloud Deployment Models.
3. Impact of cloud computing on real world environment.

RESOURCES:

TEXT BOOKS:

1. Barrie Sosinsky, "*Cloud Computing Bible*," Wiley India Pvt Ltd, 1st Edition, 2011.
2. Ivanka Menken Ivanka Menken, "*Cloud Computing Virtualization Specialist Complete Certification Kit - Study Guide Book*," Emereo Publishing, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Anthony T. Velte, Toby J. Velte Robert Elsenpeter, "*Cloud Computing: A practical Approach*," Tata Mc Graw Hill, ISBN: 9780071626941, 1st Edition, 2010.
2. John W. Rittinghouse, James F. Ransome, "*Cloud Computing implementation, Management and Security*," CRC Press, ISBN: 9788120341609, Taylor & Francis group, 1st Edition 2010.
3. George Reese, "*Cloud Application Architectures*," O'reilly publishers, 1st Edition, 2010.
4. David S. Linthicum, "*Cloud Computing and SOA Convergence in your Enterprise*," Addison- Wesley, 1st Edition, 2010.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. <https://www.coursera.org/specializations/cloud-computing>
3. <https://www.udemy.com/course/introduction-to-cloud-computing-on-amazon-aws-for-beginners/>

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. <https://trailhead.salesforce.com/en/home>
3. [https://mkyong.com/tutorials/google- App- engine-tutorial/](https://mkyong.com/tutorials/google-App- engine-tutorial/)
4. <https://www.awsacademy.com>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA101019	ARTIFICIAL INTELLIGENCE	3	-	-	-	3

Pre-Requisite

Anti-Requisite

Co-Requisite

COURSE DESCRIPTION: Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Probabilistic reasoning, Represent knowledge and reason under uncertainty, Robotics, Ethics and safety in AI.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Architect intelligent agents using artificial intelligence techniques and principles.

CO2. Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.

CO3. Select and apply appropriate knowledge representation to build Bayesian network models to reason under uncertainty.

CO4. Investigate robot hardware and frameworks for intelligent robotic perception.

CO5. Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes										Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	
CO1	3	1	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	1	-	-	-	-	-	-	3
CO5	-	-	-	-	-	1	-	2	-	-	-	-	3
Course Correlation Mapping	3	2	2	-	-	1	-	2	-	-	-	-	3

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (10 Periods)

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

Module 2: PROBLEM SOLVING BY SEARCHING (09 Periods)

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

Module 3: SEARCHING COMPLEX ENVIRONMENTS (09 Periods)

Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; The minimax search algorithm, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

Module 4: PROBABILISTIC REASONING (09 Periods)

Representing Knowledge in an uncertain domain, Semantics of Bayesian networks, Probabilistic reasoning over time – Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman Filter.

Module 5: ROBOTICS, ETHICS AND APPLICATIONS (08 Periods)

Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, AI applications – Language Models

Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Trust and transparency, AI safety.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Real-World Case Study Analysis on
2. AI in healthcare
3. AI in finance or e-commerce (credit scoring, dynamic pricing)

RESOURCES:

TEXT BOOKS:	
1.	Zhou Wei SHI WEB RESOURCES Advanced Artificial intelligence, World Scientific Publishing Co. Pte. Ltd, 3 rd edition, ISBN 9789811293986 (hardcover) ,3 rd edition.
REFERENCE BOOKS:	
1.	Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 4th (2020) edition,
2.	Pearson publications.
VIDEO LECTURES:	
1.	https://www.youtube.com/watch?v=1HpYwa52LeY
2.	https://www.youtube.com/watch?v=kOkehUZrjBM
3.	https://www.youtube.com/playlist?list=PLxf3-FrL8GzRALeq_9BtdQcIN6SF4bTCG

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA101014	MACHINE LEARNING	3	-	-	-	3

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Introduction to machine learning, Bayesian concept learning, Supervised learning, Unsupervised learning, Artificial neural networks, Ensemble learning.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze the process of machine learning modeling and evaluation to automatically infer a general description for a given learning problem.
- CO2.** Analyze the underlying mathematical models within machine learning algorithms and learning tasks.
- CO3.** Design and implement machine learning solutions for classification, regression, and clustering problems.
- CO4.** Design and implement efficient neural architectures to model patterns for a given learning problem.
- CO5.** Develop intelligent solutions to solve societal problems related to computer vision, information security, healthcare and other areas.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes										Program Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	
CO1	3	2	-	-	-	-	-	-	-	-	3	-	3	
CO2	2	3	-	-	-	-	-	-	-	-	3	-	2	
CO3	2	3	2	1	-	-	-	-	-	-	3	-	2	
CO4	3	3	3	1	-	-	-	-	-	-	3	-	3	
CO5	2	3	2	-	-	2	-	-	-	-	3	-	2	
Course Correlation Mapping	2	3	2	1	-	2	-	-	-	-	3	-	2	

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO MACHINE LEARNING (09 Periods)

Machine Learning: Human learning, Types of human learning, Machine learning, Types of machine learning, Applications of machine learning, Issues in machine learning. Preparing to Model: Machine learning activities, Types of data, Exploring structure of data, Data quality and remediation.

Module 2: MODELING AND EVALUATION, BAYESIAN CONCEPT LEARNING (09 Periods)

Modeling and Evaluation: Selecting a model, Training a model, Model representation and interpretability, Evaluating performance of a model, Improving performance of a model. Feature Engineering: Feature transformation, Feature subset Selection. Bayesian Concept Learning: Introduction, Importance, Bayes' theorem, Bayes' theorem and concept learning, Bayesian belief network.

Module 3 SUPERVISED LEARNING (10 Periods)

Classification: Classification model, Classification learning steps, K-Nearest Neighbor, Support vector machines, Decision Tree - Decision tree representation, Problems for decision tree learning, Decision tree learning algorithm, Hypothesis space search, Inductive bias in decision tree learning, Issues in decision tree learning. Regression: Introduction, Simple linear regression, Improving accuracy of the linear regression model, Multiple linear regression, Assumptions and problems in regression analysis, Polynomial regression model, Logistic regression.

Module 4 UNSUPERVISED LEARNING (07 Periods)

Introduction, Unsupervised vs supervised learning, Applications of unsupervised learning, Clustering as a machine learning task, Types of clustering techniques, Partitioning methods, KMedoids, Hierarchical clustering, DBSCAN.

Module 5 ARTIFICIAL NEURAL NETWORKS, ENSEMBLE LEARNING (10 Periods)

Artificial Neural Networks: Neural network representations, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Back propagation algorithm, Convergence and local minima, Representational power of feed forward networks, Hypothesis space search and inductive bias, Hidden layer representations, Generalization, Over fitting, Stopping criterion. Ensemble Learning: Bagging, Boosting, Gradient boosting.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Introduction to Python machine learning libraries.
2. Use Naïve Bayes classifier to solve the credit card fraud detection problem.
3. Implement K-Nearest Neighbor algorithm to solve classification problem.
4. Implement CART algorithm for decision tree learning. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. Explore the problem of overfitting in decision tree develop solution using pruning technique.

5. Perform Exploratory Data Analysis on the given dataset. Implement CART algorithm for decision tree learning. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
6. Train an SVM Classifier with Linear Kernel. Use an appropriate data set for building the SVM Classifier and apply this knowledge to classify a new sample.
7. Build linear regression and multiple regression models to predict the price of the house (Boston House Prices Dataset).
8. Build a polynomial regression model for predicting the salary of the employees.
9. Build a neural network that will read the image of a digit and correctly identify the number.
10. Solve classification problem by constructing a feedforward neural network using Back propagation algorithm. (Wheat Seed Data).

RESOURCES:

TEXT BOOKS:

1. Tom M. Mitchell, *Machine Learning*, McGraw Hill, 2013.
2. Saikat Dutt, Subramanian Chandra mouli, Amit kumar das, *Machine Learning*, Pearson, 2019.

REFERENCE BOOKS:

1. Manaranjan Pradhan, U Dinesh Kumar, *Machine Learning Using Python*, Packt Publishing, 2019.
2. Aurelien Geron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, Techniques to Build Intelligent Systems*, 2nd Edition, O'Reilly, 2019.
3. Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press, 4th Edition, 2020.
4. Shai Shalev Shwartz, Shai Ben David, *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press, 2014.

SOFTWARE/TOOLS::

1. Python
2. Scikit-learn/Keras/TensorFlow

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106106202/>
2. <https://www.coursera.org/learn/machine-learning>
3. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

4. https://onlinecourses.nptel.ac.in/noc23_cs87/preview
5. https://onlinecourses.nptel.ac.in/noc23_ee87/preview
6. <https://www.coursera.org/learn/ntumlone-algorithmicfoundations>
7. <https://www.coursera.org/specializations/machine-learning-introduction>
8. <http://ndl.iitkgp.ac.in/document/YkxIRXFvZXJrTDBkVzVVZi9ESjl6eXpRZkxRc2lhOWhIVXBhUVVWaXZINDNyZUVIdU9LdIYvd20wbkQ4MC92UQ>
9. <https://www.coursera.org/learn/unsupervised-learning-recommenders-reinforcementlearning>

WEB RESOURCES:

1. <https://www.ibm.com/topics/machine-learning>
2. <https://www.simplilearn.com/tutorials/machine-learning-tutorial/what-is-machine-learning>
3. https://www.w3schools.com/python/python_ml_getting_started.asp
4. <https://developers.google.com/machine-learning/crash-course>
5. <https://www.greenteapress.com/thinkstats/>
6. <https://info.deeplearning.ai/machine-learning-yearning-book>
7. <https://www.kaggle.com/code/kanncaa1/machine-learning-tutorial-for-beginners>
8. <https://machinelearningmastery.com/machine-learning-in-python-step-by-step/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM102006	MACHINE LEARNING AND AI USING PYTHON	3	-	2	-	4
Pre-Requisite	25CA102005-Python Programming					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course helps to understand the basics of Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, machine learning in data science and various machine learning algorithms. The proposed course will combine theory and practice to enable the student to gain the necessary knowledge to work on real time problems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Architect intelligent agents using artificial intelligence techniques and principles.

CO2. Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.

CO3. Build Linear Regression models for given dataset

CO4. Implementation of clustering algorithms on data models and build recommendation System

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	2	-	3
Course Correlation Mapping	3	3	3	3	3	-	-	-	-	2	-	3

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND PROBLEM SOLVING BY SEARCHING (10 Periods)

Introduction to AI and its applications- Setting up the Python environment for AI development, Python programming essentials for AI Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents. Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions

Module 2: INTRODUCTION TO MACHINE LEARNING (10 Periods)

Introduction to machine learning: Supervised learning techniques (linear regression, logistic regression, support vector machines), Unsupervised learning techniques (clustering, dimensionality reduction), Evaluation and validation of machine learning models, Feature engineering and selection, Handling imbalanced datasets, Introduction to model optimization and hyperparameter tuning

Module 3 LINEAR REGRESSION (09 Periods)

Basic facts of linear regression, Model representation for a single variable, Cost Function, Gradient Descent for Linear Regression, Multivariate Linear Regression, Implementation of linear regression, Case studies of linear regression using data set.

Module 4 LOGISTIC REGRESSION (08 Periods)

Basic facts and implementation of logistic regression, Classification, Hypothesis Representation, Decision Boundary, Cost function, Multi-classification, solve a case study to predict output using existing data set.

Module 5 DECISION TREE (08 Periods)

Introduction - Constructing Decision Trees - Regression Tree and Classification Tree - Attribute Selection Measures, Entropy, Information Gain, Gini Index.

Total Periods: 45

EXPERIENTIAL LEARNING:

List of experiments:

1. Design and implement agent programs for Table-driven agents using the agent function of vacuum-cleaner world. The agent cleans the current square if it is dirty, otherwise it moves to the other square
2. Implement agent programs for Simple reflex agents and Model-based reflex agents using the agent function of vacuum-cleaner world.
3. Solve the travelling sales man problem using Hill Climbing search algorithm.
4. Design and implement solution for 8-puzzle problem using Greedy Best First Search. 5. Find the shortest path between a starting location and destination location in a graph using A* search algorithm

5. Use python to predict employee attrition in a firm and help plan their manpower (take dataset from Kaggle)
6. Create customer clusters using different market strategies on a dataset
7. Make a movie recommendation system

RESOURCES:

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 4 th Edition, 2020.
2. Pradhan, Manaranjan, and U. Dinesh Kumar. Machine Learning Using Python. Wiley, 2020.
3. Jose, Jeeva. Introduction to Machine Learning. Khanna Book Publishing Co., 2020

REFERENCE BOOKS:

1. Stephen Lucci , Danny Kopec, Artificial Intelligence in the 21st Century, Mercury Learning and Information, 3rd Edition,2018.
2. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition, 2009.
3. Mukhopadhyay, Sayan. Advanced Data Analytics Using Python: With Machine Learning, Deep Learning and NLP Examples. 1st ed. edition. Apress, 2018
4. Monte F. Hancock, Jr. Practical Data Mining. 1st edition. Auerbach Publications, 2011.

VIDEO LECTURES:

1. <https://youtu.be/SfigNnlRyIM>
2. <https://youtu.be/nmWGhb9E4es>
3. <https://youtu.be/YwlBCZVdpml>
4. https://youtu.be/wefc_36d5mU
5. <https://youtu.be/VImxF-9jk1E>

WEB RESOURCES:

1. <https://searchenterpriseai.techtarget.com/definition/AI>
2. https://www.w3schools.com/python/python_ml_getting_started.asp
3. <https://realpython.com/python-ai-neural-network/>

SOFTWARE/TOOLS:

Google CoLab

Programming Language : Python 3.8

Machine Learning Library : Tensor Flow 2.1 and Keras

PROGRAME ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM101004	Object-Oriented Analysis and Design Patterns	3	-	-	-	3

Pre-Requisite 25CA101006-Software Engineering

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course emphasises on Object Oriented software design and application of design patterns. Various types of design patterns are taught. Focus will be on Object Oriented Analysis of the system requirements followed by system design. This course helps in learning software design in a real world perspective

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the object-oriented concepts and modelling.
- CO2.** Design the architecture and defining class objects for the system.
- CO3.** Design the various diagrams for representation of system.
- CO4.** Analyzing the constructed system by using various SDLC approaches.
- CO5.** Perform Object oriented analysis.
- CO6.** Perform overall design using various UML diagrams .

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	3	3	3	-	-	-	-	-	3	2	3
CO2	2	3	3	3	-	-	-	-	-	3	2	3
CO3	1	3	3	3	3	-	-	-	-	2	1	3
CO4	1	3	3	3	3	-	-	-	-	3	1	3
CO5	1	3	3	-	-	-	-	-	-	3	1	3
CO6	-	3	-	3	-	2	-	-	-	-	-	3
Course Correlation Mapping	2	3	2	1	-	2	-	-	-	3	3	

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO UML AND STRUCTURAL MODELING (09 Periods)

INTRODUCTION TO UML: Introduction to object oriented concepts like inheritance, Polymorphism, Information hiding, Importance of modelling, Principles of modelling, Object oriented modelling, An overview of UML, Conceptual model of the UML, Architecture, Software development life cycle.

BASIC STRUCTURAL MODELING: Classes: Terms and concepts, Common modelling techniques; Relationships Modelling simple dependencies, Single inheritance and structural relationships; Common mechanisms and diagrams.

ADVANCED STRUCTURAL MODELING: Advance classes, Advance relationships, Interfaces, Types and Roles, Packages, Instances.

Module 2: OBJECT-ORIENTED DESIGN PROCESS (09 Periods)

THE OBJECT-ORIENTED DESIGN PROCESS: The object and class Concepts, Identifying classes, Identifying responsibilities, Relationships between Classes, Use Cases, CRC cards, UML class diagrams, Sequence diagrams, State diagrams, Using Java doc for design documentation, Case Study: A voice mail system.

Module 3 GUIDELINES FOR CLASS DESIGN AND INTERFACE TYPES AND POLYMORPHISM (10 Periods)

GUIDELINES FOR CLASS DESIGN: An overview of the date classes in the java library, designing a day class, the importance of encapsulation, analyzing the quality of an interface, programming by contract, unit testing. **INTERFACE TYPES AND POLYMORPHISM:** The icon interface type, polymorphism, drawing shapes, the comparable interface type, the comparator interface type, anonymous classes, frames and user interface components, user interface actions, timers, designing an interface type.

Module 4 PATTERNS AND GUI PROGRAMMING AND INHERITANCE ABSTRACT CLASSES (07 Periods)

PATTERNS AND GUI PROGRAMMING: Iterators, the pattern concept, the observer pattern, layout managers and the strategy pattern, components, containers and the composite pattern, scroll bars and the decorator pattern, how to recognize patterns, putting patterns to work.

INHERITANCE AND ABSTRACT CLASSES: The concept of inheritance, graphics programming with inheritance, abstract classes, the template method pattern, protected interfaces, the hierarchy of swing components, the hierarchy of standard geometric shapes, the hierarchy of exception classes, when not to use inheritance.

Module 5 FRAMEWORKS, MULTITHREADING AND MORE DESIGN PATTERNS (10 Periods)

FRAMEWORKS: Frameworks, applets as a simple framework, the collections framework, a graph editor framework, enhancing the graph editor framework. **MULTITHREADING:** Thread basics, Thread synchronization, Animations. **MORE DESIGN PATTERNS:** The Adapter pattern, Actions and the command pattern, the factory method pattern, the proxy pattern, the singleton pattern, the visitor pattern, other design patterns.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Identify Use Cases and develop the Use Case model.
2. Identify the business activities and develop an UML Activity diagram.
3. Identify the conceptual classes and develop a domain model with UML Class diagram.
4. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
5. Draw the State Chart diagram.
6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
7. Implement the Technical services layer.
8. Implement the Domain objects layer.
9. Implement the User Interface layer.
10. Draw Component and Deployment diagrams.
11. Draw the System architecture and UML diagrams for any on the following cases
- . Suggested domains:
 - (a) Library management system
 - (b) Hospital management system
 - (c) ATM system
 - (d) Transport System
 - (e) Book bank System
 - (f) Exam Registration System
 - (g) Stock maintenance system.
 - (h) Online course reservation system
 - (i) E-ticketing System
 - (j) Credit card processing
 - (k) e-book management system
 - (l) Recruitment system
 - (m) Foreign trading system
 - (n) Conference Management System
 - (o) BPO Management System

RESOURCES:

TEXT BOOKS:

1. Grady Booch, James Rumbaugh, Ivar Jacobson (2009), The Unified Modeling Language User guide, 2nd edition, Pearson Education, New Delhi, India.
2. Cay Horstmann (2004), Object-Oriented Design and Patterns, Wiley India edition, New Delhi, India.

REFERENCE BOOKS:

1. Meilir Page-Jones (2000), Fundamentals of Object Oriented Design in UML, Pearson Education and NewYork.
2. Craig Larman (2005), An introduction to Object -Oriented Analysis and Design and Unified Process Appling UML and Patterns, 3rdedition, Pearson Education, New Delhi, India.
3. John W. Satzinger, Robert B Jackson, Stephen D Burd (2004), Object-Oriented Analysis and Design with theUnified Process, Cengage learning, India. Object Oriented Software Engineering by Ivar Jacobson
4. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia

VIDEO LECTURES:

1. <https://archive.nptel.ac.in/courses/106/105/106105153/>
2. https://onlinecourses.nptel.ac.in/noc19_cs48/preview
3. https://onlinecourses.nptel.ac.in/noc20_cs84/preview

WEB RESOURCES:

1. <http://ndl.ethernet.edu.et/bitstream/123456789/90366/3/Revised%20OOSAD%20Module2020.pdf>
2. <https://online.stanford.edu/courses/cs108-object-oriented-systems-design>
3. <https://www.w3computing.com/systemsanalysis/object-oriented-systems-analysis-design/>
8. <https://machinelearningmastery.com/machine-learning-in-python-step-by-step/>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM101005	SOFTWARE PROJECT MANAGEMENT	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Software project management and its importance, Plans, methods and methodologies, Software processes and process models, Stepwise project planning, Software effort estimation, Cost estimation, Activity planning, Plan models, Critical path and critical activities, Risk management, Resource allocation, Monitoring and control, Managing people, Software quality

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Apply knowledge of software project management, project plans, process models for efficient implementation and completion of projects.
- CO2.** Estimate effort for the project to assign and schedule available resources in the most effective and economical way possible.
- CO3.** Develop network models for sequences of activities in a project for effective project management.
- CO4.** Identify the risk factors, monitor the progress and quality of projects to take mitigating actions.
- CO5.** Recognize the need for organizational behavior, teamwork and communication to improve the performance on projects.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes										Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	
CO1	3	3	-	3	-	-	-	3	-	-	-	3	
CO2	3	3	-	3	-	-	-	-	-	-	-	3	
CO3	3	3	-	-	-	-	-	-	-	-	-	3	
CO4	3	2	-	-	-	-	-	-	-	-	-	3	
CO5	3	3	-	3	-	-	-	-	-	-	-	3	
Course Correlation Mapping	3	2	-	3	-	-	-	3	-	-	-	3	

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module 1:	Introduction to Software Project Management:	(10 Periods)
<p>Importance of software project management, Defining project, Software projects versus other types of project, Contract management and technical project management, Activities covered by software project management, Plans, methods and methodologies, Categorizing software projects, Project charter, Stakeholders, Setting objectives, The business case, Project success and failure, Management and management control, Project management life cycle, Traditional versus modern project management practices.</p>		
Module 2:	PROJECT APPROACH AND EFFORT ESTIMATION	(09 Periods)
<p>Selection of Project Approach: Build or buy, Choosing methodologies and technologies, Software processes and process models, Choice of process models, Spiral model, Software prototyping, Incremental delivery, Agile methods.</p> <p>Software Effort Estimation: Effort estimation, Problems with over and under estimates, Basis for software estimating, Software effort estimation techniques, Bottom-up estimating, The top-down approach and parametric models, Albrecht function point analysis, COCOMO II.</p>		
Module 3	ACTIVITY PLANNING AND RISK MANAGEMENT	(09 Periods)
<p>Activity Planning: Objectives of activity planning, Projects and activities, Sequencing and scheduling activities, Network planning models, Formulating a network model, Adding the time dimension, The forward pass, The backward pass, Identifying the critical path and critical activities, Activity float.</p> <p>Risk Management: Risk, Categories of risk, Risk management approaches, A framework for dealing with risk, Risk identification, Risk assessment, Risk planning, Risk management, PERT technique, Monte Carlo simulation.</p>		
Module 4	RESOURCE ALLOCATION, MONITORING AND CONTROL	(09 Periods)
<p>Resource Allocation: Nature of resources, Identifying resource requirements, Scheduling resources, Creating critical paths, Publishing resource schedule, Cost schedules, Scheduling sequence.</p> <p>Monitoring and Control: Creating framework, Review, Visualizing progress, Cost monitoring, Earned value analysis, Prioritizing monitoring, Getting the project back to target, Change control, Software configuration management.</p>		
Module 5	MANAGING PEOPLE, QUALITY IN SOFTWARE ENVIRONMENT	(08 Periods)
<p>Managing People: Organizational behavior, Oldham-Hackman job characteristics model, Ethical and professional concerns, Working in teams – Decision making, Organization and team structures, Dispersed and virtual teams, Communication genres and plans, Leadership.</p> <p>Software Quality: The place of software quality in project planning, Importance of software quality, Defining software quality, Software quality models, ISO 9126, Process capability models, Quality plans</p>		
Total Periods: 45		

EXPERIENTIAL LEARNING:

1. Requirement Management Plan
2. Use Case Diagram.
3. Sequence Diagram
4. Collaboration Diagram
5. Activity Diagram

RESOURCES:

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell, Rajib Mall, *Software Project Management*, 6th Edition, McGraw Hill, 2018.

REFERENCE BOOKS:

1. Michele Sliger and Stacia Broderick, *The Software Project Manager's Bridge to Agility*, Addison-Wesley, 2008.
2. Pankaj Jalote, *Software Project Management in Practice*, Pearson, 2002.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview
2. <https://www.youtube.com/watch?v=ZRaZVLRXctU>
3. <https://www.youtube.com/watch?v=vi1NFF1OTPc>

WEB RESOURCES:

1. <https://www.udemy.com/course/software-project-management-the-complete-course/>.
2. <https://www.coursera.org/courses?query=software%20project%20management>.
3. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA101018	ETHICAL HACKING	3	-	-	-	3

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION Ethical hacking, Network and computer attacks, Foot printing, Social engineering, Port scanning, System hacking, Sniffers, Denial of service, Hacking web servers, Wireless hacking, Cryptography, Network Protection System.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge on the computer security, social engineering and the intent of ethical hacking.
- CO2.** Select and apply foot printing and port scanning tools to discover vulnerabilities of the computer system.
- CO3.** Investigate hacking techniques and tools to maintain computer security.
- CO4.** Analyze cryptosystems and network protection systems for information security and intrusion prevention.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	3	-
CO2	2	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	1	-	-	-	-	-	-	3	-
CO4	3	3	3	1	-	-	-	-	-	-	3	-
CO5	2	3	2	-	-	2	-	-	-	-	3	-
Course Correlation Mapping	2	3	2	1	-	2	-	-	-	-	3	-

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module 1: ETHICAL HACKING, NETWORK AND COMPUTER ATTACKS (09 Periods)

Introduction to Ethical Hacking: The role of security and penetration testers, Penetration-Testing methodologies, What you can and cannot do legally.

Network and Computer Attacks: Malicious software, Trojans, Backdoors, Viruses, and Worms, Protection against malware attacks, Intruder attacks on networks and computers, Addressing physical security.

Module 2: TCP/IP CONCEPTS AND SOCIAL ENGINEERING (09 Periods)

TCP/IP Concepts: Overview of TCP/IP – Application layer, Transport layer, Internet layer; IP addressing – Planning IP address assignments, IPv6 addressing.

Social Engineering: What is social engineering, What are the common types of attacks, Understand insider attacks, Understand identity theft, Describe phishing attacks, Understand online scams, Understand URL obfuscation, Social engineering countermeasures

Module 3: FOOTPRINTING AND PORT SCANNING (09 Periods)

Foot printing: Using web tools for footprinting, Conducting competitive intelligence, Using domain name system zone transfers.

Port Scanning: Port scanning, Using port scanning tools, Conducting ping sweeps, Understanding scripting

Module 4: SYSTEM HACKING (10 Periods)

System hacking -Password cracking techniques, Types of passwords, Key loggers and other spyware technologies, Escalating privileges, Root kits, How to hide files, Steganography technologies, How to cover your tracks and evidences; Sniffers-Protocols susceptible to sniffing, Active and passive sniffing, ARP poisoning, Ethereal capture and display filters, MAC flooding, DNS spoofing techniques, Sniffing countermeasures; Denial of Service - Types of DoS attacks, How DDoS attacks work, How BOTs/BOTNETs work, Smurf attack, SYN flooding, DoS/DDoS counter measures; Session hijacking - Spoofing vs.hijacking, Types of session hijacking, Sequence prediction, Steps in performing session hijacking, Preventing session hijacking.

Module 5: CRYPTOGRAPHY, NETWORK PROTECTION SYSTEMS (08 Periods)

Cryptography: Understanding Cryptography basics, Symmetric and asymmetric algorithms, Public key infrastructure, Cryptography attacks.

Network Protection Systems: Understanding routers, Firewalls, Honeypots

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Analyze Windows Server 2019 vulnerabilities as reported by CVE.
2. Write a detailed report on Memory Corruption Vulnerability.
3. Conduct a vulnerability assessment on a simulated network. Identify and prioritize potential vulnerabilities.
4. Develop a plan to remediate the vulnerabilities while considering their severity and impact.

RESOURCES:

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, James E. Corley, *Hands-On Ethical Hacking and Network Defense*, 3rd Edition, Cengage Learning, 2017.
2. Kimberly Graves, *CEH: Official Certified Ethical Hacker Review Guide*, Wiley, 2007.

REFERENCE BOOKS:

1. Michael Gregg, *Certified Ethical Hacker (CEH) Certguide*, 3rd Edition, Pearson, 20

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
2. <https://www.youtube.com/watch?v=t8nwQ6At0CU&list=PL7AT7LU4byRKMBC EWpeZ4QO d2VWvdIHXU>

WEB RESOURCES:

1. <https://snyk.io/ethical-hacking-resources/>
2. <https://www.hackerone.com/ethical-hacker/useful-online-resources-new-hackers>
3. <https://hackernoon.com/top-resources-to-learn-ethical-hacking>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM101006	FUNDAMENTALS OF DATA SCIENCE	3	-	-	-	3

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION Basic Terminologies of data science, Computation using NumPy, Data exploration using Pandas, Data transformation, Data wrangling, Plotting and visualization using Matplotlib, Data aggregation, Time series analysis.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the fundamental concepts of data, information, knowledge, and the role of Data Science in solving real-world problems using suitable tools and techniques.
- CO2.** Apply various data storage formats, data sources, and demonstrate proficiency in using SQL and NoSQL databases for data management and retrieval.
- CO3.** Apply data preparation techniques such as cleaning, reduction, and transformation, and evaluate machine learning models using standard performance metrics.
- CO4.** Analyze the Data Science methodology and lifecycle, and understand Big Data analytics frameworks like Hadoop and MapReduce for large-scale data analysis.
- CO5.** Visualize and interpret datasets effectively using Tableau and Python, applying statistical and analytical methods to derive meaningful insights.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	1	1	3	-	-	-	-	-	3	-
CO2	3	3	2	2	3	-	-	-	-	-	3	-
CO3	3	3	2	3	3	-	-	-	-	-	3	-
CO4	3	3	2	3	3	-	-	-	-	-	3	-
CO5	-	-	3	3	3	-	-	-	-	-	3	-
Course Correlation Mapping	3	3	2	2	3	-	-	-	-	-	3	-

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module 1:	INTRODUCTION TO DATA SCIENCE	(10 Periods)
<p>Introduction: Data, information, and Knowledge-Data Science: the art of data exploration-Data Science tasks-Data Science objectives- Applications of Data Science. Importance of Data Science: Need for Data Science - Data Science Process – Business Intelligence and Data Science – Prerequisites for a Data Scientist – Tools and Skills required.</p>		
Module 2:	Data Storage FORMATS and No-SQL	(09 Periods)
<p>Data, sources, and generation: Introduction-Data attributes-Data-storage formats-Data sources-Data generation. Databases for Data Science: Structured Query Language (SQL): Basic Statistics, Data Munging, Filtering, Joins, Aggregation, No-SQL: Document Databases, Wide-column Databases and Graphical Databases</p>		
Module 3	Data Preparation AND Machine Learning Paradigm	(09 Periods)
<p>Data Preparation: Data cleaning-Data reduction-Data transformation-Data normalization-Data integration Basics Concepts: Machine Learning Paradigm - Evaluating a classifier: Evaluation steps- Handling unbalanced classes Model generalization-Evaluation metrics: confusion matrix-accuracy-precision and recall-F-measure.</p>		
Module 4	Data Science Methodology AND Data Analytics Lifecycle	(09 Periods)
<p>Data Science Methodology: Big Data analysis: Introduction-Characteristics of Big Data-Types of Big Data-Big Data analysis problems – techniques - Big Data analytics platforms-MapReduce architecture. Examples of Data Analytics – Data Analytics Lifecycle: Data Discovery, Data Preparation, Model Planning, Model Building, Communicate Results.</p>		
Module 5	Data Visualizing using Tableau	(08 Periods)
<p>Data Visualizing using Tableau: Introduction-Dimensions and Measures, Descriptive statistics-Basic Charts-Dashboard design & principles-Special chart types Data Science in Practice: Need of Data Science in the real world-Hands-on Data Science with Python-Necessary Python libraries-loading the dataset-Dataset preprocessing-Feature selection</p>		
		Total Periods: 45

EXPERIENTIAL LEARNING:

1. Real-World Case Study Analysis on
2. AI in healthcare
3. AI in finance or e-commerce (credit scoring, dynamic pricing)

RESOURCES:

TEXT BOOKS:

1. Jugal K. Kalitha, Dhruba K. Bhattacharyaa, Swarup Roy Fundamentals of Data Science: Theory and Practice Academic Press 2023, 1st Edition.
2. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare Fundamentals of Data Sciences.
3. Wes McKinney, Python for Data Analysis, O'Reilly, 2nd Edition, 2017.

REFERENCE BOOKS:

1. Joel Grus Data Science from Scratch: First Principles with Python O'Reilly Publications 2019, 2nd Edition.

VIDEO LECTURES:

1. <https://archive.nptel.ac.in/courses/106/106/106106212/>
2. https://onlinecourses.nptel.ac.in/noc22_cs32/preview

WEB RESOURCES:

1. https://swayam.gov.in/nd1_noc19_cs60/preview
2. <https://towardsdatascience.com/>
3. <https://www.w3schools.com/datascience/>
4. <https://github.com/jakevdp/PythonDataScienceHandbook>

PROGRAM ELECTIVE

z **Course Title** **L T P S C**
25CA102008 **DATA ANALYTICS** **3 - 2 - 4**

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and understanding the need of Big Data Analytics, challenges and different analytical architectures, Installation and understanding of Hadoop Architecture and its ecosystems, Processing of Big Data with Advanced architectures.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
- CO2.** Access and Process Data on Hadoop Distributed File System
- CO3.** Manage Job Execution in Hadoop Environment
- CO4.** Ability to understand the importance of Big Data in Social Media and Mining
- CO5.** Analyze the value from the Data

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	2	3	-	-	-	-	-	3	3	3
CO2	3	2	3	3	3	-	-	3	3	3	3	-
CO3	3	3	2	3	-	-	-	-	-	3	3	3
CO4	3	3	3	1	3	1	-	1	3	3	3	3
CO5	3	3	3	3	3	3	-	3	3	3	3	-
Course Correlation Mapping	3	3	3	3	3					3	3	3

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module 1:	INTRODUCTION TO BIG DATA ANALYTICS	(09 Periods)
Overview of Big Data Analytics, Data Science, Big Data Characteristics, Architecture of Big Data Systems, Advantages of Big Data and Challenges faced by Big Data Systems.		
Module 2:	BIG DATA TECHNOLOGIES	(09 Periods)
Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data – Predictive Analytics – Mobile Business Intelligence and Big Data		
Module 3	HADOOP	(09 Periods)
Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce – Data Serialization.		
Module 4	HADOOP ARCHITECTURE	(09 Periods)
Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node		
Module 5	HDFS and MAP REDUCE FRAMEWORK	(09 Periods)
HDFS Architecture, Hadoop Configuration, Map Reduce Framework		

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Perform setting up and Installing Hadoop in its standalone operating mode
2. Perform setting up and Installing Hadoop in its Pseudo and Fully Distributed operating mode
3. By Using web-based tools to monitor the Hadoop Setup.
4. Perform Hadoop Commands
5. Implement the File Management task by adding the files and directories in Hadoop
6. Implement the Retrieving file task in Hadoop
7. Implement the Removing file task in Hadoop.

RESOURCES:

TEXT BOOKS:

1. Big Data Analytics by G Sudha Sadasivam and R. Thirumahal, Oxford Higher Edition.
2. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'Reilly Media, 2012.

REFERENCE BOOKS:

1. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012
2. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
2. <https://www.upgrad.com/data-science/pg-programme>
3. <https://www.youtube.com/watch?v=CaqJ65CIoMw>

SOFTWARE/TOOLS:

Hadoop (<https://hadoop.apache.org/releases.html>)

Cassandra (<http://cassandra.apache.org/download/>)

WEB RESOURCES:

1. Big Data Analytics Tutorial (tutorialspoint.com)
2. [hackerrank-solutions](https://github.com/hackerrank-solutions) · GitHub Topics · GitHub
3. What is Big Data - [javatpoint](http://javatpoint.com)

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM101007	SOFTWARE TESTING AND QUALITY ASSURANCE	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course introduces the principles and practices of Software Quality Assurance and Testing, focusing on testing strategies, methodologies, and tools to ensure software reliability and performance. It covers testing techniques, quality metrics, SQA planning, and standards like ISO 9000 and CMM, along with case studies on testing specialized systems such as web, client/server, and security applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Ability to apply software testing knowledge and engineering methods for various applications.
- CO2** Apply software testing methods and modern software testing tools for testing projects.
- CO3** Ability to understand the importance of software test automation and develop a test tool to support test automation.
- CO4** Evaluate basic understanding and knowledge of contemporary issues in advance software testing methodologies.
- CO5** Apply various communication methods and skills to communicate with the teammates to conduct practice-oriented software testing project.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	3	2	-
CO3	2	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	3	2	-
CO5	3	3	3	-	-	-	-	-	-	3	3	-
Course Correlation Mapping	3	2	3	-	-	-	-	-	-	3	2	-

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: Software Testing Strategy and Environment & Software Testing Methodology (09 Periods)

Software Testing Strategy and Environment: Establishing testing policy- structured approach to testing, test factors - Economics of System Development Life Cycle (SDLC) Testing Software Testing Methodology Defects hard to find- verification and validation - functional and structural testing -workbench concept -eight considerations in developing testing methodologies - testing tactics checklist

Module 2: Software Testing Techniques and Software Testing Tools (09 Periods)

Black-Box - Boundary value, Bottom-up, Branch coverage, Cause-Effect graphing - Inspections - JADs -Pareto Analysis, Prototyping - Random Testing - Risk-based Testing - Regression Testing - Structured Walkthroughs -Thread Testing - Performance Testing -White-Box Testing Taxonomy of Testing tools - Methodology to evaluate automated testing tools -Load Runner, Win runner and Rational Testing Tools

Module 3 Testing Process Eleven Step Testing Process (09 Periods)

Testing Process Eleven Step Testing Process: Assess Project Management Development Estimate and Status - Develop Test Plan -Requirements Phase Testing - Design Phase Testing - Program Phase Testing - Execute Test and Record Results - Acceptance Test - Report test results - testing software installation - Test software changes - Evaluate Test Effectiveness.

Module 4 Software Quality Assurance Metrics and Measurement (09 Periods)

What is Quality? - Software Quality Assurance, Components of Software Quality Assurance - Software Quality Assurance Plan: Steps to develop and implement a Software Quality Assurance Plan – Quality Standards: ISO 9000 and Companion ISO Standards – CMM Product Quality metrics, In-Process Quality Metrics Metrics for Software Maintenance

Module 5 Software Quality metrics methodology and Case Study (09 Periods)

Establish quality requirements - Identify Software quality metrics - Implement the software quality metrics - analyze software metrics results -validate the software quality metrics Testing Specialized Systems and Applications Testing Client/Server – Web applications, Testing off the Shelf Components, Testing Security

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Testing Strategy and Methodology
 - a. Develop a test policy document for a sample software project.
 - b. Perform verification and validation exercises on a small code module.
 - c. Conduct a walkthrough session to identify potential defects
2. Testing Techniques and Tools
 - a. Perform black-box and white-box testing on a mini software application.
 - b. Use tools like LoadRunner or Selenium for performance or regression testing.
 - c. Conduct a Pareto analysis to prioritize software defects.
 - d. Apply boundary value and cause-effect testing using sample test cases.
3. Testing Process
 - a. Design a comprehensive test plan following the Eleven-Step Testing Process.

- b. Execute a test cycle for a real or simulated project and prepare a test report.
- c. Perform acceptance testing on a developed prototype or web module.

4. **SQA Metrics and Measurement**

- a. Prepare a **Software Quality Assurance (SQA) Plan** for an assigned project.
- b. Collect and analyze **product and process quality metrics** from test results.
- c. Conduct a **mini audit** of quality assurance processes based on ISO/CMM guidelines.

RESOURCES

TEXT BOOKS:

1. Solis Tech, Quality Assurance :Software Quality Assurance made easy, Kindle Edition,2016
2. Meir Liraz, Quality Assurance :How to set up and manage a Quality Control System, Kindle Edition,2013

REFERENCE BOOKS:

1. Solis Tech, Quality Assurance :Software Quality Assurance made easy, Kindle Edition,2016
2. Meir Liraz, Quality Assurance :How to set up and manage a Quality Control System, Kindle Edition,2013
3. Software Testing and continuous Quality Improvement, by William E.Lewis, GunasekaranVeerapillai, Third Edition, 2009, CRC Press. Auerbach Publications

VIDEO LECTURES:

- 1 coursera.org/courses?query=quality+assurance
- 2 <https://www.linkedin.com/learning/topics/software-quality-assurance?>
- 3 <https://extendedstudies.ucsd.edu/courses/software-testing-for-quality-assurance-cse-41266>

Web Resources:

- 1 <https://www.h2kinfosys.com/courses/qa-online-training-course-details>
- 2 <https://testinginstitute.com>
- 3 <https://www.codingtemple.com/free-courses/quality-assurance>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA101009	ADVANCED DATABASES	3	-	-	-	3

Pre-Requisite 25CA102002-Database Management Systems

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Parallel Databases; Object-Based Databases; Distributed Databases; XML; Emerging Database Technologies and Applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the concepts of parallelism to design parallel systems on multicore processors.
- CO2.** Apply object oriented concepts to design object based databases.
- CO3.** Design distributed databases by analyzing various data fragmentations.
- CO4.** Create XML databases for web based applications.
- CO5.** Implement emerging database technologies for the development of applications.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	3	-	3
CO2	3	3	3	3	3	-	-	-	-	3	-	3
CO3	3	2	3	3	3	-	-	-	-	3	-	3
CO4	3	3	3	3	3	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	3
Course Correlation Mapping	3	3	3	3	3	-	-	-	3	3	-	3

Correlation Level: **3-High;** **2-Medium;** **1-Low**

COURSE CONTENT:

Module 1:	PARALLEL DATABASES	(09 Periods)
Introduction, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems, Parallelism on Multicore Processors.		
Module 2:	OBJECT-BASED DATABASES	(09 Periods)
Overview, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multi set Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.		
Module 3:	DISTRIBUTED DATABASES	(09 Periods)
Features of Distributed versus Centralized Databases, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed databases, Distributed Database Design.		
Module 4:	XML	(09 Periods)
Structure of XML data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications. (graph database)		
Module 5:	EMERGING DATABASE TECHNOLOGIES AND APPLICATION	(09 Periods)
Mobile Database, Geographic Information Systems, Genome Data Management, Multimedia Database; NoSQL-An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types.		

Total Periods: 45**EXPERIENTIAL LEARNING:**

1. Evaluate the security of a database system.
2. Plan and execute the migration of a database from one system to another
3. Design a distributed database system for a scenario involving multiple data centers.

RESOURCES:

TEXT BOOKS:

1. A.Silberschatz,H.F.KorthandS.Sudarshan,"*Database System Concepts*," TataMcGraw Hill, 7thEdition,2019.
2. StefandCeriandGiuseppePelagatti,"*Distributed Databases Principles and Systems*," McGraw Hill, 1stEdition,2008.

REFERENCE BOOKS:

1. Ramea Elmasri and Shamkant B. Navathe," *Fundamentals of database Systems*," Pearson Education, 5thEdition, 2007.
2. Gaurav Vaish, "*Getting Started with NoSQL*," Packt Publishing, 1stEdition,2013.

VIDEO LECTURES:

1. <https://youtu.be/7M0CdMfUEmQ>
2. <https://youtu.be/tFS0qiimHPY>
3. <https://youtu.be/yTzBtde3zoI>

WEB RESOURCES:

1. <https://www.geeksforgeeks.org/difference-between-centralized-database>
2. <https://www.geeksforgeeks.org/parallelism-in-query-in-dbms>
3. <https://www.geeksforgeeks.org/object-based-databases>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA101004	RESPONSIBLE AI ARTIFICIAL INTELLIGENCE	3	-	-	-	3

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The design, development, and deployment of AI interacts with a wide range of values, including fairness, privacy, transparency, autonomy, and well-being. While AI as a technical

field is advancing rapidly, enabling applications across domains and sectors, the frameworks, regulations, and ethical tools necessary to realize the promise of AI while promoting and protecting values are not robust. This course develops an understanding of the current legal, regulatory, and ethical landscape, and develops the tools necessary to responsibly engage with AI.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** To be able to learn foundations of AI.
- CO2.** To be able to evaluate AI systems on explainability and interpretability.
- CO3.** To be able to enforce fairness in models and remove bias in data.
- CO4.** To be able to preserve the privacy of individuals while learning from them.
- CO5.** To be able to develop responsible AI modules for given practical problems and estimate the tradeoff with accuracy.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	2	3	-	3	-	-	-	-	-	-	3
CO3	3	3	3	-	3	-	-	-	-	-	-	3
CO4	3	2	2	-	3	3	-	-	-	-	-	3
CO5	3	3	3	-	3	3	-	-	-	-	-	3
Course Correlation Mapping	3	3	3	-	3	3	-	-	-	-	-	3

Correlation Level: **3-High;** **2-Medium;** **1-Low**

COURSE CONTENT:

Module 1:	FUNDATIONS OF RESPONSIBLE AI	(09 Periods)
Fundamentals of Artificial Intelligence, overview of AI scopes and Applications, Need for ethics in Artificial Intelligence, Ethical Artificial Intelligence frame work, Artificial Intelligence for Society and Humanity, Concepts of Artificial Intelligence and Responsible Artificial Intelligence, common Artificial Intelligence myths.		
Module 2:	INTERPRETABILITY AND EXPLAINABILITY	(09 Periods)
Explainable and interpretable AI, Development of explainable systems, evaluation of AI systems on explainability and interpretability, Development of a testing plan to measure explainability, Interpretability through simplification and visualization, Intrinsic interpretable methods, Post Hoc interpretability, Explainability through causality, Model agnostic Interpretation.		
Module 3	Fairness and Bias	(09 Periods)
Importance of fairness and bias in AI, Creation of fair AI systems, Evaluation and critique AI systems for fairness and bias, policies for fairness training, Different fairness levels and Sources of Biases, Exploratory data analysis, limitation of a dataset, Preprocessing, inprocessing and postprocessing to remove bias, Group fairness and Individual fairness, Counterfactual fairness.		
Module 4	Ethics, Accountability and Privacy preservation	(10 Periods)
Auditing AI models, fairness assessment, Principles for ethical practices, Definition of privacy in the context of AI systems, Attack models, Privacy-preserving Learning, Differential privacy, Federated learning, Evaluation of AI/ML system designs through a privacy lens, Apply privacy by design methodologies, Implementation of data minimization principles.		
Module 5	Responsible Generative AI and case study	(08 Periods)
Responsible Generative AI: Definition of Generative AI and LLMs, Uses and capabilities of Generative AI, Assessment of risks and ethical concerns associated with the use of LLMs, Identification of AI-generated text with different techniques, Interpretation of copyright implications of using LLMs, Design of guidelines for ethical LLM use, Recommendation systems, Medical diagnosis, Hiring/ Education, Computer Vision, Natural Language Processing		
		Total Periods: 45

EXPERIENTIAL LEARNING:

1. Design guidelines for ethical LLM use
2. Case study on Medical diagnosis, Hiring/ Education and Computer Vision

RESOURCES:

TEXT BOOKS:

1. Virginia Dignum, "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way" Springer Nature, 04-Nov-2019;ISBN-10 : 3030303705, ISBN-13 : 978-3030303709

REFERENCE BOOKS:

1. Christoph Molnar "Interpretable Machine Learning".Lulu, 1st edition, March 24, 2019; eBook. ISBN-10 : 0244768528, ISBN-13 : 978-0244768522 [available online]
2. "Silja Voeneky, Philipp Kellmeyer, Oliver Mueller, Wolfram Burgard, " the cambridge handbook of responsible artificial intelligence" Cambridge University Press, October 2022,online ISBN: 9781009207898,DOI : <https://doi.org/10.1017/9781009207898>

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc24_cs42/preview
2. <https://www.youtube.com/watch?v=DA7IdX6OIG4>
3. <https://www.microsoft.com/en-us/ai/responsible-ai>
4. <https://www.youtube.com/watch?v=h8PYkfCUO0o>
5. <https://www.youtube.com/watch?v=1MXcLgyOO9w>

WEB RESOURCES:

1. <https://www.cambridge.org/core/books/cambridge-handbook-of-responsible-artificial-intelligence/EF02D78934D18B9A22A57A46FF8FFAFC>

SOFTWARE/TOOLS:

AI Fairness 360 (AIF360) – by IBM

Fairlearn – by Microsoft

LIME (Local Interpretable Model-agnostic Explanations)

What-If Tool (by Google, for TensorBoard)

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA102037	USER INTERFACE DESIGN	3	-	2	-	4

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides fundamental user interface design principles and methodologies such as layout, controls and navigation. Students will learn the tools and techniques of Photoshop and Illustrator in order to create user interface animations

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Gain insight into the basic theories and current research topics in user-centred interaction design
- CO2.** Be able to create user interface animations with the aid of Photoshop and Illustrator
- CO3.** Develop an interactive mockup website and mobile with the design ideas in a constructive manner
- CO4.** Develop the ability to construct Navigation that enables users to easily accomplish user interface design tasks

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	2	3	-
CO4	2	3	3	3	3	-	-	-	-	3	2	-
Course Correlation Mapping	2	3	3	2	3	-	-	-	3	2	3	-

Correlation Level: **3-High;** **2-Medium;** **1-Low**

COURSE CONTENT:

Module 1:	INTRODUCTION TO PHOTOSHOP	(09 Periods)
Introduction to Photoshop - Raster graphics - Performance Optimization - Color Calibration Workspace overview - Photoshop controls - Interface - Layers and Panels - Navigation Pan - Rotate View tool - Navigator panel - Zoom in or out - Fit an image to the screen- Photoshop Tools - Usability features - Masks in UI Design - Lights and Shadows - Emphasis and Blending		
Module 2:	COLOR SCHEME	(10 Periods)
Color Scheme - Primary Color - Secondary colors - Neutral colors - Brainstorm - Typography - Web Safe Fonts - Font Themes - Size - Color and Contrast - Tracking - Leading - Soft Buttons - 3D Buttons - Realistic Buttons - Web Template Design - Components of a Web Page		
Module 3	LOGO DESIGN PRINCIPLES	(10 Periods)
Logo Design Principles - Purpose - Target audience - Planning essentials - Web Layout Design - Rule of third - Rule of odds - Poster Design Principles - F shaped pattern - Visual Hierarchy - User friendly - Photoshop Etiquette - Stretching text and images - Proofread - Make easy to find		
Module 4	UI ILLUSTRATIONS	(08 Periods)
UI Illustrations - Creating visual triggers - Creative storytelling - Emotional appeal - Aesthetic satisfaction - Mobile GUI Design - Mobile GUI Guidelines - Android UI Design - Screen Components - IOS UI Design - Animations - UI Animations in Photoshop - UI Animation in Illustrator.		
Module 5	WEB DESIGN	(08 Periods)
Mockup Design - Responsive Web Design - Setting the stage - Basic mechanics - Typography and Layout - Navigation patterns - Advanced Enhancement -Performance - Page Designs - Metro UI Design - Mascot Design - Characters Purpose - Unique features - Exporting for Web, Mobile, Print - Design Optimization		

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Design a UI for a Game website
2. Design a UI for a female centric website
3. Design a UI suitable for both mobile and PC
4. Design a UI for a horror themed website
5. Design a one pager UI for a website
6. Design a one pager UI for a mobile
7. Design a mascot for an imaginary brand
8. Design a UI compatible for IOS
9. Design a mock-up website for a service sector company
10. Design a mobile (Android and IOS) mock-up website for an online store

RESOURCES:

TEXT BOOKS:

1. Diana MacDonald, "Practical UI Patterns for Design Systems: FastTrack Interaction Design for a Seamless User Experience", Apress, 2019.
2. Jenifer Tidwell, "Designing Interfaces: Patterns for Effective Interaction Design" Second Edition, O'Reilly Media, Inc., 2010.

REFERENCE BOOKS:

1. R. Moore "UI design with Adobe Illustrator", Berkely, California: Adobe Press, 2013.
2. Lesa Snider, "Photoshop CS6: The Missing Manual", 2nd Edition, O'Reilly Media Publisher, 2012

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_ar05/preview
2. <https://www.coursera.org/specializations/user-interface-design>

WEB RESOURCES:

1. <https://www.usability.gov/what-and-why/user-interface-design.html>
2. <https://www.coursera.org/in/articles/what-is-a-user-interface-ui-designer-guide>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA101017	CYBER SECURITY	3	-	-	-	3
Pre-Requisite	25CA101012-Computer Networks					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Cybercrime, Cyber offenses, Phishing, Identity theft, Cybercrime in mobile and wireless devices, Organizational measures for handling mobile devices, Security implications on using mobile devices, Tools and methods used in cybercrime, Forensics of computer and organizational implications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze the methods of cybercrime, information security, cyber criminals.
- CO2.** Illustrate the Cyber offenses, Categories of cybercrime and how criminals plan the attacks.
- CO3.** Investigate tools used for cybercrime to protect computational assets
- CO4.** Illustrate the concepts of Cyber forensics, Digital Forensics Science, Digital Evidence, Collecting Electronic Evidence, Network Forensics.
- CO5.** Study the IPR issues, web threats for organizations, security and privacy implications, social computing and the associated challenges for organizations.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	3	3	2	-	3
Course Correlation Mapping	3	3	3	3	3	-	-	3	3	2	-	3

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module 1:	CYBERCRIME	(10 Periods)
Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Global perspective on cybercrimes		
Module 2:	CYBEROFFENSES AND ATTACKS	(09 Periods)
Cyber offenses: Categories of cybercrime, How criminals plan the attacks, Social engineering, Cyber stalking, Cyber cafe and cybercrimes, Botnets, Attack vector Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft)		
Module 3	TOOLS AND METHODS USED IN CYBERCRIME	(09 Periods)
Proxy servers and anonymizers, Password cracking, Key loggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks		
Module 4	COMPUTER FORENSICS	(09 Periods)
Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Digital Forensics Life Cycle - The Digital Forensics Process, The Phases in Computer Forensics/Digital Forensics, Precautions to be Taken when Collecting Electronic Evidence, Network Forensics.		
Module 5	ORGANIZATIONAL IMPLICATIONS	(08 Periods)
Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social computing and the associated challenges for organizations, Forensics best practices for organizations.		

Total Periods: 45**EXPERIENTIAL LEARNING:**

1. Steps to attack a victim computer by using "ProRat" trojan tool
2. Perform the packet sniffing mechanism by download the "wire shark" tool and extract the packets
3. Perform the task of creating mail messages by using fake mail id by using the "fake mailer" website (<https://emkei.cz>)

RESOURCES:

TEXT BOOKS:

1. Nina Godbole, SunitBelapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.

REFERENCE BOOKS:

1. Nilakshi Jain, Ramesh Menon, Cyber Security and Cyber Laws, Wiley, 2020.
2. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, CybersecurityEssentials, 1st Edition, Sybex, 2018.
3. ErdalOzkaya, Cybersecurity: The Beginner's Guide, 1st Edition, Packt Publishing,2019.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
3. <https://www.coursera.org/learn-foundations-of-cybersecurity>

WEB RESOURCES:

1. Yuri Diogenes, ErdalOzkaya, Cybersecurity: Attack and Defense Strategies, 2nd Edition, Packt Publishing, 2019.
2. <http://www.ignou.ac.in/upload/Announcement/programmedetails.pdf>
3. Alessandro Parisi, Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing, 2019.

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM101008	BLOCK CHAIN TECHNOLOGIES	3	-	-	-	3

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction to Blockchain Technologies and its decentralization concepts, Digital Currencies, Smart Contracts, Ethereum, Hyperledger, Alternative Blockchains, Current Challenges and Scope of Research.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze the concepts of distributed systems, decentralization and blockchains in the Blockchain ecosystem.
- CO2.** Devise suitable Blockchain platforms for scalable applications.
- CO3.** Assess the challenges, trending technologies for understanding the research scope in Blockchain technologies.
- CO4.** Pertain to ethical and legal usage of Blockchain applications.
- CO5.** Formulate secured and sustainable Blockchains for healthy and safe society.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	3	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	2	-	3	-	-	-	-	-	-	-	3
Course Correlation Mapping	3	2	-	3	-	-	-	3	-	-	-	3

Correlation Level: **3-High;** **2-Medium;** **1-Low**

Course Content:

Module 1:	INTRODCUTION TO BLOCKCHAIN	(09 Periods)
History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, Signature-Hash chain to Block chain-Basic consensus mechanisms.		
Module 2:	BLOCK CHAIN PROTOCOLS	(09 Periods)
Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for Permissioned Block chains.		
Module 3:	Chain code Design and Implementation	(09 Periods)
Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.		
Module 4:	Block chain in Financial Software and Systems	(09 Periods)
Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance- Block chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting.		
Module 5:	Block chain Cryptography and Block chain for Government	(09 Periods)
Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain.		

Total Periods: 45**EXPERIENTIAL LEARNING:****Part 1** Understanding Block using (<https://tools.superdatascience.com/Blockchain/block>)

Understanding Block chain using

1.1 (<https://tools.superdatascience.com/Blockchain/Blockchain>)

Understanding Distributed Blockchain using

1.2 <https://tools.superdatascience.com/Blockchain/distributed>1.3 Understanding Tokens using <https://tools.superdatascience.com/Blockchain/tokens>

Understanding coin based transaction using

1.4 (<https://tools.superdatascience.com/Blockchain/tokens>)**Part 2** Using JavaScript Perform following (Source: YouTube Channel: Simply Explain Savjee)

- 2.1 Creating a Blockchain
- 2.2 Implementing Proof-of-Work
- 2.3 Miner rewards & transactions
- 2.4 Signing transactions
- 2.5 Angular frontend

Part 3 Introduction to Geth:

- 3.1 Introduction to geth
- 3.2 Creation of private Blockchain
- 3.2 Creation of Account
- 3.4 Mining using geth

Part 4 Introduction to Remix Ethereum:

- 4.1 Introduction to Metamask
- 4.2 Creation of account using Metamask
- 4.3 Introduction to Remix Ethereum
 - Introduction to solidity program structure, compilation and deployment
- 4.4 environment.
- 4.5 Write a smart contract in solidity to store and get "Hello World".
 - Write a smart contract in solidity to create a function setter and getter to set and
- 4.6 get a value.
- 4.7 Write a smart contract in solidity to print the array of integers and its length.
- 4.8 Write a solidity code to print array elements and its position.

Part 5 Introduction to Ethereum-Ganache:

- 5.1 Creation of account using Ganache.
- 5.2 Introduction to solidity smart contract compilation and deployment environment.
- 5.3 Write a smart contract in solidity to store and get "Hello World".

RESOURCES:

TEXT BOOKS:

1. C Mark Gates, "Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block chain with Hyper ledger: Building

decentralized applications with Hyperledger Fabric and Composer”, 2018.

3. A. Bahga, Vijay Madisetti, “Block chain Applications: A Hands-On Approach”, Arshdeep Bahga, Vijay Madisetti publishers 2017.

REFERENCE BOOKS:

1. Roger Wattenhofer, “The Science of the Blockchain” CreateSpace Independent Publishing, 2016.
2. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.

VIDEO LECTURES:

1. <https://in.coursera.org/learn/introduction-blockchain-technologies>
2. <https://nptel.ac.in/courses/106105184/>
3. NPTEL & MOOC courses titled blockchain technology

WEB RESOURCES:

1. <https://www.udemy.com/topic/blockchain/>
2. <https://in.coursera.org/courses?query=blockchain>
3. <https://www.simplilearn.com/blockchain-certification-training-course>

PROGRAM ELECTIVE														
Course Code	Course Title									L	T	P	S	C
25MM101009	CRYPTOGRAPHY									3	-	-	-	3
Pre-Requisite	-													
Anti-Requisite	-													
Co-Requisite	-													

COURSE DESCRIPTION: Cryptographic protocols; Encryption techniques for confidentiality; Mathematics of symmetric and asymmetric algorithms; Hash functions for integrity; digital signature schemes.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

- CO1.** Apply cryptographic protocols to ensure authentication in network systems.
- CO2.** Analyze the efficiency of cryptographic techniques based on security attacks.
- CO3.** Choose suitable key management scheme for efficient key exchange between the authenticated parties.
- CO4.** Implement algorithms using information, complexity, and number theories for ensuring the security requirements-CIA.
- CO5.** Evaluate Message Digest and Secure Hash Algorithms using hash functions for data Integrity.
- CO6.** Analyze well known digital signature algorithms for securing communication.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	2	-		-	-	-	-	-	-	3
CO2	1	3	1	-	1	-	-	-	-	-	-	3
CO3	3	3	1	-		-	-	-	-	-	-	3
CO4	2	2	3	1	1	-	-	-	-	-	-	1
CO5	2	2	3	1	1	-	-	-	-	-	-	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3
CO6	3	3	2	1	1	-	-	-	-	-	-	3
Course Correlation Mapping	3	3	2	1	1	-	-	-	-	-	-	3

Correlation Level: **3 - High**

2 - Medium

1 - Low

Course Content:

Module 1:	FOUNDATIONS OF CRYPTOGRAPHY	(09 Periods)
FOUNDATIONS OF CRYPTOGRAPHY: Steganography, Substitution ciphers and Transposition Ciphers, One Time Pads.		
Module 2:	CRYPTOGRAPHIC TECHNIQUES	(09 Periods)
CRYPTOGRAPHIC TECHNIQUES: Key Management, Electronic Codebook Mode, Block Replay, Cipher Block Chaining Mode, Stream Ciphers, Cipher-Feedback Mode, Synchronous Stream Ciphers, Output-Feedback Mode, Counter Mode, Choosing a Cipher Mode, Interleaving, Block Ciphers versus Stream Ciphers.		
Module 3	MATHEMATICS FOR CRYPTOGRAPHIC ALGORITHMS	(09 Periods)
MATHEMATICS FOR CRYPTOGRAPHIC ALGORITHMS: Mathematical background: Information Theory, Complexity Theory, Number Theory, Factoring, Prime Number Generation, Discrete Logarithms in a Finite Field, Data Encryption Standard (DES), DES decryption, Security of DES, Public Key Algorithms: RSA.		
Module 4	AUTHENTICATION and HASH FUNCTION	(09 Periods)
Authentication requirements - Authentication functions – Message Authentication Codes HASH FUNCTIONS: Hash Functions- Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure Hash Algorithm - HMAC		
Module 5	DIGITAL SIGNATURES and SYSTEM LEVEL SECURITY	(09 Periods)
Digital Signature Algorithm (DSA), Security of DSA, Discrete Logarithm Signature Schemes, Diffie-Hellman Key exchange. Intrusion detection - password management - Viruses and related Threats - Virus Counter measures - Firewall Design Principles – Trusted Systems.		

Total Periods: 45**EXPERENTIAL LEARNING:**

1. Implement the following Poly-alphabetic Ciphers and analyze its attack resiliency.
 - a. Hill cipher
 - b. Vigenere
2. Implement the following block cipher modes and analyze the role of Initialization Vector(IV)
 - a. counter mode
 - b. Output Feedback mode
3. Implement a stream cipher algorithm with running key generator.

TEXT BOOKS:

1. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C",
John Wiley and Sons, New York, 2009.

REFERENCE BOOKS:

1. Alfred J Menezes, Paul C van Oorschot and Scott A. Vanstone, "Handbook of Applied Cryptography", CRC Press, New York, 2010.
2. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2004

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs03/preview
2. <https://www.coursera.org/specializations/applied-crypto>
3. <https://www.udemy.com/course/du-cryptography/>

WEB RESOURCES:

1. <https://www.udacity.com/course/applied-cryptography--cs387>
2. <https://www.classcentral.com/course/udacity-applied-cryptography-326>
3. <https://www.classcentral.com/course/udacity-applied-cryptography-326>
4. https://wiki.openssl.org/index.php/Command_Line_Utils
5. <https://www.sslshopper.com/article-most-common-openssl-commands.html>

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MM101010	MULTIMEDIA SYSTEMS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Multimedia and its applications, Global structure of Multimedia, Medium, Multimedia system and properties, Characteristics of a Multimedia system, Overview sound system, producing digital audio, Music and speech, Speech Generation, Speech Analysis, Uses of images and Graphics, Digital Video, Video signal representation, Need for Data Compression, Compression Basics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Apply the knowledge of the basic fundamentals components of Multimedia.
- CO2.** To get familiar with Multimedia file formats and standards.
- CO3.** Understanding the video formats and types of animation.
- CO4.** Understand the basics of text, Image and Video compression.
- CO5.** Understand the various compression algorithms for multimedia content.
- CO6.** Work independently or in teams to solve problems with effective Communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	-	-	-	3	3	2	3
CO2	3	3	3	3	3	-	-	-	3	3	2	3
CO3	1	3	3	3	3	-	-	-	-	-	-	3
CO4	3	2	2	1	1	-	-	-	-	2	2	2
CO5	3	2	2	1	2	-	-	-	-	2	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	2	2	-	-	-	3	2	2	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: MULTIMEDIA AND DIGITAL REPRESENTATION (08 Periods)

Multimedia Presentation and Production – Characteristics of a Multimedia Presentation – Uses of Multimedia – Promotion of Multimedia based content – Steps for creating a Multimedia Presentation.

Analog Representation – Waves – Digital Representation – Analog to Digital conversion – Digital to Analog conversion – Quantization Error – Fourier Representation – Pulse Modulation.

Module 2: TEXT AND IMAGE (08 Periods)

Types of text – Unicode Standard – Font – Insertion of Text – File format

Image types – Color Models – Basic steps for Image processing – Scanner – Digital camera – Interface standards – Color Management System (CMS) – Device Independent color models – Gamma and Gamma Correction – Image Processing Software – File formats – Image Output on Monitor – Image output on printer

Module 3: AUDIO (12 Periods)

Acoustics – Nature of Sound Waves – Fundamental Characteristics of Sound – Musical Note and Pitch – Psycho Acoustics – Element of Audio Systems – Microphone – Amplifier – Loudspeaker – Audio Mixer – Digital Audio – Synthesizers – Musical Instrument Digital Interface (MIDI) – MIDI messages – MIDI Connections – Basics of Staff Notation – Sound Card- Audio Recording Devices – Audio File Formats and CODECs – Software Audio player – Audio Recording System 99 | P a g e – Digital Audio Broadcasting – Audio and Multimedia – Voice Recognition and Response – Audio processing software.

Module 4: VIDEO (07 Periods)

Analog Video camera – Transmission of Video signals – Video-Signal formats – Television Broadcasting standards – Digital Video – Digital Video Standards – PC Video – Video Recording Formats and Systems – Video File formats and CODECs – Video Editing – Video Editing Software

Module 5: ANIMATION AND MULTIMEDIA APPLICATION DEVELOPMENT (10 Periods)

Uses of Animation – Key frames and Tweening – Types of Animation – Computer Assisted Animation – Creating Movement – Principles of Animation – Some Techniques of Animation – Animation of the web – 3D Animation – Cameras – Special Effects – Creating Animation – Rendering Algorithms – Animation Software – File formats.

Software Life Cycle Overview – ADDIE Model – Conceptualization – Content Collection and Processing – Story – Flowline – Script – Storyboard – Implementation – Authoring Metaphors – Testing and Feedback – Final Delivery – Report Writing/Documentation – Case Study – Computer Games.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Create a simple painting program using Flash or equivalent.
2. Create a simple animated banner using Flash or equivalent.
3. Design an object dragging program.
4. Prepare a photo album using Flash or equivalent.
5. Create animated buttons which is used for web design using Adobe Photoshop or equivalent.
6. Design image mapping using Flash or equivalent.
7. Create image morphing using adobe Photoshop or equivalent.
8. Make animations using macromedia Flash or equivalent.
9. Create animated Gifs for use as banners, titles and buttons.
10. Create short film in Flash or equivalent using any theme.
11. To perform animation using any animation software.
12. To perform image editing using basic tool, masking effect and rendering effects using Photoshop or equivalent.

RESOURCES

TEXT BOOKS:

1. Principles of Multimedia, Ranjan Parekh, Tata McGraw –Hill Publication Company Limited, New Delhi, Fifth reprint, 2008
2. Multimedia: Making It Work, Tay Vaughan, 7th Edition, Tata Mc-Graw Hill., 2008.
3. John F. Koegel Buford, Multimedia Systems, Pearson Education Asia.

REFERENCE BOOKS:

1. Rajneesh Aggarwal & B. B Tiwari, " Multimedia Systems", Excel Publication, New Delhi, 2007.
2. Li & Drew, " Fundamentals of Multimedia" , Pearson Education, 2009.
3. Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007
4. Anirban Mukhopadhyay and Arup Chattopadhyay, "Introduction to Computer Graphics and Multimedia", Second Edition, Vikas Publishing House.

VIDEO LECTURES:

1. <https://www.coursera.org/lecture/internet-of-things-multimedia/multimedia-technologies-YQGDv>
2. <https://www.udemy.com/course/graphic-designing-course-for-special-needs-people/>

WEB RESOURCES:

1. <https://nptel.ac.in/courses/117105083>
2. https://archive.nptel.ac.in/content/storage2/courses/117105083/pdf/ssg_m1l1.pdf

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101002	SINGLE VARIABLE CALCULUS	3	-	-	-	3
Pre-Requisite:	-					
Anti-Requisite:	-					
Co-Requisite:	-					

COURSE DESCRIPTION: This course provides fundamental knowledge of calculus. Further, this course focuses on differentiability, Sequences and Series of functions, Tests for convergence and Divergence, Definite and Indefinite Integrals.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Evaluate the Sequences and Series of numbers, and Identify tests for convergence and divergence.
- CO2.** Demonstrate knowledge on the concepts of limits, continuity, differentiability and their applications.
- CO3.** Apply knowledge in single variable calculus for evaluating the consequences of Rolle's and intermediate value theorems for continuous functions.
- CO4.** Apply the techniques in calculus for evaluating Definite and Indefinite Integrals.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	2	1	-	-	-	-
CO2	3	3	3	3	2	-	-	-	-
CO3	3	3	3	3	2	-	-	-	-
CO4	3	3	3	3	2	-	-	-	-
Course Correlation Mapping	3	3	3	3	2	-	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: SEQUENCES: CONVERGENCE AND DIVERGENCE (09 Periods)

Limits of sequences of real numbers, operations on convergent sequences, The Squeeze or Sandwich Rule, Subsequences, Bounded Monotone Sequences, Bounded Monotone convergence theorem, The Bolzano-Weierstrass Theorem, Cauchy Sequences.

Module 2: TEST FOR CONVERGENCE AND DIVERGENCE SERIES (09 Periods)

Basic Divergence tests, Direct Comparison test, Limit Comparison Test, Cauchy's Condensation test, Alternating series test, Dirichlet's test.

Module 3: LIMITS AND CONTINUITY (09 Periods)

Limit of a function, Limit point of a set, properties of Limits of functions, Infinite limits, Limits at Infinity, Basic Properties of continuous functions, Uniform Continuity, Piece wise continuous functions.

Module 4: DIFFERENTIABILITY AND THEIR APPLICATIONS (09 Periods)

Basic Properties of differentiable functions, Local Extreme theorem, Rolle's theorem and the Mean value theorems, L- Hospital's Rule: Another form, Second -Derivative test and concavity.

Module 5: DEFINITE AND INDEFINITE INTEGRALS (09 Periods)

Definition and Basic Properties of Riemann Integrals, Darboux Integral, Basic Properties of Definite Integrals, The Fundamental theorems of Calculus, The mean value theorem for Integrals, Average Value of a function, The Logarithmic and Exponential functions.

Total Periods: 45

EXPERIENTIAL LEARNING

1. You want to sell a certain number n of items in order to maximize your profit. Market research tells you that if you set the price at \$1.50, you will be able to sell 5000 items, and for every 10 cents you lower the price below \$1.50 you will be able to sell another 1000 items. Suppose that your fixed costs ("start-up costs") total \$2000, and the per item cost of production ("marginal cost") is \$0.50. Find the price to set per item and the number of items sold in order to maximize profit, and also determine the maximum profit you can get.
2. Describe all functions that have derivative $5x - 3$.
3. An object moves so that its velocity at time t is $v(t) = -9.8t + 20$ m/s. Describe the motion of the object between $t = 0$ and $t = 5$, find the total distance traveled by the object during that time, and find the net distance traveled.

RESOURCES

TEXT BOOKS:

1. S. Ponnusamy, Foundations of Mathematical Analysis, Birkhauser Boston Inc, Twelve edition, 2010
2. M. Thamban Nair, Calculus of One Variable, Springer, Second Edition 2021.

REFERENCE BOOKS:

1. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand & Company, Revised Edition, 2018.
2. Shanti Narayan and P.K. Mittal, Integral Calculus, S. Chand & Company, Revised Edition, 2014.
3. George, B., Thomas, Jr., Ross L. Finney, Late Jan. D. Weir Giordano, Thomas Calculus, Pearson, 10th Edition, 2005.
4. Frank Ayres and Elliott Mendelson, Calculus, McGraw-Hill, 6th Edition, 2013.
5. Robert T Smith and Roland Minton, Calculus: Early Transcendental Functions, 4th Edition, 2012.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/101/104/109104124/>
2. https://ocw.mit.edu/courses/18-01-single-variable-calculus-fall-2006/video_galleries/video-lectures

WEB RESOURCES:

1. <https://www.khanacademy.org/math/differential-calculus>
2. <http://tutorial.math.lamar.edu/Classes/CalcI/CalcI.aspx>
3. <http://www.calculus-help.com/tutorials>

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101011	ORDINARY DIFFERENTIAL EQUATIONS	3	-	-	-	3
Pre-Requisite	25MM101002-SINGLE VARIABLE CALCULUS					
Anti-Requisite	-----					
Co-Requisite	-----					

COURSE DESCRIPTION: This course provides fundamental knowledge of differential equations. Further, this course focuses on Linear Differential Equations, Differential Equations of first order and Higher order linear differential equations

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Solve linear differential equations and convert non-exact homogeneous equations to exact differential equations by using integrating factors.
- CO2.** Demonstrate the knowledge on methods of finding solutions of differential equations of the first order but not of the first degree
- CO3.** Solve higher-order linear differential equations, both homogeneous and non homogeneous, with constant coefficients.
- CO4.** Understand the concept and apply appropriate methods for solving differential equations.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	--	3	1	--	--	--	--
CO2	3	3	--	3	1	--	--	--	--
CO3	3	2	-	3	1		--	--	--
CO4	3	2	-	3	1		--		--
Course Correlation Mapping	3	3	-	3	1		--		--

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1 Differential Equations of first order and first degree (09 Periods)

Formation of Differential equations, Exact differential equations, Integrating factors, Linear Differential Equations; Bernoullis equation, Orthogonal Trajectories.

Module 2 Differential Equations of first order but not of the first degree (09 Periods)

Equations solvable for p ; Equations solvable for y ; Equations solvable for x ; Clairaut's Equation.

Module 3 Higher order linear differential equations-I (09 Periods)

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators. General Solution of $f(D)y=0$. P.I. of $f(D)y = Q$ when $Q = e^{ax}$, $\sin bx$ or $\cos bx$.

Higher order linear differential equations-II (09 Periods)

Module 4

Solution of the non-homogeneous linear differential equations with constant coefficients. P.I. of $f(D)y = Q$ when $Q = x^k$, $e^{ax} V$, where V is a function of x . P.I. of $f(D)y = Q$ when $Q = XV$, where V is a function of x .

Module 5 Higher order linear differential equations-III (09 Periods)

Method of variation of parameters; Linear differential Equations with non-constant coefficients; The Cauchy-Euler Equation, Legendre's linear equations

Total Periods: 45

EXPERIENTIAL LEARNING

1. An electric circuit consists of inductance 0.25 *henries*, a resistance of 250 *ohms* and a condenser of capacitance 2×10^{-4} *farads*. Estimate the charge q and the current i at time t , given the initial conditions $q = 0.002$ *coulombs*, $i = 0$ when $t = 0$.
2. A simple pendulum of length l is oscillating through a small angle θ in a medium in which the resistance is proportional to the velocity. Establish the differential equation of its motion. Discuss the motion and find the period of oscillation.

3. Find how many seconds a clock would loss per day if the length of its pendulum were increased in the ratio 900:90.

RESOURCES

TEXT BOOKS:

1. Zafar Ahsan , Differential Equations and Their Applications, Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition, 2004.
2. M.D, Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company, New Delhi, 20th Edition, 2020.

REFERENCE BOOKS:

1. S Narayanan and T K Manicavachogam Pillay, Differential Equations: S V Publishers Private Ltd., 1981.
2. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=NBcGLLU90fM&list=PLbMVogVj5nJSGlf9sluucwobyr_zz6gID
2. https://www.youtube.com/watch?v=stxyteSFH08&list=PLR3C3NSCyhZQ7ZjFjTnrFNXOPv2_622x

WEB RESOURCES

1. <http://www.sosmath.com/diffeq/diffeq.html>
2. http://www.analyzemath.com/calculus/Differential_Equations/applications.html

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101012	MULTIVARIABLE CALCULUS	3	-	-	-	3
Pre-Requisite	25MM101002-SINGLE VARIABLE CALCULUS					
Anti-Requisite	Nil					
Co-Requisite	Nil					

COURSE DESCRIPTION: This course covers a range of subjects pertaining to multivariable calculus. Specifically, this encompasses subjects such as the differentiation and integration of multivariable functions, along with their practical uses. The course encompasses the study of vector functions in calculus, along with their applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO5.** Determine the maximum and minimum of functions of two or three variables.
- CO6.** Evaluate multiple integrals in Cartesian, Polar and Spherical coordinates.
- CO7.** Demonstrate gradient, directional derivative, divergence, curl of a vector field.
- CO8.** Evaluate the line, surface and volume integrals and understand the relation between line, surface and volume integrals using Green's, Gauss, Stoke's theorems.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	-	2	1	-	-	-	-
CO2	2	3	-	3	1	-	-	-	-
CO3	3	2	-	3	1	-	-	-	-
CO4	3	2	-	3	1	-	-	-	-
Course Correlation Mapping	3	3	-	3	1	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: Multivariable Calculus (Differentiation) (11 Periods)

Introduction to function of several variables, Jacobian and its properties, Functional dependence, Maxima and minima of functions of two variables, Lagrange's multiplier method.

Module 2: Multivariable Calculus (Integration-1) (09 Periods)

Evaluation of Double integrals (Cartesian and Polar coordinates), Change of order of integration (Cartesian form only), Change of variables: Double integration from Cartesian to Polar coordinates.

Module 3: Multivariable Calculus (Integration-2) (07 Periods)

Evaluation of triple integrals, Triple integration from Cartesian to Spherical polar coordinates, cylindrical coordinates.

Module 4: Vector Calculus (Vector Differentiation) (07 Periods)

Scalar and Vector fields: Gradient of a scalar field, Directional derivative, Divergence of a vector field, Solenoidal vector, Curl of a vector field, Irrotational vector, Laplacian operator.

Module 5: Vector Calculus (Vector Integration) (11 Periods)

Line Integral, Surface Integral and Volume integrals, Green's, Stoke's and Gauss divergence theorems, Verification and evaluation of vector integrals using them.

Total Periods: 45

EXPERIENTIAL LEARNING

1. American Airlines requires that the total outside dimensions (length + width + height) of a checked bag not exceed 62 inches. Suppose you want to check a bag whose height is equal to its width. What is the largest volume bag of this shape that you can check on an American Airlines flight?
2. An insulated rod of length l has its ends A and B maintained at $0^\circ C$ and $100^\circ C$ respectively until steady state conditions prevail. If B is suddenly reduced to $0^\circ C$ and maintained at $0^\circ C$, establish an equation to find the temperature at a distance x from A at time t under the above conditions.
3. Apply the Gamma function; obtain the mass of an octant of the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ with the density at any point being $\rho = kxyz$.
4. A person weighs 150lb walking exactly one revolution up a circular, spiral staircase of radius x ft. if the person rises 10ft then find the work done by the person. Consider different radii and find the work done by the person in each case.

RESOURCES

TEXT BOOKS:

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th edition, 2011.
3. R. Gupta, *Vector Calculus*, Laxmi Publications, New edition, 2016.

REFERENCE BOOKS:

1. Dennis G. Zill and Warren S. Wright, *Advanced Engineering Mathematics*, Jones and Bartlett, 6th edition, 2011.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/111107108> (MVC)

WEB RESOURCES:

1. http://www.efunda.com/math/math_home/math.cfm
2. <http://www.sosmath.com/>
3. <http://www.mathworld.wolfram.com/>

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101014	INTEGRAL TRANSFORMS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite						
Co-Requisite	-					

COURSE DESCRIPTION: This course focus on basic areas of theory and more advanced Mathematics topics which provide students with the relevant mathematical tools required for solving differential equation in Engineering and higher-level research problem. This course includes Fourier series, Fourier Transforms, Laplace transforms, Inverse Laplace transform.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Have understanding regarding different kind of integral transforms
- CO2** Demonstrate Fourier series to study the behavior of periodic functions and their applications and Fourier transform to connect the frequency and time domain systems and will be able to solve the problem based on it.
- CO3** Have deep understanding of Laplace Transformation and its real life application.
- CO4** Solve initial value problem and boundary value problem using Laplace Transform.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3		2	2	-	-	-	-
CO2	3	3		3	2	-	-	-	-
CO3	3	3		3	2	-	-	-	-
CO4	3	3		2	2	-	-	-	-
Course Correlation Mapping	3	3		3	2	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: Fourier Series: **(09 Periods)**

Periodic function, Fourier series formula for periodic functions, Fourier series for Odd and Even functions, Fourier series for Discontinuous function, Half range Fourier series, Half range Cosine series, Half range Sine series.

Module 2: Fourier Integral: **(09 Periods)**

Fourier Integral of a function formula and examples, Fourier Cosine integral, Fourier Sine integral, Complex Fourier integral, Evaluation of integration using Fourier integral.

Module 3 FOURIER TRANSFORMS **(09 Periods)**

Fourier transform, sine and cosine transform, properties, convolution theorem, Application of Fourier sine and cosine transform on differential equation.

Module 4 LAPLACE TRANSFORMS **(09 Periods)**

Definition of Laplace transforms, Existence conditions, Laplace transforms of standard functions, Properties of Laplace transforms, Laplace transforms of derivatives, Laplace transforms of integrals, Multiplication by t^n , Division by t , Laplace transforms of periodic functions, Laplace transforms of unit step function and unit impulse function.

Module 5 INVERSE LAPLACE TRANSFORMS **(09 Periods)**

Inverse Laplace transforms by different methods, Convolution theorem, Inverse Laplace transforms by convolution theorem, Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients

Total Periods: 45

EXPERIMENTAL LEARNING

1. A 100-gm mass is suspended from a spring with constant 50 N/m. It is set into motion by raising it 10 cm above its equilibrium position and giving it a velocity of 1 m/s downward. During the subsequent motion a damping force acts on the mass and the magnitude of this force is twice the velocity of the mass. If an impulse force of magnitude 2 N is applied vertically upward to the mass at $t = 3$ s, find the position of the mass for all time.
2. Develop a differential equation from an LRC circuit connected in series using Kirchoff Voltage law and then solve using Laplace transform. Analyze the result by using any technology.

RESOURCES

TEXT BOOKS:

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th edition, 2011.

REFERENCE BOOKS:

1. W. E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, 9/e, Wiley India, 2009.
2. Dr. T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M. V. S. S. N. Prasad, *Mathematics – II*, S. Chand publications.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/111106111>
2. https://www.youtube.com/watch?v=n9XP6pljtW8&list=PLbRMhDVUMngfsMNuiGSQQuNwPevZukOY_

WEB RESOURCES:

1. <https://www-users.cse.umn.edu/~mille003/fouriertransform.pdf>
2. <https://nitkkr.ac.in/docs/12-%20Laplace%20Transforms%20and%20their%20Applications.pdf>

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101015	NUMBER THEORY AND ALGEBRA	3	-	-	-	3
Pre-Requisite	----					
Anti-Requisite	----					
Co-Requisite	----					

COURSE DESCRIPTION: The course contains various topics related to Number theory and its applications, Rings, ideals, polynomial rings and finite fields. In particular this contains the topics related to arithmetic functions and congruences which are helpful to the students in cryptography and Network security related topics in computer sciences.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Demonstrate the knowledge on the concepts of Basic number theory and their applications in computer sciences.
- CO2** Apply knowledge congruences in the computer programming involved in network security issues
- CO3** Evaluating and analyze the results and concepts in cryptography through the knowledge of Arithmetic functions and their properties.
- CO4** Apply the techniques of abstract algebra in evaluation of the problems in network security.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	2	1	-	-	-	-
CO2	3	3	-	2	2	-	-	-	-
CO3	3	3	-	2	1	-	-	-	-
CO4	3	3	-	2	1	-	-	-	-
Course Correlation Mapping	3	3	-	2	2	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: BASIC NUMBER THEORY (09 Periods)

Divisibility of integers, GCD and LCM and their properties, Prime numbers and their properties, Euclidean algorithm.

Module 2: CONGRUENCES (09 Periods)

Congruences and their elementary properties, Complete and reduced residue systems, Linear congruences, Chinese Remainder theorem, Fermat's theorem, Wilson's theorem, Applications.

Module 3: ARITHMETIC FUNCTIONS (09 Periods)

Arithmetic functions, multiplicative and totally multiplicative functions, Euler's totient function, Divisor function, Sum of divisors (The function σ), Möbius function ($\mu(n)$), Elementary properties of arithmetic functions.

Module 4: Rings and Ideals (09 Periods)

Rings, examples of Rings. Basic properties, Integral domain, Field and Ideals, Ring homomorphism and isomorphism.

Module 5: Polynomial Rings and Finite fields (09 Periods)

Polynomial ring in one variable, Irreducible polynomials over finite fields, Factorization polynomial over finite fields, properties of finite fields, Primitive roots.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Exhibit the complete residue system modulo 17 composed entirely of multiples of 3.
2. Analyse the numbers and prove every square number is of the form $5k-1$, $5k$, $5k+1$, where n is some positive integer.

RESOURCES

TEXT BOOKS:

1. Nadiya Gubareni, Introduction to Modern Algebra and its applications, CRC Press, 2019.
2. K.C. Chowdhury, A first course in Number Theory, Asian Books, First edition, 2004.
2. Hiram Paley, Paul M. Weichsel, First course in Abstract Algebra, Holt, Rinehart and Winston, First Edition, 1966.
3. Joseph Silverman, A Friendly introduction to Number Theory, Pearson Publishers, 5th Edition, 2019.
4. Edwin Weiss, First course in Algebra and Number Theory, Academic Press, 1971.

REFERENCE BOOKS:

1. Papantonopoulou, Algebra, Pure and Applied Mathematics, Prentice Hall, 2002.
2. Arkadii slinko, Algebra fir applications, Springer Publications, 2015.
3. Abhijit Das, Computational Number Theory, CRC Press, 2013.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=yHwneN6zJmU>
2. <https://www.youtube.com/watch?v=6DfXcNv6as4>
1. https://www.youtube.com/watch?v=MNj_e-t9tIs&list=PLLtQL9wSL16htZdyMm99giCaam049Od4x
2. <https://www.youtube.com/playlist?list=PLU6SqdYcYsfLyL330UDwLrRvNvWbto7DR>

WEB RESOURCES:

1. https://math.libretexts.org/Courses/Mount_Royal_University/MATH_2150%3A_Higher_Arithmetic/4%3A_Greatest_Common_Divisor_least_common_multiple_and_Euclidean_Algorithm
2. https://ocw.mit.edu/courses/18-781-theory-of-numbers-spring-2012/de23a8d881a615303f6d4fa665669dc9/MIT18_781S12_lec4.pdf
3. <https://crypto.stanford.edu/pbc/notes/numbertheory/mult.html>
4. <https://sites.math.washington.edu/~bviray/teaching/RingHomomorphismsAndIsomorphisms.pdf>
5. <https://www.birs.ca/workshops/2006/06w5021/report06w5021.pdf>

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101019	NUMERICAL ANALYSIS, PROBABILITY AND STATISTICS	3	-	-	-	3
Pre-Requisite	----					
Anti-Requisite	----					
Co-Requisite	----					

COURSE DESCRIPTION: This course provides fundamental knowledge of errors in numerical computation, numerical solutions of equations, interpolation; numerical differentiation and integration, curve fitting, numerical solutions of ordinary differential equations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Acquire knowledge on the concepts of errors and their approximations, errors in a series approximation.
- CO2** Develop skills in analyzing and solving algebraic and transcendental equations by various numerical methods.
- CO3** Use relevant numerical techniques for Interpolation of data and fitting interpolation polynomials.
- CO4** Develop numerical skills for finding the values of derivatives and integrals through various numerical methods and fitting of various types of curves to the experimental data.
- CO5** Apply the Numerical techniques for solving differential equations numerically when analytical methods fail to hold.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: ERRORS IN NUMERICAL COMPUTATIONS (09 Periods)

Errors and their Accuracy, Errors and their Analysis, Absolute, Relative and Percentage Errors, A general error formula, Error in a series approximation.

Module 2: SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: (09 Periods)

The bisection method, The iteration method, The method of false position, Newton Raphson method, Generalized Newton Raphson method.

Module 3: INTERPOLATION (09 Periods)

Errors in polynomial interpolation, Finite Differences, Forward differences, Backward differences, Central Differences, Symbolic relations, Newton's forward and backward difference formulae, Lagrange's interpolation formula. Partial fractions using Lagrange's interpolation formula.

Module 4: NUMERICAL DIFFERENTIATION, INTEGRATION AND CURVE FITTING. (09 Periods)

Numerical differentiation using Newton's forward and backward formulae. Numerical integration using Trapezoidal rule, Simpsons 1/3rd rule and 3/8th rule, Curve fitting by the principle of least squares, fitting of a straight line, parabola and exponential curves.

Module 5: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS (09 Periods)

Numerical solutions of first order Initial value problems using Taylor series method, Euler's method, modified Euler's method, Runge - Kutta method (4thorder only) and Milne's predictor - corrector method.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a Python program to solve algebraic equation by bisection method.
2. Write a Pseudo code on numerical integration using Simpson1/3 method.

RESOURCES

TEXT BOOKS:

1. Numerical Analysis by S.S.Sastry, published by Prentice Hall of India Pvt. Ltd., New Delhi. (Latest Edition) .
2. B.S. Grewal, Higher engineering mathematics, Khanna Publishers, 42th Edition.2012

REFERENCE BOOKS:

1. Finite Differences and Numerical Analysis by H.C Saxena published by S. Chand and Company, Pvt. Ltd., New Delhi.
2. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar, R.K. Jain.
3. Numerical Analysis by G. Sankar Rao published by New Age International Publishers, New – Hyderabad.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/111/107/111107105/>
2. <https://www.youtube.com/watch?v=88ys5ZIolSg&list=PL6E313980EF23CA6E>

WEB RESOURCES:

1. <https://www.numerical-methods.com/>
2. https://blasingeame.enr.tamu.edu/z_zCourse_Archive/P620_14C/P620_14C_zReference/PDF_Txt_Hnbk_Num_Meth.pdf

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101016	GROUP THEORY	3	-	-	-	3
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: This course provides a discussion on the structures and characteristics of groups, subgroups, normal subgroups and cyclic groups.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Demonstrate when a binary algebraic structure forms a group or not.
- CO2** Determine subgroups and determine whether given subsets of a group are subgroups.
- CO3** Identify the criteria for normal subgroups of a group.
- CO4** Identify the applications of fundamental theorem on homomorphism.
- CO5** Determine whether a given group is cyclic, and given a finite cyclic group, find a generator for a subgroup of a given order.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3		3	2	-	-	-	-
CO2	2	3		2	2	-	-	-	-
CO3	3	3	-	2	1	-	-	-	-
CO4	2	3		3	2	-	-	-	-
CO5									
Course Correlation Mapping	3	3	-	3	2	-	-	-	-

Correlation Levels: **3: High; 2: Medium; 1: Low**

COURSE CONTENT

Module 1: GROUPS

(08 Periods)

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group. Composition tables with examples.

Module 2: SUBGROUPS

(10 Periods)

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition – examples-criterion for a complex to be a subgroups. Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

Co-sets and Lagrange's Theorem :-

Cosets Definition – properties of Cosets-Index of a subgroups of a finite groups- Lagrange's Theorem

Module 3: NORMAL SUBGROUPS

(10 Periods)

Definition of normal subgroup – proper and improper normal subgroup-Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group – simple group – quotient group – criteria for the existence of a quotient group.

Module 4: HOMOMORPHISM

(08 Periods)

Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties- kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

Module 5: PERMUTATIONS AND CYCLIC GROUPS

(09 Periods)

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups : Definition of cyclic group – elementary properties – classification of cyclic groups.

Total Periods: 45

EXPERIENTIAL LEARNING

1. If There are 28 Elements of Order 5, Identify the Subgroups of Order 5.
2. Let G be a group of order 5757. Assume that G is not a cyclic group. Then determine the number of elements in G of order 33.
3. Determine the Number of Elements of Order 3 in a Non-Cyclic Group of Order 57

RESOURCES

TEXT BOOKS:

1. V.Venkateswara Rao, N. Krishnamurthy, B.V.S.S. Sarma, S. Anjaneya Sastry, A text book of Mathematics, S.Chand & Company, New Delhi, First Edition, 2014.
2. Seth Warner, Modern Algebra, Dover publications, First Edition, 2003.

REFERENCE BOOKS:

1. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011
2. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
3. Joseph J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/111105112>
2. 3. https://onlinecourses.nptel.ac.in/noc21_ma42/preview

WEB RESOURCES:

1. <https://pages.mtu.edu/~kreher/ABOUTME/syllabus/GTN.pdf>
2. <https://web.osu.cz/~Zusmanovich/teach/books/visual-group-theory.pdf>
3. <https://www.jmilne.org/math/CourseNotes/GT.pdf>

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101017	RINGS AND FIELDS	3	-	-	-	3
Pre-Requisite	----					
Anti-Requisite	----					
Co-Requisite	----					

COURSE DESCRIPTION: Introduction to ring and field theory, including: polynomial rings, matrix rings, ideals and homomorphisms, quotient rings, Chinese remainder theorem, Euclidean domains, principal ideal domains, unique factorization domains, introduction to module theory, basic theory of field extensions, splitting fields and algebraic closures, finite fields, introduction to Galois theory.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Know the fundamental concepts in ring theory, analyze Integral domain, and evaluate the field of fractions of an integral domain.
- CO2** Use Isomorphism theorems of rings and to calculate Prime and Maximal ideals
- CO3** Construct Principal ideal domain (PID), Unique factorization domain (UFD), Euclidean domain (ED)
- CO4** Develop and reconstruct Rings of polynomials and factorization of polynomials over a field.
- CO5** The students study the notion of finite fields which has a useful application in coding theory.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	3	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-
CO4	3	2	3	-	-	-	-	-	-
CO5	3	3	3						
Course Correlation Mapping	3	2	3	-	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: BASICS OF RING THEORY (09 Periods)

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws, Integral Domains, Division Ring and Fields, The characteristic of a ring and its properties.

Module 2: SUBRINGS & IDEALS (10 Periods)

Subrings and its properties, Ideals, Ideal generated by a subset of a ring, Operations on ideals, quotient ring, Ring Homomorphisms, Properties of ring homomorphisms, Prime and maximal ideals.

Module 3: DOMAINS OF RING THEORY (09 Periods)

Principal ideal domain (PID), Unique factorization domain (UFD), Euclidean domain (ED) and its properties.

Module 4: POLYNOMIAL RINGS (09 Periods)

Polynomial rings in one variables and its properties, factorization of polynomials, irreducible polynomials, quotient rings of polynomials.

Module 5: FIELD THEORY (08 Periods)

Basic properties of fields, Field extensions, Finite and simple extensions of fields. Algebraic closure of a field. Splitting fields. Finite fields.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Check whether the set $S = \{0, 1, 2, 3, 4\}$ is a ring or not with respect to operation addition modulo 5 & multiplication modulo 5.
2. Explain the difference between the rings, fields and group.

RESOURCES

TEXT BOOKS:

1. I. N. Herstein, Abstract Algebra, John Wiley and Sons, 3rd Edition, 1996.
2. John B. Fraleigh, A First Course in Abstract Algebra, Pearson publications, 7th edition , 2002.

REFERENCE BOOKS:

1. Hungerford, Algebra, Springer; 8 edition, 2003) .
2. John R. Durbin, Modern Algebra: An Introduction, Wiley, 6 edition , 2008.

VIDEO LECTURES:

1. <https://archive.nptel.ac.in/courses/111/106/111106131>
2. <https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-ma06>
3. https://onlinecourses.nptel.ac.in/noc22_ma76/preview
4. https://onlinecourses.nptel.ac.in/noc20_ma09/preview

Web Resources:

1. http://www.math.niu.edu/~beachy/abstract_algebra/study_guide/contents.html
2. https://en.wikipedia.org/wiki/Ring_theory
3. https://en.wikipedia.org/wiki/Algebraic_structure
4. <https://mathworld.wolfram.com/search/?q=Ring+Theory>

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101013	PARTIAL DIFFERENTIAL EQUATIONS	3	-	-	-	3
Pre-Requisite	25MM101012- MULTIVARIABLE CALCULUS					
Anti-Requisite	-----					
Co-Requisite	-----					

COURSE DESCRIPTION: This course provides fundamental knowledge of Partial differential equations. Further, this course focuses on finding the solution for linear and nonlinear partial differential equations by using various methods.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Classify Partial differential equations, formulation of partial differential equations.
- CO2** Solve Cauchy's problems for first order equations and Lagrange's equations by various methods.
- CO3** Solve Lagrange's equations by various methods.
- CO4** Finding solutions of nonlinear partial differential equations of order on $f(x,y,z,p,q)=0$.
- CO5** Finding solutions of nonlinear partial differential equations of order one by charpit's equations.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	-	1	1	-	-	-	-
CO2	2	3	-	1	1	-	-	-	-
CO3	3	2	-	2	1	-	-	-	-
CO4	3	3	-	2	1	-	-	-	-
CO5	3	3	-	2	1				
Course Correlation Mapping	3	3	-	2	1	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION OF PARTIAL DIFFERENTIAL EQUATIONS **(07 Periods)**

Definition of PDE, Classification of First Order Partial Differential Equation, Formation of PDE's by elimination of arbitrary constants, functions.

Module 2: LINEAR PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER **(10 Periods)**

Cauchy's first order equations, Lagrange's Equations, Method of grouping, Lagrange's method of solving partial differential equations

Module 3: LINEAR PARTIAL DIFFERENTIAL EQUATIONS OF SECOND ORDER **(08 Periods)**

Lagrange's method of solving partial differential equations of second order, Solution to homogeneous and non-homogeneous linear partial differential equations of second and higher order by complimentary function and particular integral method, Method of separation of variables.

Module 4: NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS **(10 Periods)**

Non linear partial differential equations, Charpit's method.

Module 5: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION **(10 Periods)**

One dimensional wave equation, heat equation, Laplace equation

Total Periods: 45

EXPERIENTIAL LEARNING

1. A simple pendulum of length l is oscillating through a small angle θ in a medium in which the resistance is proportional to the velocity. Establish the differential equation of its motion. Discuss the motion and find the period of oscillation.

2. Design an equation for the momentum of inertia of a hollow sphere about a diameter and find the momentum of inertia when its external and internal radii being 5 meters and 4 meters.

RESOURCES

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna publishers, 44th edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th edition, 2011.
3. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company, New Delhi, 20th Edition, 2020.

REFERENCE BOOKS:

1. S Narayanan and T K Manicavachagam Pillay, Differential Equations: S V Publishers Private Ltd., 1981.
2. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.
3. N. P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, Reprint, 2010.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/111103021>
2. <https://nptel.ac.in/courses/111107108>

Web Resources:

1. http://www.efunda.com/math/math_home/math.cfm
2. <http://www.sosmath.com/>
3. <http://www.mathworld.wolfram.com/>

INTERDISCIPLINARY MINOR

Course Code	Course Title	L	T	P	S	C
25MM101018	LINEAR ALGEBRA	3	-	-	-	3
Pre-Requisite	25MM101017-Rings and Fields					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: This course provides a discussion on matrix factorizations, linear systems, Eigenvalues and Eigenvectors, vector spaces, linear transformations, and orthogonality.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Demonstrate the concepts of matrix factorizations and solutions of the linear system.
- CO2** Apply the concepts of vector spaces and subspace on problems of computational systems.
- CO3** Apply the concepts of Basis and Linear transformation on problems of computational systems
- CO4** Use the inner product spaces for the study of orthogonality and to construct orthonormal basis.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3		3	2	-	-	-	-
CO2	2	3		2	2	-	-	-	-
CO3	3	3	-	2	1	-	-	-	-
CO4	2	3		3	2	-	-	-	-
Course Correlation Mapping	3	3	-	3	2	-	-	-	-

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: MATRICES AND LINEAR SYSTEM OF EQUATIONS (10 Periods)

Elementary Row-operations, Elementary Matrices, Echelon form, Rank of a matrix by row-reduction, Solutions of system of linear equations by row reduction, Matrix Factorization, LU factorization, LDU factorization.

Module 2: VECTOR SPACES (09 Periods)

Vector spaces, Sub-spaces, Four fundamental subspaces of a matrix, Span, Linearly independent and dependent.

Module 3 BASIS OF A VECTOR SPACE (10 Periods)

Basis, Basis extension theorem, construction of Basis, dimensions, Finite dimensional vector space.

Module 4 LINEAR TRANSFORMATION (08 Periods)

Linear transformation, Kernel and range of linear transformation, Basic properties, Invertible linear transformation, Rank- Nullity theorem, Matrix of linear transformation.

Module 5 INNER PRODUCT SPACES (08 Periods)

Inner product, Norm, Distance, Inner product space, Orthogonal and orthonormal basis, Gram-Schmidt orthogonalization, Singular Value Decomposition for square matrices.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Let Breakfast consists of orange juice, cereal, and eggs with the following nutritional information:

	OJ	Cereal	Eggs
Protein	0%	10%	20%
Vitamin C	20%	15%	0%
Calories	100	120	100

1. If you must have 30% protein, 30% Vitamin C and 300 calories for your breakfast, How many servings of OJ, Cereal, and Eggs should you have?
2. Solve for the Eigen values and Eigen vectors of 2x2 matrix on paper and larger matrices using MATLAB.
3. Check that the complex numbers $\mathbb{C} = \{x + iy / i^2 = -1, x, y \in \mathbb{R}\}$, satisfy all of the conditions in the definition of vector space over \mathbb{C} . Make sure you state carefully what your rules for vector addition and scalar multiplication.

RESOURCES

TEXT BOOKS:

1. Peter Selinger, Matrix theory and linear algebra, 1st Edition, creative commons license, 2018.
2. Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Linear Algebra, Pearson Education, 5th Edition, 2022.

REFERENCE BOOKS:

1. Kuladeep Singh, Linear Algebra step by step, Oxford University press, 1st edition, 2014.
2. David Poole, *Linear Algebra: A Modern Introduction*, Brooks/Cole, 2nd edition, 2005.
3. Edgar G. Goodaire, Linear Algebra, Cambridge University Press, 1st Edition, 2014.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/111106051>
2. <https://nptel.ac.in/courses/111106135>

Web Resources:

1. <https://catalogimages.wiley.com/images/db/pdf/9781119570271.excerpt.pdf>
2. https://web.northeastern.edu/dummit/docs/linalgprac_5_eigenvalues_and_diagonalization.pdf
3. <https://web.auburn.edu/holmerr/2660/Textbook/vectorspace-print.pdf>
4. <https://textbooks.math.gatech.edu/ila/linear-transformations.html>
5. <https://linear.axler.net/InnerProduct.pdf>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EC101701	AI IN HEALTHCARE	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Artificial Intelligence (AI) in Healthcare; The Present State and Future of AI in Healthcare Specialties; The Role of Major Corporations in AI in Healthcare; Applications of AI in Healthcare.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand the fundamental concepts of AI in Healthcare sector.
- CO2** Analyse the present state and future of AI in Healthcare specialties for different scenarios.
- CO3** Apply design concepts and metrics for AI in Healthcare.
- CO4** Demonstrate basic concepts and terminologies of future applications of Healthcare in AI.
- CO5** Develop AI applications through AI techniques for healthcare

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	2	-	-	-	-	-
CO2	2	3	-	2	-	2	2	-	-
CO3	2	-	2	2	-	-	-	-	-
CO4	2	-	-	-	2	2	-	-	-
CO5	-	-	3	-	-	-	-	-	-
Course Correlation Mapping	2	-	3	2	2	2	2	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN (08 Periods) HEALTHCARE

Introduction to AI in Healthcare, Benefits & Risks, AI in the health sector, AI versus human intelligence, The future of AI in health sector, AI & Neural networks.

**Module 2: THE PRESENT STATE & FUTURE OF AI IN HEALTHCARE (10 Periods)
SPECIALTIES**

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

**Module 3: THE ROLE OF MAJOR CORPORATIONS IN AI IN
HEALTHCARE (08 Periods)**

IBM Watson, The role of Google & Deep mind in AI in Healthcare, Baidu, Facebook & AI in Healthcare, Microsoft & AI in Healthcare.

Module 4: FUTURE OF HEALTHCARE IN AI (10 Periods)

Evidence-based medicine, personalized medicine, Connected medicine, Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Incentivized Wellness, Block chain, Robots, Robot-Assisted Surgery, Exoskeletons, Inpatient Care, Companions, Drones, Smart Places, Smart Homes, Smart Hospitals.

Module 5: APPLICATIONS OF AI IN HEALTHCARE (09 Periods)

Case Study 1: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

Case Study 2: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self-Management.

Case Study 3: Delivering A Scalable and Engaging Digital Therapy.

Case Study 4: Improving Course Outcomes for Junior Doctors through the Novel Use of Augmented and Virtual Reality for Epilepsy.

Case Study 5: Big Data, Big Impact, Big Ethics: Diagnosing Disease Risk from Patient Data.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Analyze how the artificial intelligence is used to predict the disease result and Prognosis Assessment of a patient.
2. How does drug discovery happen and how does AI is helping in drug discovery and Labs.
3. Justify that artificial intelligence provide engineering solutions for early detection and Diagnosis of diseases.
4. Demonstrate the prediction of bladder volume of a patient.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Dr. Parag Mahajan, *Artificial Intelligence in Healthcare*, MedManthra Publications, First Edition 2019.
2. Arjun Panesar, *Machine Learning and AI for Healthcare Big Data for Improved Health*, Apress Publications, 2019.

REFERENCE BOOKS:

1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril*, National Academy of Medicine Publication, First Edition 2019.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=-aHBwTQQyNU>
2. <https://intellipaat.com/blog/artificial-intelligence-in-healthcare/>

WEB RESOURCES:

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/>
2. <https://www.ibm.com/topics/artificial-intelligence-healthcare>
3. <https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CM101701	BANKING AND INSURANCE	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Introduction to Banking; Bank-Customer Relationship; Electronic Payment System and Business Models; Introduction to Risk and Insurance; Insurance Overview.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Demonstrate the importance of Banking and functions of the Reserve Bank of India and its role in the country's sustainable development.
- CO2** Demonstrate the role, relationships, and operations between Banker and Customer.
- CO3** Demonstrate the Online Banking system, various types of Electronic Payments, and Business models.
- CO4** Demonstrate the concept of risk and principles, functions, and, types of Insurance companies.
- CO5** Understand the principles of insurance and its functions.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	2	-	1
CO2	3	-	-	-	-	-	2	-	1
CO3	3	-	-	-	-	-	2	-	1
CO4	3	-	-	-	-	-	2	1	1
CO5	3	-	-	-	-	-	2	1	1
Course Correlation Mapping	3	-	-	-	-	-	2	1	1

Correlation Levels: *3: High; 2: Medium; 1: Low*

COURSE CONTENT

Module 1: INTRODUCTION TO BANKING

(09 Periods)

Meaning - Importance of banking- Functions of banking - Reserve Bank of India: Functions – Role of RBI in sustainable development.

Module 2: BANK-CUSTOMER RELATIONSHIP

(09 Periods)

Debtor-creditor relationship, deposit products or services, payment, and collection of cheques. Accounts – Types of accounts, the procedure for opening and closing an account - Loans and Advances- principles of lending.

Module 3 ELECTRONIC PAYMENT SYSTEM&BUSINESS MODELS

(09 Periods)

Introduction to Online Banking - types of e-payment system, e-cash, NEFT, RTGS, Credit cards, Electronic Wallet and Debit cards. **Business models**- B2B, B2C, C2C, and B2G.

Module 4 INTRODUCTION TO RISK AND INSURANCE

(09 Periods)

Insurance: Definition, Insurance as risk mitigation mechanism, elements of insurance. Concept of risk, risk Vs uncertainty.

Module 5 INSURANCE OVERVIEW

(09 Periods)

Principles of insurance - insurance types - LIC & GIC – insurance functions, IRDA - Insurance Players in India.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Make a PowerPoint presentation on the banking system in India.
2. Submit a report on the working of insurance companies.
3. Prepare a report on the functions of RBI & IRDA in India.
4. Submit a report on electronic banking facilities provided by Indian banks.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. RanganadhaChary, A.V. and Paul, R.R., *Banking and Financial system*, Kalyani Publisher, New Delhi, 3rdedition, 2016.
2. Sharma, R.K., Shashi K. Gupta and Jagwant Singh, *Banking and Insurance*, Kalyani Publishers, New Delhi, 17th edition, 2014

REFERENCES BOOKS:

1. *Indian Institute of Banking & Finance, Digital Banking*, Taxman Publications Pvt.

Ltd., 2016 edition, 2016.

2. Jyotsna Sethi and Nishwan Bhatia, *Elements of Banking and Insurance*, PHI Learning Pvt. Ltd., 2nd edition, 2012.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=a1_p8zhbAfE
2. https://www.youtube.com/watch?v=bxNw9VB5Y_0

WEB RESOURCES:

1. <https://unacademy.com/content/railway-exam/study-material/economics/importance-of-banking-sector-in-the-country/>
2. <https://www.geeksforgeeks.org/ life-insurance-meaning-elements-and-types-of-life-insurance-policies/>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25DS101701	BIOINFORMATICS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course focus on Biological Data Acquisition, Databases, Data Processing, Methods of Analysis, Applications of Bio-informatics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand basic biological data acquisition in bioinformatics.
- CO2** Identify the proper databases for the information search by choosing the biological databases and also submission and retrieval of data from databases.
- CO3** Analyze the results of bioinformatics data using text and sequence-based searching techniques.
- CO4** Analyze the secondary and tertiary structures of proteins by applying different alignment programs
- CO5** Design biological databases by using contextual knowledge on bioinformatics.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-
CO5	3	2	3	3	3	-	-	-	-
Course Correlation Mapping	3	3	3	3	3	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: BIOLOGICAL DATA ACQUISITION (09 Periods)

Biological information, Retrieval methods for DNA sequence, protein sequence and protein structure information

Module 2: DATABASES (09 Periods)

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary and secondary sequence databases, protein sequence and structure databases.

Module 3: DATA PROCESSING**(09 Periods)**

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local and global. Distance metrics. Similarity and homology. Scoring matrices, PAM and BLOSUM

Module 4: METHODS OF ANALYSIS**(09 Periods)**

Dynamic programming algorithms, Needleman-Wunsch and Smith-Waterman. Heuristic Methods of sequence alignment, FASTA and BLAST; Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment, CLUSTAL program, Prediction of Tertiary structure of proteins.

Module 5: APPLICATIONS**(09 Periods)**

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis, Genomics, Proteomics, Genome analysis – Genome annotation, DNA Microarray, computer aided drug design (CADD).

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Calculate the dynamic programming matrix and one or more optimal alignment(s) for the sequences GAATTG and GATTA, scoring +2 for a match, -1 for a mismatch and with a linear gap penalty of $d = 2$.
2. Determine whether the RNA string GGACCACCAAGG should be folded into two substructures.
3. Discuss how to carry out the multiple sequence alignment of the following three sequences: TTTTAAAA, AAAACCCC, CCCCTTTT.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES**TEXT BOOKS:**

1. Lesk, A. K., *Introduction to Bioinformatics*, Oxford University Press, 4th Edition, 2013
2. Dan Gusfield, *Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology*, Cambridge University Press, 1997.

REFERENCE BOOKS:

1. Baldi, P. and Brunak, S., *Bioinformatics: The Machine Learning Approach*, MIT Press, 2nd Edition, 2001.
2. Mount, D.W., *Bioinformatics Sequence and Genome Analysis*, Cold Spring Harbor Laboratory Press, 2nd Edition, 2004.
3. Tindall, J., *Beginning Perl for Bioinformatics: An introduction to Perl for Biologists*, O'Reilly Media, 1st Edition, 2001.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=liNbIw4x50E>
2. <https://www.youtube.com/watch?v=eZfyWdHnzR0>

WEB RESOURCES:

1. <https://www.britannica.com/science/bioinformatics>
2. <https://www.ebi.ac.uk/training/online/courses/bioinformatics-terrified/what-bioinformatics/>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25BS101036	BIOLOGY FOR ENGINEERS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to living organisms, Proteins, Nucleic acids and enzymes, Genetics and Molecular biology, Recombinant DNA technology, Human physiology and applied biology.

COURSE OUTCOMES: After successful completion of the course, students will be able to

- CO1** Identify difference between cells, Cellular components and their functions.
- CO2** Understand Proteins, Nucleic acids structure and function and also Mechanism of enzyme action.
- CO3** Identify Central dogma of Molecular biology and processes of Molecular Biology.
- CO4** Understand Recombinant DNA technology and its importance in creating new Animals and Plants.
- CO5** Understand basics and Mechanism of different Physiological process including nerve function and applications of biological sciences.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-
Course Correlation Mapping	3	2	-	-	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: LIVING ORGANISMS

(09 Periods)

Comparison of biological organisms with manmade systems, Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources, molecular taxonomy

Module 2: PROTEINS, NUCLEIC ACIDS AND ENZYMES

(10 periods)

Biomolecules, structure, function and Classification of proteins, structure, function and Classification of and Nucleic acids, Enzymes, Enzyme nomenclature, Classification of Enzymes and Mechanism of Enzyme action, Industrial applications of enzymes, Fermentation and its industrial applications

Module 3 GENETICS AND MOLECULAR BIOLOGY

(11 Periods)

Mendel's laws, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

Module 4 RECOMBINANT DNA TECHNOLOGY

(08 Periods)

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

Module 5 HUMAN PHYSIOLOGY AND APPLIED BIOLOGY

(07 Periods)

Fundamentals of Human physiology, neurons, synaptic and neuromuscular junctions, Introduction to EEG, DNA fingerprinting, DNA Micro array and Genomics.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Identify the Cell and Cellular organelle spotters and write the functions of spotters identified
2. Prepare a table of Enzymes and their importance.
3. Assignments on Central dogma of Molecular biology
4. Identify different organs in the organ system diagrams.
5. Assignments on photosynthesis.
6. Quiz related to organ system and functions.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Rajiv Singal, Gaurav Agarwal, *Biology for Engineers*, CBS, 2019.
2. S. Sing and T. Allen, *Biology for Engineers*, Vayu Education of India, 2014.

REFERENCE BOOKS:

1. B. Alberts, A. Johnson et al., *The molecular biology of the cell*, Garland Science, 6th edition, 2014.
2. A. T. Johnson, *Biology for Engineers*, CRC press, 2011.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=N0Y386SVGN8>
2. <https://www.youtube.com/watch?v=1Pzk-UqilW4>

3. <https://www.youtube.com/watch?v=208pMhKoQeo>

WEB RESOURCES:

1. Structure and function of Proteins: <https://nptel.ac.in/courses/104102016/16>
2. Enzyme catalysis: <https://nptel.ac.in/courses/103103026/module3/lec35/4.html>
3. Biochips: <https://nptel.ac.in/courses/112104029/3>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25LG101701	BUSINESS COMMUNICATION AND CAREER SKILLS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Nature and Scope of Communication, Corporate Communication, Writing Business Messages & Documents, Careers & Résumés, and Interviews.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO6.** Demonstrate knowledge of professional communication by analyzing and applying the styles and strategies of business communication in Communication Networks, Interpersonal, and Informal communication.
- CO7.** Analyze the limitations of communication by applying and demonstrating corporate and cross-cultural communication strategies effectively in a business context and Crisis Management situations.
- CO8.** Apply appropriate strategies and techniques in writing business messages, business letters, and résumé for effective professional communication and career building.
- CO9.** Demonstrate appropriate communication techniques and answering strategies by analyzing the expectations during presentations and interviews.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	-	-	2	-	3	-	-
CO2	1	2	-	-	2	-	3	1	-
CO3	1	-	-	-	2	-	3	-	-
CO4	1	2	-	-	2	-	3	-	-
Course Correlation Mapping	2	2	-	-	2	-	3	1	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: NATURE AND SCOPE OF COMMUNICATION (09 Periods)

Introduction – Communication Basics – Functions of Communication – Communication Networks – Interpersonal Communication – Informal Communication – Communication Barriers – Roles of a Manager.

Module 2: CORPORATE COMMUNICATION (09 Periods)

Introduction – Corporate Communication – Cross-Cultural Communication; Concept & Styles – Corporate Communication Strategy – Corporate Citizenship – Crisis Communication: Case Study.

Module 3: WRITING BUSINESS MESSAGES & DOCUMENTS (09 Periods)

Introduction – Importance of Written Business Communication – Types of Business Messages – Five Main Stages of Writing Business Messages – Business Letter Writing – Kinds of Business Letters – Common Components of Business Letters – Strategies for Writing the Body of a Letter.

Module 4: CAREERS AND RÉSUMÉS (09 Periods)

Introduction – Career Building – Résumé Formats: Traditional, Electronic and Video Résumé – Sending Résumés – Follow-up Letters – Business Presentations and Speeches: Planning – Structuring – Organizing – Delivery.

Module 5: INTERVIEWS (09 Periods)

Introduction – General Preparation for an Interview – Success in an Interview – Important Non-verbal Aspects – Types of Interviews – Styles of Interviewing – Types of Interviewing –Online Recruitment Process.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. People often get confused in identifying or using English vocabulary on most occasions. Prepare a list of confusing words and find methods to overcome the difficulties in using those words to uplift the career of professionals.
2. Organizations and institutions use modern technology in communicating with their colleagues, clients, and stakeholders. Make a PowerPoint presentation on the modern communication system of any organization and its role in the success of the organization and its career.
3. As a student in the modern technological world, organizing or attending webinars is inevitable. Analyze the pros and cons of video conferencing by organizing webinars and preparing a report.
4. Form a team and act as a team leader. Prepare a performance appraisal report of the team using visual aids to support the presentation.
5. Make a detailed study on social networking and its impact on modern business and Career.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Meenakshi Raman, Prakash Singh, *Business Communication*, Oxford University Press, New Delhi, 2nd edition, 2012.
2. Neera Jain, Sharma Mukherji, *Effective Business Communication*, Tata Mc Graw-Hill

REFERENCE BOOKS:

1. Courtland L. Bovee et al., *Business Communication Today*, Pearson, New Delhi, 2011.
2. Krizan, *Effective Business Communication*, Cengage Learning, New Delhi, 2010.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/110105052>
2. https://edurev.in/courses/14522_Business-Communication-The-Ultimate-Guide

WEB RESOURCES:

1. <http://www.career.vt.edu/interviewing/TelephoneInterviews.html>
2. http://job-search-search.com/interviewing/behavioral_interviews
3. <https://goo.gl/laEHOY> (dealing with complaints)
4. <http://www.adm.uwaterloo.ca/infoecs/CRC/manual/resumes.html>
5. <https://goo.gl/FEMGXS>
6. <http://www.resumania.com/arcindex.html>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CE101701	CIVIL ENGINEERING AND THE SOCIETY	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on introduction to civil engineering, aesthetics of historic and modern civil engineering structures, unpredictable nature and the civil engineering; civil engineering solutions for the problems of traffic, pollution, water and waste management; building sustainable smart cities.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze principles of civil engineering to basic civil engineering problems following ethics and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.
- CO2.** Analyze aesthetics of historic and modern civil engineering structures to solve complex civil engineering problems using tools and techniques by following ethics and latest trends considering society, environment and sustainability besides communicating effectively in graphical form.
- CO3.** Analyze unpredictable nature and the role of civil engineering to solve complex civil engineering problems using tools and techniques by following ethics and considering society, environment and sustainability besides communicating effectively in graphical form.
- CO4.** Analyze civil engineering solutions for the problems of traffic, pollution, water and waste management to solve complex problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.
- CO5.** Analyze the building principles of sustainable smart cities to solve complex problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	-	-	2	3	2	1
CO2	3	3	-	1	2	2	2	2	1
CO3	3	3	-	1	2	2	2	2	1
CO4	3	3	-	1	2	2	2	2	1
CO5	3	3	-	1	2	2	2	2	1
Course Correlation Mapping	3	3	-	1	2	2	2	2	1

Correlation Levels:

3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO CIVIL ENGINEERING

(07 Periods)

Philosophy of civil engineering, Disciplines of civil engineering, Evolution of construction and civil engineering in the world; Civil engineer - Duties and responsibilities, Role of Civil engineer in the society; Civil engineering materials and their applications, Latest advancements in civil engineering.

Module 2: AESTHETICS OF HISTORIC AND MODERN CIVIL ENGINEERING STRUCTURES

(09 Periods)

Aesthetics in civil engineering structures; Aesthetic principles and techniques - Analysis of materials, textures and colors in aesthetic design, Integration of aesthetics with structural engineering principles; Historic civil engineering structures - Case studies of iconic historic structures (e.g. Colosseum, Taj Mahal, Eiffel Tower); Modern civil engineering structures - Exploration of contemporary iconic structures (e.g. Burj Khalifa, Sydney Opera House, Golden Gate Bridge); Integration of aesthetics and functionality - Ethical considerations in balancing aesthetics, functionality and sustainability; Future trends in aesthetic engineering.

Module 3 UNPREDICTABLE NATURE AND THE CIVIL ENGINEERING

(09 Periods)

Unpredictable nature, Examples of unpredictable natural disasters - Earthquakes, Floods, Landslides, Hurricanes, Tsunamis, Impacts of unpredictable natural events on infrastructure; Role of civil engineering; Resilience in civil engineering - Strategies for building resilient structures, Risk assessment and analysis, Incorporating safety factors, Using robust construction materials, Implementing redundancy and backup systems, Sustainable design practices; Case studies of successful resilient designs.

Module 4 CIVIL ENGINEERING SOLUTIONS FOR THE PROBLEMS OF TRAFFIC, POLLUTION, WATER AND WASTE MANAGEMENT

(11 Periods)

Introduction to urban challenges and sustainable development; Traffic management solutions - Causes and impacts of traffic congestion, Intelligent transportation systems; Pollution control and environmental engineering, Sources and types of urban pollution, Air quality monitoring and control strategies, Water pollution control, Noise pollution management, Sustainable construction practices to reduce pollution; Water resource management, Water demand and supply management in urban areas, Rainwater harvesting techniques, Water conservation and wastewater treatment technologies; Waste management strategies, Solid waste generation and disposal challenges, Waste-to-energy conversion technologies, Case studies of successful waste management initiatives; Integration and synergies among Solutions, Multi-disciplinary approach for holistic solutions.

Module 5 BUILDING SUSTAINABLE SMART CITIES

(09 Periods)

Smart city; Elements of smart city infrastructure - Buildings, Mobility, Energy, Water, Waste management, Health and digital layers; Need for an integrated approach; Role of science, technology and innovation in the implementation of smart infrastructure; Smart infrastructure design principles and policies; Case studies: Gujarat International Finance Tech-City in India.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Group discussion on compatibility of modern construction materials compared to that of traditional civil engineering materials
2. Poster presentation on historic and modern civil engineering structures.
3. Submit a case study report on Life Cycle Analysis (LCA) of any one of the historic civil engineering structure.
4. Submit a case study report on the theme of severity of the natural disasters on the Civil engineering structures.
5. Debate on challenges, limitations and solutions for design and implementation of smart city.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. David Muir Wood., *Civil Engineering: A Very Short Introduction*, Oxford University Press, 1st Edition, 2012.
2. Roger Scruton, *The Aesthetics of Architecture*, Princeton University Press, 2nd Edition, 2013.

REFERENCE BOOKS:

1. Anubha Kaushik and C. P. Kaushik, *Perspectives in Environmental Studies*, New Age International (P) Ltd Publications, 6th Edition, 2018.
2. Sang Lee (Editor), *Aesthetics of Sustainable Architecture*, 010 publishers, 1st Edition, 2013.
3. Marc Kushner, *The Future of Architecture in 100 Buildings*, Simon and Schuster, 1st Edition, 2015.
4. Nicholas J. Garber and Lester A. Hoel, *Traffic and Highway Engineering*, Nelson Engineering, 1st Edition, 2008.
5. Stephen M. Wheeler and Timothy Beatley, *Sustainable Urban Development*, Reader Routledge Urban Reader Series, 3rd Edition, 2014.
6. Larry W. Mays, *Water Resources Engineering*, Wiley India Private Limited, 3rd Edition, 2011.
7. Hans Straub, *A History of Civil Engineering: An Outline from Ancient to Modern Times*, The MIT Press, 4th Edition, 1964.
8. Brian Vanden Brink, *Iconic: Perspectives on the Man-Made World*, Down East Books, Illustrated Edition, 2012.

VIDEO LECTURES:

1. <https://archive.nptel.ac.in/courses/123/105/123105001/>
2. https://onlinecourses.nptel.ac.in/noc22_ce42/preview
3. https://onlinecourses.nptel.ac.in/noc19_ce31/preview
4. https://onlinecourses.nptel.ac.in/noc20_ce07/preview

WEB RESOURCES:

1. <https://bregroup.com/insights/aesthetics-in-architecture-how-beauty-and-design-are-inspiring-each-other/>
2. <https://keckwood.com/news-updates/how-civil-engineers-help-during-disaster-recovery/#:~:text=Civil%20engineers%20provide%20humanitarian%20and,shortages%20to%20hard%20hit%20communities>

3. <https://smartcities.gov.in/>
4. <https://www.twi-global.com/technical-knowledge/faqs/what-is-civil-engineering>
5. <https://www.ice.org.uk/engineering-resources/knowledge-resources/water-and-waste-water-management>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25SS101701	CONSTITUTION OF INDIA	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides and in-depth knowledge about Constitution of India's Preamble and its Philosophy; Union Legislature; Federalism in India; Judiciary and Public Services; Nation Building. The students can gain first-hand information and knowledge about these dynamics and accordingly act based on these sources in their professional and routine activities.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

- CO1:** Demonstrate knowledge in the Parliamentary proceedings, Election Commission, Public Services and Foreign Policy of India.
- CO2:** Apply the reasoning informed by the various aspects of the Constitution and its provisions to assess societal issues and the consequent responsibilities relevant to the professional engineering practice.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	-	-	-	-	3	2	-	-
CO2	2	-	-	-	-	3	-	3	-
Course Correlation Mapping	2	-	-	-	-	3	2	3	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: PREAMBLE AND ITS PHILOSOPHY (09 Periods)

Introduction to Indian Constitution; Evolution of Indian Constitution; preamble and its philosophy

Module 2: UNION LEGISLATURE (09 Periods)

The Parliament, Parliamentary Structure, Process of Legislation; President of India – Powers and Functions; Prime Minister and Council of Ministers; Constitution Amendment Procedure.

Module 3: FEDERALISM IN INDIA (09 Periods)

Centre-State Administrative Relationship; Governors – Powers and Functions; State Legislature - Composition and powers; Chief Ministers - Powers and Functions; The Election Commission – Powers and Functions.

Module 4: JUDICIARY AND PUBLIC SERVICES (09 Periods)

The Union Judiciary - Supreme Court and High Court; Fundamental Rights and Duties All India Services - Central Civil Services -State Services - Local Services.

Module 5: INTERNATIONAL PARTICIPATION (09 Periods)

Foreign Policy of India; International Institutions Influence: UNO, WTO, WHO, SAARC, International Summits: BRICS, NSS, UNEP – India's Role in International Negotiations; Environmentalism in India.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Review newspapers and submit a report on critical analysis of Indian Civil Servants exercise of powers, in the awake of constitutionally assigned authority.
2. Visit your village Panchayat office or Municipality office and generate a report on your observations about maintained Constitutional symbolism.
3. Watch few videos on recent Indian Independence Day and Republic Day celebrations as marked in New Delhi and present a detailed report, by considering the following aspects:
 - a) Comparatively analyze the speeches of the President of India and Prime Minister of India as delivered on these two occasions.
 - b) Compare these two events relevance in terms of Indian Armed Forces presence.
 - c) Observe, compare and analyse 'flag code' relevance as marked in these two events.
4. Watch a few videos on recent 'proceedings' of any state Legislative Assembly session and submit a detailed report.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Briji Kishore Sharma, *Introduction to the Constitution of India*, Prentice Hall of India, 2005

REFERENCE BOOKS:

1. Mahendra Pal Singh, V. N. Shukla's, *Constitution of India*, Eastern Book Company, 2011
2. Pandey J. N., *Constitutional Law of India*, Central Law Agency, 1998

VIDEO LECTURES:

1. Doctrine of Basic Structure: <https://www.youtube.com/watch?v=cvUf9ZeEe8Y>
2. Significance of the Constitution: https://www.youtube.com/watch?v=vr1Dc_-ZKbQ

WEB RESOURCES:

1. The Constitution of India: <https://www.youtube.com/watch?v=of2SoO8i8mM>
2. Protection of Constitutional Democracy:
<https://www.youtube.com/watch?v=smJ99cdPrns>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CM101702	COST ACCOUNTING AND FINANCIAL MANAGEMENT	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Cost accounting; cost sheet & preparation of cost sheet; standard costing & variance analysis; financial management & ratio analysis; introduction to investment.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Demonstrate the concepts of Cost Accounting and Management Accounting and the elements of costing.
- CO2** Determine the Cost of Production for pricing decisions.
- CO3** Apply the Standard Costing and Variance techniques for the control of the cost of production
- CO4** Analyze the Profitability and financial condition of an organization using Ratios.
- CO5** Apply Capital Budgeting techniques for making investment decisions in an organization.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	2	-	-	1	-
CO2	3	-	-	-	2	-	-	1	-
CO3	3	-	-	-	2	-	-	1	-
CO4	3	-	-	-	2	-	-	1	-
CO5	3	-	-	-	2	-	-	1	-
Course Correlation Mapping	3	-	-	-	2	-	-	1	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: COST ACCOUNTING

(09 Periods)

Meaning of Cost and Cost Accounting, Objectives, Scope, Advantages, and Disadvantages – Cost Accounting Vs Management Accounting – Elements of Costing – Installation of costing system – Material Control, Labor Control, Overhead Control.

Module 2: COST SHEET & PREPARATION OF COST SHEET

(09 Periods)

Analysis of Cost – Preparation of cost sheet, estimate, tender, and quotation (Simple problems) – Importance of Costing while pricing the products

Module 3 STANDARD COSTING & VARIANCE ANALYSIS

(09 Periods)

Introduction to Standard Costing & Variances – Variance Analysis: Material variances, Labor variances (Simple Problems).

Module 4 FINANCIAL MANAGEMENT & RATIO ANALYSIS

(09 Periods)

Meaning, Objectives - Nature and Scope, Importance of FM – Ratio Analysis: Types of Ratios: Solvency Ratios, Liquidity Ratios, Turnover Ratios, and Profitability Ratios - Financial Statement Analysis through Ratios (Simple Problems).

Module 5 INTRODUCTION TO INVESTMENT

(09 Periods)

Investment - Meaning and Definition- concept of risk and returns - Capital budgeting techniques – Security Analysis and Portfolio Management (Basic concepts).

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Prepare a report on the role of cost accountants in the growth of a company.
2. To visit the manufacturing unit to observe how they used various techniques for analyzing the financial health of a company.
3. Prepare a report on factors influencing the form of business organization.
4. Prepare the cost sheet with practical examples of any two manufacturing companies.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. S.P. Jain and K.L. Narang: *Cost Accounting*, Kalyani Publishers, Ludhiana, 10th edition, 2016.
2. I.M. Pandey, *Financial Management*, Vikas Publishing House Pvt. Ltd., 14th edition, 2016.

REFERENCE BOOKS:

1. The Institute of Company Secretaries of India, *Cost and Management Study Material*, New Delhi.
2. CA Saravana Prasath, *Cost Accounting and Financial management*, Wolters Kluwer India Pvt. Ltd., New Delhi, 2018.

VIDEO LECTURES:

- 1 <https://www.youtube.com/>

watch?v=ESqO8sFgQa0&list=PLlhS1FfDZcUVE2kzOhEubO9rkvUOAgnZbz

2 <https://www.youtube.com/>

watch?v=tzasFmP1CpAhttps://www.youtube.com/watch?v=tzasFmP1CpA

WEB RESOURCES:

1 https://www.tutorialspoint.com/accountingBasics/management_versus_cost_accounting.htm

2 <https://www.netsuite.com/portal/resource/articles/financial-management/financial-management.shtml>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CB101701	CYBER LAWS AND SECURITY	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Cyber Crimes and Indian IT Act; Cyber Offenses; Tools and Methods used in Cyber Crime; Phishing and Identity Theft; Indian and Global Perspective on Cyber Crimes and Cyber Security; Organizational Implications on Cyber Security; IPR Issues; Cyber Crime and Terrorism; Cyber Crime Illustrations

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge in Cyber security, Cybercrimes and its related laws in Indian and Global Act.
- CO2.** Analyze the legal perspectives and laws related to cybercrimes in Indian context.
- CO3.** Apply security and privacy methods in development of modern applications and in organizations to protect people and to prevent cybercrimes.
- CO4.** Solve Cyber security issues using privacy policies and Use antivirus tools to minimize the impact of cyber threats.
- CO5.** Apply security standards for the implementation of Cyber Security and laws.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-
CO4	3	2	3	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-
Course Correlation Mapping	3	2	3	-	-	-	-	-	-

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO CYBER CRIMES AND OFFENSES (09 Periods)

Cyber Crimes: Introduction, Definition, Origin, Cybercrime and information security, Cyber criminals, Classifications of cybercrimes, The legal perspectives and Indian perspective, Cybercrime and Indian ITA 2000, Global perspective on cybercrimes.

Cyber Offenses: Introduction, Criminals planning on attacks, Social engineering, Cyber stalking, Cyber cafe and crimes, Botnets.

Module 2: TOOLS AND METHODS USED IN CYBER CRIME AND PHISHING AND IDENTITY THEFT (09 Periods)

Introduction, Proxy servers and Anonymizers, Phishing, Password cracking, Key loggers and Spywares, Virus, Worms and Ransomware, Trojan horses and Backdoors, Steganography, DoS and DDoS attacks.

Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

Module 3 CYBER CRIMES AND CYBER SECURITY-LEGAL PERSPECTIVES (08 Periods)

Introduction, Cyber laws in Indian context, The Indian IT act, Challenges to Indian law and Cybercrime scenario in India, Consequences of not addressing the weakness in IT act, Digital signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber law, Technology and Students in India scenario.

Module 4 CYBER SECURITY-ORGANIZATIONAL IMPLICATIONS (10 Periods)

Introduction, Web threats for organizations – evils and perils, Security and privacy implications from cloud computing, Social Media Marketing-Security risks and Perils for organizations, Social computing and associated challenges for organizations, Protecting people's privacy in organization, Organizational guidelines for internet usage, Safe computing and Usage policy, Incident handling and Best practices.

Module 5 CYBER CRIME AND TERRORISM AND ILLUSTRATIONS (09 Periods)

Cyber Crime & Terrorism: Introduction, Intellectual property in the cyber space, The ethical dimension of cybercrimes, The psychology, Mindset and skills of hackers and cyber criminals, Sociology of cyber criminals, Information warfare.

Cyber Crime Illustrations: Indian banks lose millions of rupees, Justice vs. Justice, Parliament attack, The Indian case of online gambling, Bank and credit card related frauds, Purchasing goods and services scam, Nigerian 419 scam.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. The Cyber Security Risks on Social Media – Learn from Case Studies: <https://www.rswebsols.com/tutorials/internet/cyber-security-risks-social-media>
2. SIX automates key cybersecurity tasks to actively protect itself against social media threats: <https://www.hootsuite.com/resources/six-group-case-study>
3. Important Cyber Law Case Studies : <https://www.cyberlegalservices.com/detail-casestudies.php>

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Nina Gobole, SunitBelapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India, 2011.

REFERENCE BOOKS:

1. Prashant Mali, *Cyber Law and Cyber Crimes*, Snow White Publications Pvt. Ltd., 2013.
2. Alfred Basta and et al, *Cyber Security and Cyber Laws*, Cengage Learning India 2018

VIDEO LECTURES:

1. Learn Cyber Security | Cyber Security Training:
<https://www.youtube.com/watch?v=PIHnamdwGmw>
2. Cyber Security For Beginners: <https://www.youtube.com/watch?v=4RE4d23tDFw>

WEB RESOURCES:

1. <https://study.com/academy/course/computer-science-110-introduction-to-cybersecurity.html>
2. <https://www.pandasecurity.com/en/mediacenter/panda-security/types-of-cybercrime/>
3. <https://mediasmarts.ca/digital-media-literacy/digital-issues/cyber-security/cyber-security-spam-scams-frauds-identity-theft>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EE101701	ELECTRICAL SAFETY AND SAFETY MANAGEMENT	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION:

The course deals with the various aspects of potential risk due to electrical shock; safety precautions to be followed while working in hazardous zones; safe practices while handling various electrical equipment and during maintenance; and relevant electrical safety standards and Indian rules and acts.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the Indian electricity rules, regulations and various standards to be maintained for the safety of life and equipment.
- CO2.** Understand the potential effects of electrical shock and safety measures to protect against such risk.
- CO3.** Understand the safety aspects and safe practices to be followed while installing residential, commercial, and agricultural appliances.
- CO4.** Identify various hazardous working zones and take necessary precautionary measures while working in such areas.
- CO5.** Follow safety measures during installation, testing and commissioning, and maintenance of electrical equipment/plant.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	1	3	1	3	1
CO2	3	-	-	-	1	2	2	-	1
CO3	3	-	-	-	1	2	2	-	1
CO4	3	-	-	-	2	3	2	2	1
CO5	3	-	-	-	-	3	2	2	1
Course Correlation Mapping	3	-	-	-	1	3	2	3	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INDIAN ELECTRICITY RULES AND ACTS, AND THEIR (10 Periods) SIGNIFICANCE

OSHA standards of electrical safety, Basic electrical safety rules as per OSHA; Objectives and scope of IE acts and IE rules, Ground clearance and Section Clearances, Clearance in transmission and distribution lines, Significance of Equipment Earthing, Earthing of equipment bodies, structures and non-current carrying metallic parts, Earthing of system neutral; Rules regarding first aid and firefighting facility, Electrical safety general requirements as per IE rules.

Module 2: INTRODUCTION TO ELECTRICAL SAFETY AND SAFETY (10 Periods) MANAGEMENT

Electric Safety: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, Protection against electrical hazards and types, Effect of current on the human body, Principles of electrical safety and approach to prevent accidents.

Electric shocks and its prevention: Primary and secondary electrical shocks, possibilities of getting an electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, Safety precautions in LV installations and electric plant.

Module 3: ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL, AND (08 Periods) AGRICULTURAL INSTALLATIONS

Introduction—Wiring and fitting; Domestic appliances—water tap giving a shock, shock from wet wall, fan firing shock; Multi-storied building, Temporary installations, Agricultural pump installation; Do's and Don'ts for safety in the use of domestic electrical appliances; Principles of safety management in electrical plants, safety auditing, and economic aspects.

Module 4: ELECTRICAL SAFETY IN HAZARDOUS AREAS (07 Periods)

Hazardous zones—class 0, 1 and 2; Sparks, flashovers and corona discharge in electrical plants; equipment for hazardous locations; scope for live line work, principles of live line maintenance, special tools for live line maintenance, safety instructions for working on HV lines/apparatus.

Module 5: SAFETY DURING INSTALLATION TESTING AND (10 Periods) MAINTENANCE

Safety during installations: Preliminary preparations, preconditions for the start of installation work and safe sequence, safety aspects during installations of Transformers and Rotating machines.

Safety during testing: Purpose of commissioning checks and tests, equipment tests, high voltage energization tests, performance and acceptance tests, and safety aspects during commissioning.

Safety during maintenance: Operators' safety, Types of safety maintenance, Safety procedures, safety precautions during maintenance, and planning of maintenance.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Study and submit a report on various electrical safety standards followed in abroad countries.
2. Visit a nearby industry and submit a report on various safety measures followed in the industry.
3. Study and submit a report on standard practices followed during the maintenance/commissioning of the electrical apparatus in any industry.
4. Collect information about various safety/alert sign boards and the relative measures for a

particular situation.

5. Should practice preliminary first aid assistance such as Cardiopulmonary resuscitation (CPR) and shall demonstrate.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Rao, Prof. H.L. Saluja, *Electrical Safety, Fire Safety Engineering and Safety Management*, Khanna Publishers. New Delhi, 2nd Edition, 2018 Reprint.

REFERENCE BOOKS:

1. Cadick, John, Mary Capelli-Schellpfeffer, and Dennis K. Neitzel, *Electrical safety Handbook*, McGraw-Hill Education, 2012.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=g-ofq7i_u48

WEB RESOURCES:

1. <https://cercind.gov.in/Act-with-amendment.pdf>
2. <https://www.edapp.com/blog/electrical-safety-training-topics/>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25MG101701	ENTREPRENEURSHIP FOR MICRO, SMALL AND MEDIUM ENTERPRISES	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: To understand the setting up and management of MSMEs and initiatives of Government and other institutions support for growth and development of MSMEs

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the basic of SME and challenges of MSMEs
- CO2.** Explain the opportunities to Set-Up SSI/SME Units and role of rural & women entrepreneurship.
- CO3.** Illustrate roles of various institutions supporting MSMEs.
- CO4.** Understand Management of MSME, NPA & sickness units
- CO5.** Evaluate role of Government in Promoting Entrepreneurship

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	2	1	-	-	-	-	-
CO2	1	1	2	-	-		2		1
CO3	2	2	1	-	-	-	-	1	-
CO4	3	1	2	-	-	-	-	-	-
CO5	2	2	1	-	-	1	-	-	-
Course Correlation Mapping	2	2	2	2	1	1	2	1	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: Introduction2

(07 Periods)

Concept & Definition, Role of Business in the modern Indian Economy SMEs in India, Employment and export opportunities in MSMEs. Issues and challenges of MSMEs

Module 2: MSME Setting

(09 Periods)

Identifying the Business opportunity, Business opportunities in various sectors, formalities for setting up an enterprise - Location of Enterprise - steps in setting up an enterprise - Environmental aspects in setting up, Incentives and subsidies.

Module 3: MSMEs Supporting Institutions

(09 Periods)

Forms of Financial support, Long term and Short term financial support, Sources of Financial support, Development Financial Institutions, Investment Institutions, Central level institutions, State level institutions, Other agencies, Commercial Bank - Appraisal of Bank for loans

Module 4: Management of MSME

(10 Periods)

Management of Product Line; Communication with clients - Credit Monitoring System - Management of NPAs - Restructuring, Revival and Rehabilitation of MSME, Problems of entrepreneurs - sickness in SMI - Reasons and remedies -- Evaluating entrepreneurial performance

Module 5: Entrepreneurship Promotion

(10 Periods)

MSME policy in India, Agencies for Policy Formulation and Implementation: District Industries Centers (DIC), Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB)

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Present a case study on MSMEs Business Strategies.
2. Collect the data about nearby MSMEs and Present their structures in a PPT
3. Discuss in the group MSMEs opportunities in terms of Orientation and Development.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Vasant Desai, *Small Scale Industries and Entrepreneurship*, Himalaya Publishing House, 2003..
2. Poornima M Charanthimath, *Entrepreneurship Development Small Business Enterprises*, Pearson, 2006.

REFERENCE BOOKS:

1. Suman Kalyan Chaudhury, *Micro Small and Medium Enterprises in India Hardcover*, Raj Publications, 2013.
2. Aneet Monika Agarwal, *Small and medium enterprises in transitional economies, challenges and opportunities*, DEEP and DEEP Publications
3. Paul Burns & Jim Dew Hunt, *Small Business Entrepreneurship*, Palgrave Macmillan publishers, 2010.

VIDEO LECTURES:

1. <https://sdgs.un.org/topics/capacity-development/msmes>
2. <https://blog.tatanexarc.com/msme/msme-schemes-in-india-for-new-entrepreneurs-and-start-ups/>

WEB RESOURCES:

1. ncert.nic.in/textbook/pdf/kebs109.pdf
2. <https://www.jetir.org/papers/JETIR1805251.pdf>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CE101702	ENVIRONMENTAL POLLUTION AND CONTROL	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on fundamentals of air pollution, dispersion of pollutants, effects and control of air pollution, water pollution, soil pollution and control, and municipal solid waste management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Analyze air and noise pollution using appropriate tools and techniques to solve complex environmental issues following relevant standards considering society, environment and sustainability besides communicating effectively in graphical form.
- CO2** Analyze air and noise pollution control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.
- CO3** Analyze water pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.
- CO4** Analyze soil pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.
- CO5** Analyze solid waste and its management measures using appropriate tools and techniques to solve solid waste disposal issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	-	2	2	3	3	2	1
CO2	2	3	-	2	2	3	3	2	1
CO3	2	3	-	2	2	3	3	2	1
CO4	2	3	-	2	2	3	3	2	1
CO5	2	3	-	2	2	3	3	2	1
Course Correlation Mapping	2	3	2	2	2	3	3	2	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: AIR AND NOISE POLLUTION

(08 Periods)

Air Pollution: Scope, Significance, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, material and vegetation; Global effects of air pollution; Air pollution meteorology – Lapse rate, Inversion, Plume pattern; Dispersion of air pollutants - Dispersion models and applications; Ambient air quality standards.

Noise Pollution: Sound pressure, Power and intensity, Impacts of noise, permissible limits of noise pollution, measurement of noise, Noise standards.

Module 2: AIR AND NOISE POLLUTION CONTROL

(10 Periods)

Self-cleansing properties of the environment, Dilution method, Control at source, Process changes and equipment modifications, Control of particulates – Types of equipment, Design and operation - Settling chambers, Centrifugal separators, Bag house filters, Wet scrubbers, Electrostatic precipitators; Control of gaseous pollutants – Adsorption, Absorption, Condensation, Combustion; Control of air pollution from automobiles, Control of noise pollution, Case studies, Latest developments in the air and noise pollution control.

Module 3: WATER POLLUTION AND CONTROL

(10 Periods)

Water pollution – Sources, Causes, Effects; Surface and groundwater quality – Physical, Chemical, Biological; Drinking water quality standards, Water purification – Processes, Engineered systems – Aeration, Solids separation, Settling operations, Coagulation, Softening, Filtration, Disinfection; Wastewater – Sources, Causes, Effects, Treatment process and disposal – Primary, Secondary, Tertiary; Case studies, Latest developments in the water pollution control.

Module 4: SOIL POLLUTION AND CONTROL

(08 Periods)

Soil pollutants, Sources of soil pollution, Causes, Effects and control of soil pollution, Diseases caused by soil pollution, Methods to minimize soil pollution, Effective measures to control soil pollution, Soil quality standards, Case studies, Latest developments in the soil pollution control.

Module 5: MUNICIPAL SOLID WASTE MANAGEMENT

(09 Periods)

Municipal solid waste – Types, Composition and characteristics; Methods of collection and transportation, Methods of disposal – Open dumping, Sanitary landfill, Composting and Incineration; Utilization - 6R Concept, Recovery and recycling and Energy Recovery; Latest developments in solid waste management.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Explain plume patterns due to air pollution and meteorology effects and draw a neat sketch of plume pattern from any chimney that you have observed in recent times.
2. Compare the different air pollution control equipment used in India and draw a neat sketch line diagram of equipment you have seen in any of your industrial visit.
3. Submit a study report on Coagulation, Flocculation, Sedimentation, Filtration and Disinfection in your own words after watching a YouTube video on water treatment.

4. Enumerate the effective measures to control soil pollution with any two case studies.
5. Submit a report on case studies on the use of 6Rs concept of Municipal Solid Waste Management.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Inc. 1985.
2. C. S. Rao, *Environmental Pollution Control Engineering*, New Age International Pvt. Ltd., 2nd Edition 2007.
3. Ibrahim A. Mirsa, *Soil Pollution: Origin, Monitoring & Remediation*, Springer, UK, 2nd Edition, 2008.

REFERENCE BOOKS:

1. M. N. Rao and H. V. N. Rao, *Air Pollution*, Tata McGraw-Hill Education Pvt. Ltd., 19th Edition, 2010.
2. Daniel Vallero, *Fundamentals of Air Pollution*, Academic Press (Elsevier), 5th Edition, 2014.
3. S. M. Khopkar, *Environmental Pollution Monitoring and Control*, New Age International Pvt. Ltd., 2nd Edition, 2007.
4. V. M. Domkundwar, *Environmental Engineering*, DhanpatRai & Co. Pvt. Ltd., New Delhi, 2014.

VIDEO LECTURES:

1. <https://archive.nptel.ac.in/courses/123/105/123105001/>
2. <https://archive.nptel.ac.in/courses/105/107/105107213/>
3. <https://archive.nptel.ac.in/courses/103/107/103107084/>

WEB RESOURCES:

1. <https://www.lkouniv.ac.in/site/writereaddata/siteContent/202005012116016435Ranvijay-Pratap-Singh-Environmental-Pollution.pdf>
2. [https://www.deshbandhucollege.ac.in/pdf/resources/1585622878_HIST_\(HONS.\)_II_Env-Pollution.pdf](https://www.deshbandhucollege.ac.in/pdf/resources/1585622878_HIST_(HONS.)_II_Env-Pollution.pdf)
3. https://www.jica.go.jp/jica-ri/IFIC_and_JBICI-Studies/english/publications/reports/study/topical/health/pdf/health_08.pdf
4. https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/education/proceeding_of_short-term_training/diploma/Environmental_Sciences_May_24-28_2007/Lecture_notes/Env_Pollution-rb.pdf
5. https://anits.edu.in/online_tutorials/es/Unit%203.pdf

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EC101702	ESSENTIALS OF VLSI	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course contains the topics that make student realize the need for Testing. The various types of testing along with Fault Modeling. Test methods for evaluation and test generation algorithms, Delay Tests, IDDQ Tests for testing the circuits , Ad-Hoc DFT Methods, Scan Based Designs, Built-In Self Test.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the importance of Testing, fault models and related theorems.
- CO2.** Analyze various test methods as applicable to digital circuits.
- CO3.** Appraise the various combinational and sequential circuit test generation algorithms for functional verification of digital circuits
- CO4.** Assess delay test algorithms and IDDQ test algorithms for at-speed testing of CMOS Integrated Circuits.
- CO5.** Recognize the concepts and architectures for Built-In Self Test to satisfy industry specifications.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3					-	-	-	-
CO2	3	3	2	2	2	-	-	-	-
CO3	3	3	2	2	2	-	-	-	-
CO4	3	3	2	2	2	-	2	3	-
CO5	3	-	-	-	-	-	-	3	-
Course Correlation Mapping	3	3	2	2	2	-	2	3	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO VLSI

(09 Periods)

Levels of Abstraction, VLSI Design Flow, MOS Transistor - Characteristics, I_{DS} – V_{DS} Relation, NMOS and CMOS Logic – Logic Gates Design, NMOS and CMOS Fabrication Process.

Module 2: CMOS CIRCUIT DESIGN PROCESS

(10 Periods)

MOS Layers, Stick Diagrams, NMOS and CMOS Design Styles, Lambda based Design Rules, NMOS and CMOS Layouts for Inverter and Universal Gates, Sheet Resistance, Capacitance and Delay Calculations, Effects of Scaling.

Module 3: SUBSYSTEM DESIGN

(11 Periods)

Adders – Manchester Carry Chain Adder, Carry Look Ahead Adder, Carry Select Adder, Carry Skip adder, Barrel Shifter, Multiplier – Array Multiplier, Booth Multiplier.

Module 4: PROGRAMMABLE HARDWARE

(06 Periods)

Design Styles, Programmable Interconnects, Field Programmable Gate Arrays, Complex Programmable Logic Devices, Cell based Design Methodology.

Module 5: DESIGN FOR TESTABILITY

(09 Periods)

Ad-Hoc DFT Methods, Full Scan Design, Partial Scan Design, Random Logic BIST – Test-per-Clock and Test-per-Scan BIST Systems; Boundary Scan Standard – TAP Controller and Port.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

5. Develop and Illustrate D – algorithm for Sequential Circuits.
6. Illustrate the applicability of existing testing algorithms for circuits with multiple stuck-at-faults.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Michael L. Bushnell, Vishwani D. Agrawal, *Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits*, Kluwer Academic Publishers, Springer US, New York, 2006.

REFERENCE BOOKS:

1. Miron Abramovici, Melvin A. Breuer, Arthur D. Friedman, *Digital Systems Testing and Testable Design*, Wiley, Jaico Publishing House, 1st Edition, 2001.
2. Alfred L. Crouch, *Design for Test for Digital ICs & Embedded Core Systems*, Pearson Education, 1st Reprint Edition, 2007.
3. Robert J. Feugate, Jr., Steven M. McIntyre, *Introduction to VLSI Testing*, Prentice Hall, 1st Illustrated Edition, 1998.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/117105137>
2. <https://nptel.ac.in/courses/117103125>
3. <https://nptel.ac.in/courses/106103016>
4. <https://archive.nptel.ac.in/courses/106/103/106103116/>

WEB RESOURCES:

1. <https://www.electronics-tutorial.net/vlsi-design-for-testability/IC-Testing.html>
2. <https://alexromanov.github.io/2022/08/14/what-is-testability/>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CB101702	INTRODUCTION TO ETHICAL HACKING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on ethical hacking overview, role of security and penetration testers, foot printing, reconnaissance and scanning networks, enumeration and vulnerability analysis, system hacking, network protection systems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand and recognize role of security and penetration testers to protect the system from malware attacks.
- CO2.** Apply the foot printing tools to find the vulnerabilities in the system.
- CO3.** Analyze vulnerabilities to find the system security loopholes or flaws in networked systems within a given range of IP
- CO4.** Apply the web attackers tools to assess the website's security
- CO5.** Identify the possible incidents and threats, alert administrators, and prevent potential attacks using IDS

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-
CO5	3	2	3	2	-	-	-	-	-
Course Correlation Mapping	3	3	3	2	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION

(10 Periods)

Ethical Hacking Overview, Role of Security and Penetration Testers .Penetration, Testing Methodologies, Laws of the Land, Overview of TCP/IP, The Application Layer, The Transport Layer, The Internet Layer, IP Addressing, Network and Computer Attacks, Malware, Protecting Against Malware Attacks, Intruder Attacks, Addressing Physical Security.

Module 2: FOOT PRINTING, RECONNAISSANCE AND SCANNING (09 Periods)

Foot printing Concepts, Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email, Competitive Intelligence, Foot printing through Social Engineering, Foot printing Tools, Network Scanning Concepts, Port-Scanning Tools, Scanning Techniques, Scanning Beyond IDS and Firewall

Module 3: ENUMERATION AND VULNERABILITY ANALYSIS (09 Periods)

Enumeration Concepts, NetBIOS Enumeration, SNMP, LDAP, NTP, SMTP and DNS Enumeration, Vulnerability Assessment Concepts, Desktop and Server OS Vulnerabilities, Windows OS Vulnerabilities, Tools for Identifying Vulnerabilities in Windows, Linux OS Vulnerabilities, Vulnerabilities of Embedded Oss.

Module 4: SYSTEM HACKING (10 Periods)

Hacking Web Servers, Web Application Components, Vulnerabilities, Tools for Web Attackers and Security Testers Hacking Wireless Networks, Components of a Wireless Network, Wardriving, Wireless Hacking, Tools of the Trade.

Module 5: NETWORK PROTECTION SYSTEMS (07 Periods)

Access Control Lists, Cisco Adaptive Security Appliance Firewall, Configuration and Risk Analysis Tools for Firewalls and Routers, Intrusion Detection and Prevention Systems, Network, Based and Host-Based IDSS and IPSS, Web Filtering, Security Incident Response Teams, Honeypots.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. List out various ways used to Protect Yourself from Hackers.
2. Demonstrate how do White Hackers work?
3. Demonstrate The bug bounty program.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, *Hands-On Ethical Hacking and Network Defense*, Course Technology, Delmar Cengage Learning, 2010.
2. Patrick Engebretson, *The Basics of Hacking and Penetration Testing*, SYNGRESS, Elsevier, 2013.

REFERENCE BOOKS:

1. Dafydd Stuttard and Marcus Pinto, *The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws*, Wiley, 2nd Edition, 2011.
2. Justin Seitz, *Black Hat Python: Python Programming for Hackers and Pentesters*, 2nd Edition, 2014.

VIDEO LECTURES:

1. <https://www.coursera.org/learn/ethical-hacking-essentials-ehe>
2. <https://www.udacity.com/course/ethical-hacker-nanodegree--nd350>

WEB RESOURCES:

1. <https://github.com/PacktPublishing/Python-Ethical-Hacking>
2. <https://www.youtube.com/watch?v=x3IwvPvDpKE>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25BS101703	FORENSIC SCIENCE	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Forensic Science, Tools and Techniques in Forensic Science, Forensic Photography, Crime Scene Management, Crime Scene Management Laws and Forensic Science.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

- CO1** Understand the basic concepts of Forensic science.
- CO2** Apply various tools and techniques in forensic science for crime investigation.
- CO3** Understand Forensic Photography fundamentals.
- CO4** Perform Crime scene investigation, scene reconstruction and prepare reports.
- CO5** Understand Legal aspects of Forensic Science.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-
CO4	3	3	2	2	2	-	-	-	-
CO5	3	3	2	2	2	-	-	-	-
Course Correlation Mapping	3	3	2	2	2	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION

(09 Periods)

Introduction, Need, Scope, Concepts and Significance of Forensic Science, History and Development of Forensic Science, Laws and Basic principles of Forensic Science, Branches of forensic science, Organizational set-up of a Forensic Science Laboratory. Investigative strategies. Expert testimony and eye-witness report.

Module 2: TOOLS AND TECHNIQUES IN FORENSIC SCIENCE

(09 Periods)

Basic principles of microscopy, spectroscopy, chromatography, Electrophoresis, Enzyme_Linked Immunosorbent Assay (ELISA), Radio Immuno Assay (RIA). Measuring and optical instruments. Research methodologies; Formation of research design on a specific problem. Central tendency and Dispersion. Test of significance. Analysis of variance, Correlation and Regression.

Module 3: FORENSIC PHOTOGRAPHY

(8 Periods)

Basic principles of Photography, Techniques of black & white and color photography, cameras, lenses, shutters, depth of field, film; exposing, development and printing techniques; Different kinds of developers and fixers; UV, IR, fluorescence illumination guided photography; Modern development in photography- digital photography, working and basic principles of digital photography; Surveillance photography. Videography and Crime Scene & laboratory photography.

Module 4: CRIME SCENE MANAGEMENT

(11 Periods)

Crime scene investigations, protecting and isolating the crime scene; Documentation, sketching, field notes and photography. Searching, handling and collection, preservation and transportation of physical evidences, Chain of custody and Reconstruction of scene of crime. Report writing.

Module 5: LAW AND FORENSIC SCIENCE

(8 Periods)

Legal aspects of Forensic Science: Forensic Science in the Criminal Justice System, The Criminal Investigation Process, Production of Evidence: The Subpoena, The Rules of Evidence, Authentication of Evidence: The Chain of Custody, The Admissibility of Evidence, Laboratory Reports, Examples of Analysis and Reports, Expert Testimony, Getting into Court, Testifying, Being a Witness and an Expert, Considerations for Testimony.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENCIAL LEARNING

1. Study of Computer Forensics and different tools used for forensic investigation
2. **Identify and list the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt**

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Houck M.M and Siegel J.A, *Fundamentals of Forensic Science*, Elsevier, 2nd edition, 2010.
2. Sharma B.R, *Forensic Science in Criminal Investigation and Trials*, Universal Publishing Co., New Delhi, 2003.

REFERENCE BOOKS:

1. Nanda B.B and Tewari, R.K, *Forensic Science in India- A vision for the Twenty First Century*, Select Publisher, New Delhi, 2001.
2. James, S.H and Nordby, J.J, *Forensic Science- An Introduction to Scientific and Investigative Techniques*, CRC Press, USA, 2003.

3. Saferstein, *Criminalistics, An Introduction of Forensic Science*, Prentice Hall Inc, USA,2007.
4. Barry, A.J. Fisher, *Techniques of Crime Scene Investigation*, CRC Press, NewYork, 7th edition, 2003.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106106178>
2. <https://www.youtube.com/watch?v=X5fo1H7bc0g>

WEB RESOURCES:

1. <https://www.nist.gov/forensic-science>
2. <https://www.coursera.org/learn/forensic-science>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EC101703	INSTRUMENTATION IN INDUSTRIES	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on measurement of various parameters like displacement, force, torque, acceleration, velocity, density, viscometer, hygrometers, temperature, pressure, level and flow.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Select appropriate displacement, force and torque measuring devices for specific measurement application.
- CO2** Identify suitable acceleration, velocity and density measuring devices for specific measurement application.
- CO3** Apply suitable viscometer and hygrometer for measurement of viscosity, humidity and moisture for a specific application.
- CO4** Select appropriate temperature and pressure transducer for an industrial requirement.
- CO5** Identify appropriate level and flow transducer for measurement of level and flow for a specific application.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	3	-	-	-	-	-
CO2	3	2	-	3	-	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-
CO4	3	2	-	3	-	-	-	-	-
CO5	3	2	-	3	-	-	-	-	-
Course Correlation Mapping	3	2	-	3	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: DISPLACEMENT, FORCE & TORQUE MEASUREMENT

(08 Periods)

Displacement Measurement: Introduction, Strain gauge, LVDT, Capacitive Gauges and applications.

Force Measurement: Introduction, Analytical Balance, Spring Balance, Load cells.

Torque Measurement: Introduction, Strain gauge, Relative angular twist and applications.

Module 2: ACCELERATION, VELOCITY & DENSITY MEASUREMENT

(08 Periods)

Acceleration Measurement: Introduction, LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers and applications.

Velocity Measurement: Introduction, Revolution Counter, Capacitive Tacho, Drag-cup Type, Tacho and Stroboscope and applications.

Density Measurement: Introduction, Pressure type densitometers, Float type densitometers, Ultrasonic densitometer and gas densitometer.

Module 3: VISCOSITY, HUMIDITY & MOISTURE MEASUREMENT

(09 Periods)

Viscosity Measurement: Introduction, friction tube viscometer, say bolt's viscometer, rotameter viscometer, Searle's rotating cylinder, cone and plate viscometer.

Humidity Measurement: Introduction, Dry and wet bulb psychrometers, Resistive and capacitive type hygrometers

Moisture Measurement: Introduction, Thermal Conductivity and Capacitive sensors, Applications of moisture measurement, Moisture measurement in solids.

Module 4: TEMPERATURE & PRESSURE MEASUREMENT

(10 Periods)

Temperature Measurement: Definitions and standards, RTD, Thermistor, Thermocouples: Laws of thermocouple, Reference junctions compensation, Radiation fundamentals, Radiation methods of temperature measurement, Total radiation pyrometers, Optical pyrometers, Applications.

Pressure Measurement: Introduction, manometer and its types, elastic transducers Bourdon tube, diaphragm, bellows, electrical types, resistive, inductive and capacitive, Thermal conductivity gage, Ionization gage, Sound level meter, Microphone, Applications.

Module 5: LEVEL & FLOW MEASUREMENT

(10 Periods)

Level Measurement: Introduction, Gauge Glass technique, Float Types – Float-and- tape method, Float-and-shaft method, Magnetic float types. Electrical types – Resistance switch type, Inductive and Capacitance type. Ultrasonic methods. Applications

Flow Measurement: Introduction, Head types – Orifice, Venturi, Flow Nozzle. Rotameter & types. Coriolis flow meter, Gyroscopic flow meter, Liquid bridge mass flow meter, Calorimetric flow meter. Electromagnetic flow meter, Ultrasonic flow meter, Hotwire anemometer type. Applications.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Record temperature from RTD and convert temperature in to voltage.
2. Measure the speed of rotating shaft using stroboscope.
3. Record level of the tank using suitable device.
4. Measure the flow rate of water in boiler plant.
5. Measure the displacement using LVDT.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. K. Sawhney, *A Course in Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and Sons, New Delhi, 19th Revised Edition, 2013
2. D. Patranabis, *Principles of Industrial Instrumentation*, TMH, 3rd Edition, 2010.

REFERENCE BOOKS:

1. Ernest Doeblin & Dhanesh Manik, *Measurement Systems*, McGraw Hill International, 6th Edition, 2011.

VIDEO LECTURES:

1. <https://www.vlab.co.in/>
2. <https://archive.nptel.ac.in/courses/103/103/103103135/>
3. <https://nptel.ac.in/courses/103103135>

WEB RESOURCES:

1. https://www.tutorialspoint.com/electronic_measuring_instruments/index.htm
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108105064/lec1.pdf
3. <https://www.ibiblio.org/kuphaldt/socratic/sinst/book/iii.pdf>.

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25AI101701	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Introduction to Artificial Intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Represent knowledge, Robotics, Ethics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Analyze and Architect intelligent agents using Artificial Intelligence Techniques and principles
- CO2** Analyze the usage of Knowledge representation techniques in Artificial Intelligence
- CO3** Analyze and interpret the problem, identify suitable solutions using heuristic functions and search algorithms
- CO4** Investigate robot hardware and frameworks for intelligent robotic perception.
- CO5** Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-
CO4	3	-	-	-	-	1	-	-	-
CO5	-	-	-	-	-	1	-	2	-
Course Correlation Mapping	3	3	2	-	-	1	-	2	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (09 Periods)

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

Module 2: KNOWLEDGE & REASONING (09 Periods)

Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Module 3: PROBLEM SOLVING BY SEARCHING (09 Periods)

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

Module 4: SEARCH IN COMPLEX ENVIRONMENTS (09 Periods)

Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

Module 5: ROBOTICS (09 Periods)

Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.

Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Design and implement agent programs for Table-driven agents using the agent function of vacuum-cleaner world. The agent cleans the current square if it is dirty, otherwise it moves to the other square.
2. Implement agent programs for Simple reflex agents and Model-based reflex agents using the agent function of vacuum-cleaner world.
3. Solve the travelling sales man problem using Hill Climbing search algorithm

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall, 4th Edition, 2020.

REFERENCE BOOKS:

1. Stephen Lucci, Danny Kopec, *Artificial Intelligence in the 21st Century*, Mercury Learning and Information, 3rd Edition, 2018
2. Rich, Knight, Nair, *Artificial intelligence*, Tata McGraw Hill, Third Edition, 2009.
3. Deepak Khemani, *A First Course in Artificial Intelligence*, McGraw Hill Education, 2017.
4. Saroj Kaushik, *Artificial Intelligence*, Cengage Learning, 2011.

SOFTWARE/TOOLS:

1. Python
2. pandas, matplotlib

VIDEO LECTURES:

1. <https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence>
2. <http://aima.cs.berkeley.edu/>
3. <https://ai.google/education/>
4. <https://www.coursera.org/courses?query=artificial%20intelligence>
5. <https://www.edureka.co/blog/artificial-intelligence-with-python/>

WEB RESOURCES:

1. <http://www.airesources.org/>
2. <https://allthingsai.com/>
3. <https://designmodo.com/ai-tools-designers/>
4. <https://www.ulethbridge.ca/teachingcentre/chatgpt-ai-resources>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25DS101702	INTRODUCTION TO DATA SCIENCE	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to Data Science; Data Collection and Data Pre-Processing, Exploratory Data Analytics, Model Development, and Model Evaluation.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

- CO1.** Demonstrate knowledge on Data science concepts.
- CO2.** Perform data collection and pre-processing.
- CO3.** Perform exploratory data analytics.
- CO4.** Design and develop data visualization models.
- CO5.** Evaluate performance of data models.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	-	-
CO2	2	2	3	2	2	-	-	-	-
CO3	2	2	2	3	2	-	-	-	-
CO4	2	3	2	2	2	-	-	-	-
CO5	3	2	2	2	2	-	-	-	-
Course Correlation Mapping	3	2	2	2	2	-	-	-	-

Correlation Levels: **3: High** **2: Medium** **1: Low**

COURSE CONTENT

Module-1: INTRODUCTION**(09 periods)**

Introduction to Data Science, Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues.

Module-2: DATA COLLECTION AND DATA PRE-PROCESSING**(09 periods)**

Data Collection Strategies, Data Pre-Processing- Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.

Module-3: EXPLORATORY DATA ANALYTICS**(09 periods)**

Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics, ANOVA.

Module-4: MODEL DEVELOPMENT**(09 periods)**

Simple and Multiple Regression, Model Evaluation using Visualization, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making.

Module-5: MODEL EVALUATION**(09 periods)**

Generalization Error, Out-of-Sample Evaluation Metrics, Cross Validation, Overfitting, Under Fitting and Model Selection, Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search.

Total periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. **Use Case:** A human can express his emotions in any form, such as the face, gestures, speech and text. The detection of text emotions is a content-based classification problem. Detecting a person's emotions is a difficult task, but detecting the emotions using text written by a person is even more difficult as a human can express his emotions in any form.
Recognizing this type of emotion from a text written by a person plays an important role in applications such as chatbots, customer support forum, customer reviews etc. So you have to train a machine learning model that can identify the emotion of a text by presenting the most relevant emoji according to the input text.
2. **Use Case:** Customer Personality Analysis is a detailed analysis of a company's ideal customers. It helps a business to better understand its customers and makes it easier for them to modify products according to the specific needs, behaviours and concerns of different types of customers.
You have to do an analysis that should help a business to modify its product based on its target customers from different types of customer segments. For example, instead of spending money to market a new product to every customer in the company's database, a company can analyze which customer segment is most likely to buy the product and then market the product only on that particular segment.

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOK:

1. Cathy O'Neil and Rachel Schutt, *Doing Data Science*, O'Reilly, 2015

REFERENCE BOOKS:

1. David Dietrich, Barry Heller, Beibei Yang, *Data Science and Big Data Analytics*, EMC

2013.

2. Davy cielen, *Introducing Data Science*, Manning Publications, 2022.
3. Chirag Shah, *A Hands-on Introduction to Data Science*, Cambridge University Press, 2020

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=JL_grPUUnXzY&list=PLeo1K3hjS3us_ELKYSj_Fth2tIEkdKXvV
2. <https://www.youtube.com/watch?v=-ETQ97mXXF0>

WEB RESOURCES:

1. https://swayam.gov.in/nd1_noc19_cs60/preview
2. <https://towardsdatascience.com/>
3. <https://www.w3schools.com/datascience/>
4. <https://github.com/jakevdp/PythonDataScienceHandbook>
5. <https://www.kaggle.com>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25AI101702	INTRODUCTION TO MACHINE LEARNING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to machine learning, Bayesian concept learning, Supervised learning, Unsupervised learning, Artificial neural networks.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Analyze the process of machine learning modeling and evaluation to automatically infer a general description for a given learning problem.
- CO2** Analyze the underlying mathematical models within machine learning algorithms and learning tasks.
- CO3** Design and implement machine learning solutions for classification, regression, and clustering problems.
- CO4** Design and implement efficient neural architectures to model patterns for a given learning problem.
- CO5** Develop intelligent solutions to solve societal problems related to computer vision, information security, healthcare and other areas.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-
CO3	2	3	3	3	3	-	-	-	-
CO4	3	3	3	1	-	-	-	-	-
CO5	1	3	3	3	3	3	-	-	-
Course Correlation Mapping	3	3	3	3	3	3	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO MACHINE LEARNING

(10 Periods)

Machine Learning: Human learning, Types of human learning, Machine learning, Types of machine learning, Applications of machine learning, Issues in machine learning, Machine learning activities, Types of data, Selecting a model, Training a model, Model representation and interpretability, Evaluating performance of a model, Improving performance of a model.

Module 2: BAYESIAN CONCEPT LEARNING

(07 Periods)

Module 2: Bayes in Concept Learning (3 Periods)
Introduction, Importance, Bayes' theorem, Bayes optimal classifier, Naïve Bayes classifier, Applications of Bayes classifier.

Module 3: SUPERVISED LEARNING (10 Periods)

Classification: Classification model, Classification learning steps, K-Nearest Neighbor, Decision Tree, Support vector machines.

Regression: Introduction, Simple linear regression, Improving accuracy of the linear regression model, Multiple linear regression, Assumptions and problems in regression analysis.

Module 4: UNSUPERVISED LEARNING (09 Periods)

Introduction, Unsupervised vs supervised learning, Applications of unsupervised learning, Clustering as a machine learning task, Types of clustering techniques, Partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN.

Module 5: ARTIFICIAL NEURAL NETWORKS (09 Periods)

Artificial neuron, Types of activation functions, Early implementations of ANN, Architectures of neural network, Learning process in ANN, Backpropagation.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Use Naïve Bayes classifier to solve the credit card fraud detection problem.
2. Build a neural network that will read the image of a digit and correctly identify the number.

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1. Tom M. Mitchell, *Machine Learning*, McGraw Hill, 1997.
2. Saikat Dutt, Subramanian Chandramouli, Amit kumar das, *Machine Learning*, Pearson, 2019.

REFERENCE BOOKS:

- 1 Manaranjan Pradhan, U Dinesh Kumar, *Machine Learning Using Python*, Packt Publishing, 2019.
- 2 Aurelien Geron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*, O'Reilly, 2nd Edition, 2019.
- 3 Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press, 4th Edition, 2020.
- 4 Shai Shalev Shwartz, Shai Ben David, *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press, 2014.

VIDEO LECTURES:

- 1 <https://nptel.ac.in/courses/106106202/>
- 2 <https://www.coursera.org/learn/machine-learning>
- 3 https://onlinecourses.nptel.ac.in/noc23_cs18/preview
- 4 https://onlinecourses.nptel.ac.in/noc23_cs87/preview
- 5 https://onlinecourses.nptel.ac.in/noc23_ee87/preview
- 6 <https://www.coursera.org/learn/ntumlone-algorithmicfoundations>
- 7 <https://www.coursera.org/specializations/machine-learning-introduction>
- 8 <http://ndl.iitkgp.ac.in/document/YkxIRXFvZXJrTDBkVzVVZi9ESjl6eXpRZkxRc2lhOWhIVXBhUVVWaXZINDNyZUVIdU9LdIYvd20wbkQ4MC92UQ>
- 9 <https://www.coursera.org/learn/unsupervised-learning-recommenders-reinforcement-learning>

WEB RESOURCES:

- 1 <https://www.ibm.com/topics/machine-learning>
- 2 <https://www.simplilearn.com/tutorials/machine-learning-tutorial/what-is-machine-learning>
- 3 https://www.w3schools.com/python/python_ml_getting_started.asp
- 4 <https://developers.google.com/machine-learning/crash-course>
- 5 <https://www.greenteapress.com/thinkstats/>
- 6 <https://info.deeplearning.ai/machine-learning-yearning-book>
- 7 <https://www.kaggle.com/code/kanncaa1/machine-learning-tutorial-for-beginners>
- 8 <https://machinelearningmastery.com/machine-learning-in-python-step-by-step/>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CS101701	INTRODUCTION TO PYTHON PROGRAMMING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course is aimed at offering the fundamental concepts of Python scripting language to the students. It starts with the basics of Python programming and deals with lists, dictionaries, functions, exceptions and files. The objective of this course is to enable the students to develop the applications using the concepts of Python.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the basic terminology used in computer programming to write, compile and debug programs in Python programming language.
- CO2.** Use appropriate data type for handling user data and write optimized programs using the functions, and statements.
- CO3.** Manage the exceptions raised during the program execution and avoid abrupt termination of the program execution.
- CO4.** Process files and solve real world problems using classes and objects in the Python programming environment.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	-	-	-	-	-	-
CO2	3	3	-	-	-	-	2	-	-
CO3	3	3	3	-	-	-	-	-	2
CO4	2	3	3	-	-	-	-	2	-
Course Correlation Mapping	3	3	3	-	-	-	2	2	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: DATA TYPES AND INPUT/OUTPUT

(09 Periods)

Internal working of Python, Python character set, Tokens, Python Core Data Types (list, set, tuple, and dctionary), The print () function, Assignment of values to variables, The input() function, The eval()

function.

Module 2: OPERATORS AND CONTROL STATEMENTS

(09 Periods)

Operators- Arithmetic Operators, Operator precedence and Associativity, Bitwise operator, The compound assignment operator; Decision statements- Boolean operators, Boolean Expressions and Relational operators, Decision making statements; Loop Control Statements-while loop, range() function, for loop; break statement, continue statement.

Module 3: FUNCTIONS AND LISTS

(09 Periods)

Functions- Syntax and basics of a function, Use of a function, Parameters and arguments in a function, The local and global scope of a variable, The return statement, Recursive functions, The lambda function; Lists-Creating Lists, Accessing the elements of a List, List slicing, Python in-built functions for lists, List Comprehension, List Methods, Passing list to a function, Returning a list to function.

Module 4: TUPLES, SETS AND DICTIONARIES

(09 Periods)

Tuples - Creating tuples, tuple() function, Inbuilt functions for tuples, Indexing and Slicing, Operations on tuples, Passing variable length arguments to tuples, Sort tuples, Traverse tuples from a list, The zip() function, The Inverse zip(*) function; Sets - Creating sets, The set in and not in operator, The Python Set Class, Set operations; Dictionaries -Basics of Dictionaries, Creating a Dictionary, Adding and replacing values, Retrieving values, Formatting dictionaries, Deleting items, Comparing two dictionaries, Methods of dictionary class, Traversing dictionaries, Nested dictionaries, Traversing nested dictionaries.

Module 5: V FILES

(09 Periods)

File Handling-Opening a file, Writing Text, Closing files, Writing numbers to a file, Reading Text, Reading numbers from a file, Appending data, seek() function.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Calculator: Create a basic calculator program that can perform addition, subtraction, multiplication, and division operations. You can enhance it by adding more functionality, such as handling decimal numbers or including additional mathematical operations.
2. Develop recursive functions to solve problems that involve self-referential definitions.
3. Develop program to create dictionaries, add, retrieve and delete items from dictionaries.
4. Word Counter: Design a program that counts the number of words, characters, or lines in a given text file. You can also include additional features like finding the most common words or displaying statistics about the text.
5. Tic-Tac-Toe: Implement a two-player tic-tac-toe game where users take turns marking Xs and Os on a 3x3 grid. Determine the winner or detect a tie by checking the board after each move.
6. Dice Rolling Simulator: Create a program that simulates rolling dice. Allow the user to specify the number of dice to roll and display the results. You can also add features like keeping track of the roll history or calculating the probability of certain outcomes.

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXTBOOKS:

1. Ashok Namdev kamthane and Amit Ashok Kamthane, *Programming and Problem solving with PYTHON*, McGraw Hill Education, 1st Edition, 2016.

REFERENCE BOOKS:

1. Allen Downey, *Think Python*, Green Tea Press, 1st Edition, 2016.
2. W.J. Chun, *Core Python Programming*, Prentice Hall, 3rd Edition, 2013.
3. Kenneth A. Lambert, *Fundamentals of Python*, Cengage, 2nd Edition, 2015.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview
2. <https://www.coursera.org/specializations/python>
3. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
4. <https://www.youtube.com/watch?v=WGJJIrtnfpk>
5. https://www.youtube.com/watch?v=_uQrJ0TkZlc
6. <https://www.udemy.com/topic/python/>
7. <https://freevideolectures.com/course/2512/python-programming>

WEB RESOURCES:

1. <https://www.w3schools.com/python/>
2. <https://www.programiz.com/python-programming>
3. <https://www.geeksforgeeks.org/python-programming-language/>
4. <https://www.javatpoint.com/python-lists>
5. <https://www.learnpython.org/>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CB101704	INTRODUCTION TO INTERNET OF THINGS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course is emphasize on the Architecture of IoT and Summarize the roles of various organizations for IoT, To Develop simple applications using Arduino and Rasberry, Test for errors in the application, Predict the market value, Experiment with embedded boards for creating IoT prototypes, To understand the domain specific IoTs and IoT system management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand the fundamental concepts of IoT and physical computing.
- CO2** Demonstrate knowledge on variety of embedded boards and IoT Platforms
- CO3** Understand the communication protocols in IoT communications.
- CO4** Demonstrate knowledge on Domain specific IoT applications.
- CO5** Understand the IoT System management and network management protocols.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-
CO5	3	2	2				-	-	-
Course Correlation Mapping	3	3	3	-	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: Overview of IoT

(09 Periods)

The Internet of Things: An Overview, The Flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?

Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.

Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open source Vs Close source, Tapping into the community.

Module 2: Embedded Devices:

(09 Periods)

Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things

Module 3 Communication in the IoT:

(09 Periods)

Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols

Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol

Module 4 Domain specific IoTs

(09 Periods)

Introduction: Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle

Module 5 IoT and M2M

(09 Periods)

Introduction- M2M, Difference between IoT and M2M, SDN and NFV for IoT

IoT System Management with NETCONF-YANG: Need for IoT Systems Management, Simple network management protocol(SNMP), Network operator requirements, NETCONF,YANG

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. (a) Design and Simulate LED 7-Segment Display interfacing with Arduino.
(b) Design and Simulate Servo motor interfacing with Arduino.
2. (a) Design and Simulate ultrasonic sensor and LCD interfacing with Arduino.
(b) Design and Simulate Flame Sensor interfacing with Arduino.

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1. Adrian McEwen, Hakim Cassimally, *Designing the Internet of Things*, Wiley Publications, 2012
2. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Universities Press, 2014.

REFERENCE BOOKS:

1. Pethuru Raj, Anupama C. Raman, *The Internet of Things, Enabling technologies and use cases*, CRC Press.

VIDEO LECTURES:

1. <https://www.digimat.in/nptel/courses/video/106105166/L01.html>
2. <https://www.youtube.com/watch?v=oBZnySDgst8>

WEB RESOURCES:

1. <https://www.arduino>
2. <https://www.raspberrypi.org/>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25ME101705	MATERIAL SCIENCE	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Materials Structure and Constitution of Alloys; Heat treatment of steels; Properties of ferrous materials and its alloys; Properties of non-ferrous materials and its alloys; Properties and applications of Ceramics, Polymers and Composite materials.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Ability to understand and apply the principles of materials science to analyze and design materials for specific applications.
- CO2.** Analyze the properties of materials and enhance the same through heat-treatment processes.
- CO3.** Demonstrate the knowledge of ferrous and Non-ferrous materials and its alloys for engineering applications.
- CO4.** Understand the relationship between materials properties and structure at the atomic and molecular level.
- CO5.** Demonstrate the knowledge of Ceramics, Polymers, and Composite materials for suitable engineering applications.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	-	-	-	-	-	1
CO2	3	3	1	-	-	-	-	-	1
CO3	3	1	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-
CO5	3	1	-	-	-	-	-	-	-
Course Correlation Mapping	3	2	1	-	-	-	-	-	1

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: MATERIALS STRUCTURE AND CONSTITUTION OF ALLOYS **(09 Periods)**

Materials Structure: Space lattice, Unit cells and Metallic crystal structures (SC, BCC, FCC and HCP), Crystal defects: Point, Line, Interstitial and Volume, Primary and secondary bonding in materials.

Constitution of Alloys: Necessity of Alloying, Gibbs's phase and Hume Rothery rule, Iron Iron-carbide diagram and its microstructural aspects.

Module 2: HEAT TREATMENT OF STEELS

(09 Periods)

Annealing, Normalizing, Tempering, Carburization and Hardening- Austempering, Martempering, Carburizing, Nitriding, Cyaniding, Carbo-Nitriding, Flame and Induction Hardening, Vacuum and Plasma

Hardening, Time-Temperature-Transformation Diagrams and Continuous Cooling Transformation Diagrams.

Module 3: FERROUS MATERIALS AND ALLOYS

(09 Periods)

Steels: Structure, properties, classifications and applications of plain steels, Specifications of steels, Structure, properties, classifications and applications of low alloy steels, Hadfield manganese steels, Stainless steel and Tool steels.

Cast iron: Structure, properties and applications of Gray cast iron, White cast iron, Malleable cast iron, Nodular cast iron and Alloy cast iron.

Module 4: NON-FERROUS MATERIALS AND ALLOYS

(09 Periods)

Structure, properties and applications of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Nickel and its alloys, Magnesium and its alloys, Refractory and Precious metals.

Module 5: CERAMICS, POLYMERS AND COMPOSITES MATERIALS

(09 Periods)

Ceramics: Classifications, Properties and Applications, Glass-ceramics, **Polymers:** Classification, Properties and Applications, Polymerization Reaction,

Composites: Classifications, Properties and Applications of Polymer matrix composites, Ceramic matrix composites, Metal matrix composites and Nanocomposites.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Laboratory experiments allow students to apply theoretical concepts and learn how to conduct experiments safely and effectively. Some examples of laboratory experiments include mechanical testing of materials, heat treatment of metals, and microscopy analysis of materials.
2. Materials characterization techniques such as X-ray diffraction, scanning electron microscopy, and transmission electron microscopy can provide valuable insights into the structure and properties of materials. Students can gain hands-on experience with these techniques by conducting experiments and analyzing the results.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXT BOOKS:

1. V. Raghavan, *Materials Science & Engineering*, Prentice Hall of India, 5th edition, 2004.
2. R. Balasubramaniam, Callister's, *Materials Science & Engineering*, John Wiley and sons, 2nd edition, 2014.

REFERENCE BOOKS:

1. Sidney H. Avner, *Introduction to Physical Metallurgy*, Tata McGraw Hill, 2nd edition, 1997.
2. George E Dieter, *Mechanical Metallurgy*, Tata McGraw Hill, 3rd edition, 2013.
3. Kodigre V D, *Material Science and Metallurgy*, Everest Publishing House, 31st edition, 2011.

VIDEO LECTURES:

1. <https://ocw.mit.edu/courses/materials-science-and-engineering/3-012-fundamentals-of->

materials-science-fall-2005/lecture-notes/

2. <https://nptel.ac.in/courses/116/104/116104045/>
3. https://www.youtube.com/watch?v=tsX-VYvkiJ8&list=PLJV_OG0NLkV8VRNFk-0AyDZz1pZym6V8j
4. <https://www.khanacademy.org/science/materials-science>

WEB RESOURCES:

1. <https://www.doitpoms.ac.uk/tplib/teachers.php>
2. <https://www.springer.com/journal/10853>
3. <http://dmse.mit.edu/>
4. <http://dmse.mit.edu/>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25LG201701	PERSONALITY DEVELOPMENT	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course gives awareness to students about the various dynamics of personality development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge in Self-Management and Planning Career
- CO2.** Analyze the functional knowledge in attitudes and thinking strategies
- CO3.** Learn and apply soft skills for professional success.
- CO4.** Function effectively as an individual and as a member in diverse teams
- CO5.** Communicate effectively in public speaking in formal and informal situations.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	2
CO4	1	1	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	2	2	3	-	3	-	-	3	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: **SELF-ESTEEM & SELF-IMPROVEMENT**

(09 Periods)

Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve

Yourself- Exercises- case studies

Module 2: DEVELOPING POSITIVE ATTITUDES

(09 Periods)

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes – Exercises- case studies

Module 3 SELF-MOTIVATION & SELF-MANAGEMENT

(09 Periods)

Show Initiative – Be Responsible Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies- Exercises- case studies

Module 4 GETTING ALONG WITH THE SUPERVISOR

(09 Periods)

Know your Supervisor – Communicating with your Supervisor – Special Communication with your Supervisor – What Should you Expect of Your Supervisor? – What your Supervisor expects of you - Moving Ahead Getting Along with your Supervisor- Exercises- case studies

Module 5 WORKPLACE SUCCESS

(09 Periods)

First Day on the Job – Keeping Your Job – Planning Your Career – Moving Ahead- Exercises- case studies

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. List out the self-improvements in you on the charts and explain in detail.
2. Discuss different famous personalities and their attitudes.
3. Describe different personalities with respect to self-motivation and self-management.
4. Imagine you are a supervisor and illustrate different special communications.
5. Assume and Interpret different experiences on the first day of your job.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXTBOOK:

1. Harold R. Wallace and L. Ann Masters, *Personal Development for Life and Work*, Cengage Learning, Delhi, 10th edition Indian Reprint, 2011. (6th Indian Reprint 2015)
2. Barun K. Mitra, *Personality Development and Soft Skills*, Oxford University Press, 2011.

REFERENCE BOOKS:

1. K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, 2nd Revised Edition, 2011.
2. Stephen P. Robbins and Timothy A. Judge, *Organizational Behaviour*, Prentice Hall, Delhi, 16th edition, 2014

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=6Y5VWB1i1es>
2. <https://www.youtube.com/watch?v=H9qA3inVMrA>

WEB RESOURCES:

10. <https://www.universalclass.com/.../the-process-of-perso...>
11. <https://www.ncbi.nlm.nih.gov/pubmed/25545842>
12. <https://www.youtube.com/watch?v=Tuw8hxrFBH8>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CE101703	PLANNING FOR SUSTAINABLE DEVELOPMENT	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on sustainable development, environmental impact, sustainable policies, governance, theories and strategies, media and education for sustainability.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Compare sustainable development theories in national and global context to protect the society and environment.
- CO2** Analyze the unforeseen environmental impacts on sustainable development to protect the society and environment.
- CO3** Analyze policies and governance for sustainable development considering ethics, economics, society and environment.
- CO4** Analyze systems and strategies for sustainable development using appropriate tools and techniques considering ethics, economics, society and environment.
- CO5** Analyze the role of media and education in sustainable development using appropriate tools and techniques considering ethics, society and environment besides communicating effectively.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	-	-	2	2	-	-
CO2	3	3	-	-	-	2	2	-	-
CO3	3	3	-	-	-	2	2	2	1
CO4	3	3	-	-	2	2	2	2	1
CO5	3	3	-	-	2	2	2	2	-

Course Correlation Mapping	3	3	-	-	2	2	2	2	1
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Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: SUSTAINABLE DEVELOPMENT

(09 Periods)

Definition and concepts of sustainable development, Capitalization of sustainability- National and global context; Sustainable development goals, Emergence and evolution of sustainability and sustainable development, Theories of sustainability, Case studies.

Module 2: ENVIRONMENTAL IMPACT

(09 Periods)

Climate change – Science, Knowledge and sustainability; Unforeseen environmental impacts on development, Challenges of sustainable development, Centrality of resources in sustainable development, Case studies.

Module 3: SUSTAINABLE POLICIES AND GOVERNANCE

(09 Periods)

Governance - Democracy and Eco-welfare; Global civil society and world civil politics, Civic environmentalism, Policy responses to sustainable development, Economics of sustainability, Social responsibility in sustainability, National action, ISO 14001: Environmental management system.

Module 4: SUSTAINABLE SYSTEMS AND STRATEGIES

(09 Periods)

Need for system innovation, Transition and co-evolution, Theories and methods for sustainable development, Strategies for eco-innovation, Ecological foot print analysis, Socio ecological indicators – Eco labels; Policy programmes for system innovation, Case studies.

Module 5: MEDIA AND EDUCATION FOR SUSTAINABILITY

(09 Periods)

Role of emerging media, Remarkable design and communication art, Activism and the public interest, Education for sustainability, Participation in decision making, Critical thinking and reflection, Case studies.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Submit a study report on the importance and implementation of United Nations sustainable goals 17 among all the ratified nations.
2. Submit a study report on any one case study that the challenges being faced during the sustainable development goals implementation.
3. Submit a study report on the social responsibility in implementation of sustainability concept.
4. Prepare and submit a report on any two case studies that how the eco labels put on their products shall make the consumers feel satisfaction over the sustainable development.

5. Submit a report on the communication art and activism through media which makes the public interest that helps to contribute towards sustainable development.

RESOURCES

TEXT BOOKS:

- 1 John Blewitt, *Understanding Sustainable Development*, Earth Scan Publications Ltd., 2nd Edition, 2008.
- 2 Jennifer A. Elliot, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 4th Edition, 2006.

REFERENCE BOOKS:

- 1 Peter Rogers, Kazi F Jalal and John A Boyd, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 2006.
- 2 Simon Dresner, *The Principles of Sustainability*, Earth Scan Publications Ltd., 2nd Edition, 2008.
- 3 Peter Bartelmus, *Environment Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, 3rd Edition, 2003.
- 4 Gabriel Moser, Enric Pol, Yvonne Bernard, MiriliaBonnes, Jose Antonio Corraliza and Maria Vittoria Giuliani, *People Places and Sustainability*, Hogrefe& Huber Publishers, 2nd Edition, 2003.

VIDEO LECTURES:

- 1 <https://www.youtube.com/watch?v=a5i9RVyhBtc>
- 2 https://www.youtube.com/watch?v=fH_iIVPTujE
- 3 <https://www.youtube.com/watch?v=c2eNrFK5M8I>
- 4 <https://www.youtube.com/watch?v=qfOgdj4Okdw>
- 5 https://www.youtube.com/watch?v=_qLqLJq2954

WEB RESOURCES:

- 1 https://civil.gecgudlavalleru.ac.in/images/admin/pdf/1594706742_III-II-OE-Planning-for-Sustainable-Development.pdf
- 2 https://www.academia.edu/26950843/Sustainable_Development_in_Practice_Case_Studies_for_Engineers_and_Scientists
- 3 https://www.academia.edu/24286208/The_Role_of_the_Professional_Engineer_and_Scientist_in_Sustainable_Development
- 4 https://byjusexamprep.com/liveData/f/2022/8/sustainable_development_goals_upsc_notes_43.pdf
- 5 https://sdgs.un.org/sites/default/files/2020-10/course%201_Peter_Tarr%20%20-%20%20Compatibility%20Mode.pdf

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EC101705	PRINCIPLES OF COMMUNICATION ENGINEERING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Fundamentals of Communications; Analog and digital - modulation and Demodulation Techniques; Information theory and coding.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze different Analog and Digital Modulation Schemes to improve bandwidth and power efficiency.
- CO2.** Analyze Pulse Analog modulation Schemes.
- CO3.** Understand the concepts of Baseband & Passband Digital Transmission.
- CO4.** Analyze various error detection and correction codes for reliable transmission.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-
Course Correlation Mapping	3	3	2	1	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: ANALOG MODULATION

(13 Periods)

Block diagram of Electrical Communication System, Types of Communications, Need for Modulation, Types of Amplitude Modulation- AM, DSBSC, SSBSC, Power and BW requirements, Generation of AM, DSBSC, SSBSC. Detection of AM - Diode detector, Product demodulation for DSBSC & SSBSC. Frequency & Phase Modulations.

Module 2: PULSE MODULATION

(07 Periods)

Elements & Advantages of Digital communication systems, PAM, Regeneration of Base band Signal, PWM and PPM, Time Division Multiplexing, Frequency Division Multiplexing.

Module 3: BASE BAND DIGITAL TRANSMISSION**(07 Periods)**

Pulse Code Modulation- Advantages, Block diagram of PCM, Quantization, effect of Quantization, Quantization error. DM, ADM and Comparison of PCM,DM & ADM.

Module 4: PASS BAND DIGITAL TRANSMISSION**(10 Periods)**

Digital Binary Schemes-ASK, FSK, PSK, DPSK, QPSK, Modulation and Demodulation - Coherent and Non-coherent techniques.

Module 5: INFORMATION THEORY AND CODING**(08 Periods)**

Concept of Information, Entropy and Rate of Information, Coding efficiency, Shannon-Fano and Huffman Coding.

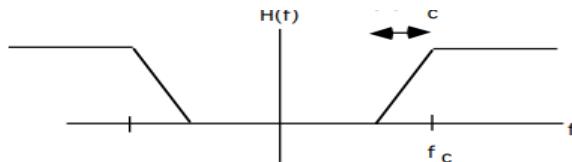
Error Correction and Detection Codes- Linear Block Codes, Cyclic Codes, Convolution Codes.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

- 1 Suppose that a non-linear device is available for which the output current i_0 and the input voltage v_i are related by: $i_0(t) = a_1 v_i(t) + a_3 v_3 i(t)$ where a_1 and a_3 are constants. Explain how this device may be used to provide(a) a product modulator (b) an amplitude modulator.
- 2 A voice signal occupying the frequency band 0.3 - 3.4 KHz is to be modulated onto a carrier wave of frequency 11.6 MHz. High pass filters such as the one shown below are available. Design a system to generate the USB wave using DSB modulators and these filters.



- 3 In a binary PCM system, the output signal to-quantizing noise ratio is to be held to a minimum of 40 dB. Determine the number of required levels, and find the corresponding output signal to quantizing-noise ratio.
- 4 A bipolar binary signal $S_i(t)$ is a +1V or -1V pulse during the interval (0, T). Additive white noise with power spectral density $\eta/2 = 10^{-5}$ W /kHz. W/Hz is added to the signal. Determine the maximum bit rate that can be sent with a bit error probability of $P_e \leq 10^{-7}$
- 5 A compact disc (CD) recording system samples each of two stereo signals with a 16-bit analog-to digital converter (ADC) at 44.1 kb/s.
 - a) Determine the output signal-to-quantizing-noise ratio for a full-scale sinusoid.
 - b) The bit Stream of digitized data is augmented by the addition of error-correcting bits, clock extraction bits, and display and control bit fields. These additional bits represent 100 percent overhead. Determine the output bit rate of the CD recording system.
 - c) The CD can record an hour's worth of music. Determine the number of bits recorded on a CD. For a comparison, a high-grade collegiate dictionary may contain 1500 pages, 2 columns per page, 100 lines per column, 8 words per line, 6 letters per word, and 7 b per letter on average. Determine the number of bits required to describe the dictionary, and estimate the number of comparable books that can be stored on a CD.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

- 1 R.P. Singh and S D Sare, *Communication Systems - Analog and Digital*, TMH, 2nd edition 2007.
- 2 Simon Haykin, *Communication Systems*, John Wiley, 2nd edition 2007.

REFERENCE BOOKS:

- 1 Herbert Taub & Donald L Schilling, *Principles of Communication Systems*, Tata McGraw-Hill, 3rd Edition, 2009.
- 2 Sham Shanmugam, *Digital and Analog Communication Systems*, Wiley-India edition, 2006.

VIDEO LECTURES:

- 1 <https://nptel.ac.in/courses/108/104/108104091/>
- 2 https://onlinecourses.nptel.ac.in/noc19_ee47/preview

WEB RESOURCES:

- 1 <https://studiousguy.com/basic-principles-of-communication/>
- 2 https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_modulation.htm

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EE101702	RELIABILITY AND SAFETY ENGINEERING	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on the fundamentals of reliability and safety engineering. The course emphasizes on various reliability measures used in assessing the performance of the system, evaluating the critical parameters of the network, and the techniques to assess the reliability of the system. The course also deals with safety management and measures in industrial and other hazardous environments.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** apply the various probability and statistics fundamentals into engineering systems to evaluate performance.
- CO2.** develop mathematical models for engineering networks/systems to evaluate the critical parameters for the reliability of a network/system.
- CO3.** analyze the time-dependent/independent characteristics of a repairable system and frequency durations techniques to assess the reliability
- CO4.** understand various safety management, policy, and planning strategies for personal and industrial safety.
- CO5.** understand various safety and hazard identification techniques and follow appropriate safety measures in industry and society.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	2	1	1	1	-
CO2	3	3	-	-	2	1	1	-	-
CO3	3	2	-	2	1	1	1	-	3
CO4	3	2	-	-	2	1	1	1	-
CO5	3	2	-	-	2	1	1	1	-
Course Correlation Mapping	3	2	--	2	2	1	1	1	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: FUNDAMENTALS OF RELIABILITY ENGINEERING (09 Periods)

Random variables, probability concepts, rules for probabilities of events. Probability density and distribution functions. Binomial distribution - Expected value and standard deviation for binomial distribution. Reliability functions, $f(t)$, $F(t)$, $h(t)$ - Relationship between these functions, Exponential density and distribution functions, expected value and standard deviation of exponential distribution. Measures of reliability - MTTF, MTTR, MTBF. Bathtub curve.

Module 2: NETWORK MODELING AND RELIABILITY EVALUATION (09 Periods)

Basic concepts - Evaluation of network reliability/unreliability, series systems, parallel systems, series - Parallel configuration systems. Redundant systems and its types. Evaluation of network reliability/unreliability using conditional probability method, tie-set and cut-set based approach, complete event tree and reduced event tree methods.

Module 3: MARKOV CHAIN AND MARKOV PROCESSES (09 Periods)

Basic concepts, stochastic transitional Probability matrix, time dependent probability evaluation, Limiting State Probability, Absorbing states. Modelling concepts - State space diagrams, time dependent reliability evaluation of single component repairable model, two component repairable model. Frequency and duration techniques.

Module 4: BASICS OF SAFETY CONCEPTS (08 Periods)

Introduction, goals, need for safety, history of safety movement – the evolution of modern safety concept, general concepts of safety management. Planning for safety- productivity, quality and safety, line and staff functions, budgeting for safety, safety policy.

Module 5: SAFETY TECHNIQUES AND APPLICATIONS (10 Periods)

Introduction to safety techniques, Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of the performance of supervisors on safety. Hazard identification techniques, components of safety audit, types of audit, audit methodology, and process of safety reporting. Applications of industrial Safety, environmental safety, health safety, electrical safety, fire safety.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. The students shall understand various IEEE reliability standards to be followed in the engineering systems for the evaluation of reliability and asses performance.
2. Should collect various engineering components assembled and their network models for evaluations of network reliability indices.
3. The students to visit a nearby power or process industry to know about various types of failures and repair performance of various engineering components and cause of replacements.
4. Should collect information about various safety/alert sign boards and the relative measures for a particular situation.
5. Should understand the standard practices followed during the maintenance/commissioning of the electrical apparatus in any industry following the various safety precautions.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Roy Billinton and Ronald N Allen, *Reliability Evaluation of Engineering Systems*, 2nd Edition, Springer, New York, 2013.
2. Frank R. Spellman, Nancy E. Whiting, *Safety Engineering: Principles and Practices*, 3rd Edition, Rowman & Littlefield, 2018.

REFERENCE BOOKS:

1. Charles E. Ebeling, *An introduction to reliability and maintainability engineering*, 2nd Edition Tata McGraw-Hill Education, 2010.
2. Dan Petersen, *Techniques of Safety Management: A Systems Approach*, 4th Edition American society of safety engineers, 2003.
3. Ajit Kumar Verma , Srividya Ajit , Durga Rao Karanki, *Reliability and Safety Engineering*, Springer London, 2016.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/105/108/105108128/>
2. <https://nptel.ac.in/courses/110/105/110105094/>
3. <https://www.youtube.com/watch?v=uutg8jKrL9w>
4. https://www.youtube.com/watch?v=_c-iZ2BAXPw
5. <https://www.youtube.com/watch?v=GeMCF3s5EDk>
6. <https://www.youtube.com/watch?v=xYWype7cxE>

WEB RESOURCES:

- 1 <https://ieeexplore.ieee.org/document/9353567>
- 2 <https://www.ualberta.ca/engineering/mechanical-engineering/research/reliability-and-safety.html>
- 3 <https://ieeexplore.ieee.org/document/9353567>
- 4 <https://www.taylorfrancis.com/books/edit/10.1201/9781003140092/industrial-liability-safety-engineering-dilbagh-panchal-mangey-ram-prasenjit-chatterjee-anish-kumar-sachdeva>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CE101704	REMOTE SENSING, GIS AND GPS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on photogrammetry, remote sensing, geographic information system, GIS spatial analysis. This course also examines remote sensing and GIS applications, global positioning system and its real-time applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Analyze photogrammetry and remote sensing to solve complex surveying problems using appropriate tools and techniques following the relevant guidelines and latest developments considering society and environment besides communicating effectively in graphical form.
- CO2** Analyze GIS to solve complex surveying problems using appropriate tools and techniques following latest developments besides communicating effectively in graphical form.
- CO3** Analyze GIS spatial analysis to solve complex surveying problems using appropriate tools and techniques following latest developments besides communicating effectively in graphical form.
- CO4** Analyze remote sensing and GIS applications to solve complex civil engineering problems using appropriate tools and techniques following the relevant guidelines and latest developments considering society, environment, sustainability and management principles besides communicating effectively in graphical form.
- CO5** Analyze global positioning system to solve complex surveying problems using appropriate tools and techniques considering society and environment besides communicating effectively in graphical form.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	-	2	2	1	1	1	1
CO2	2	3	-	-	2	1	1	-	1
CO3	2	3	-	2	2	1	1	-	1
CO4	2	3	-	-	2	1	1	1	1
CO5	2	3	-	-	2	1	1	-	1
Course Correlation Mapping	3	3	-	2	2	1	1	1	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: PHOTOGRAMMETRY AND REMOTE SENSING

(10 Periods)

Photogrammetry: Principle of photogrammetry, Types of aerial photographs, Planning and execution of photographic flights, Geometry of aerial photographs, Scale of aerial photographs and its determination, Stereoscopy, Ground control, Mosaics, Parallax measurements for height determinations, Latest developments in photogrammetry.

Remote Sensing: Elements of remote sensing, Electromagnetic spectrum, Energy resources, Physics of radiant energy, Energy interactions with earth surface features and atmosphere, Data acquisition platforms Spectral reflectance curves, Resolution; Spectral properties of water bodies, soil and vegetation; Sensors and platforms, Visual interpretation techniques.

Module 2: GEOGRAPHIC INFORMATION SYSTEM

(09 Periods)

GIS categories, Components of GIS, Fundamental operations of GIS, Spatial and non spatial data, Raster data and vector data, File management, Layer based GIS, Feature based GIS, Map projections, Latest developments.

Module 3: GIS SPATIAL ANALYSIS

(08 Periods)

Database models, Data storage, Vector data storage, Attribute data storage, Data manipulation and analysis, Integrated analysis of the spatial and attribute data - DTM/DEM, Softwares – Arc GIS, QGIS and Global mapper, Latest developments in GIS software.

Module 4: REMOTE SENSING AND GIS APPLICATIONS

(09 Periods)

Land use/Land cover classification, Rainfall-runoff studies, Flood and drought impact assessment and monitoring, Drainage morphometry, Watershed management for sustainable development, GIS based precision farming, GIS based natural resources management, Inland water quality survey and management, Regional and urban planning and management, GIS based highway alignment, GIS based traffic congestion analysis, GIS for public health – Case Studies.

Module 5: GLOBAL POSITIONING SYSTEM

(09 Periods)

Global Positioning System (GPS) – Fundamental concepts, Components of GPS – Space segment, Control segment, User segment, Reference systems, Satellite orbits; Classification of GPS receivers, GPS observations, GPS measurements and accuracy of GPS, Applications.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Sound composing project: In this assignment, Select area and collect the geometry of aerial photographs and analyze the views.
2. Visit any meteorological department and understand about rain gauges and collect, analyse the data
3. Visit Geographical Information Systems Laboratory and understand about GIS and GPS Systems

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Shivam, P. and Shashikanth, T., *A Text Book of Basic Concept of Remote Sensing, GPS and GIS*, Sankalp Publication, 2020.

2. Anji Reddi, M., *A Text Book of Remote Sensing and Geographical Information Systems*, B. S. Publications, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Bhatta, B., *Remote Sensing and GIS*, Oxford University Press, 2nd Edition, 2011.
2. Lillesand, T. M., Kiefer, R. W. and Chipman, J. W., *Remote Sensing and Image Interpretation*, John Wiley and Sons (Asia) Pvt. Ltd., 7th Edition, 2014.
3. Chandra, A. M. and Ghosh, S. K., *Remote Sensing and Geographic Information System*, Narosa Publishing House, 2nd Edition, 2015.
4. Panigrahi, N., *Geographical Information Science*, University Press, 2nd Edition, 2013.
5. Peter A. Burrough and Rachael Mc Donnell, *Principles of Geographical Information Systems*, Oxford University Press, 2nd Edition, 2014.

VIDEO LECTURES:

1. <http://nptel.ac.in/courses/105/107/105107206/>
2. <https://syslab.ceu.edu/videos/geospatial-technologies>

WEB RESOURCES:

1. Digital Audio Signal Processing: <https://www.udemy.com/course/introduction-to-geospatial-technologies-and-arcgis-interface/>
2. Learn Audio Editing - for Beginners: https://www.youtube.com/watch?v=xGgaV9r_kH8
3. <https://storymaps.arcgis.com/stories/47e984aae614442cb80aa40d121b5fe>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CE101705	SMART CITIES	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a discussion on smart city and infrastructure, smart governance, smart mobility, smart economy, smart environment, smart buildings, smart energy, smart water, smart living, smart people and case studies.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand the concept of smart cities and its infrastructure for ensuring safety and sustainability using appropriate techniques and management principles in India besides lifelong learning.
- CO2** Analyse smart cities to solve problems associated with mobility and governance for the growing population by ensuring safety and sustainability, management using appropriate standards in India besides lifelong learning.
- CO3** Analyse smart cities to solve problems associated with economy and environment for ensuring safety and sustainability, management using appropriate techniques and standards in India besides lifelong learning.
- CO4** Analyse buildings, energy and water resource systems in smart cities to solve problems associated with the growing population for ensuring safety and sustainability, management using appropriate standards in India besides lifelong learning.
- CO5** Analyse the smart cities to solve complex problems associated with people and living systems for ensuring safety and sustainability, management using appropriate techniques in India besides lifelong learning.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	2	3	1	2	2
CO2	3	3	-	1	2	3	3	2	2
CO3	3	3	-	1	2	3	3	2	2
CO4	3	3	-	1	2	3	3	3	2
CO5	3	3	-	1	2	3	3	2	2
Course Correlation Mapping	3	3	-	3	2	2	2	2	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: SMART CITY AND INFRASTRUCTURE

(09 Periods)

Smart city - Concept, Objectives, History, Need; Key trends in smart city development, Government of India – Policy for smart city.

Infrastructure: Smart city infrastructure – Components, Challenges; Managing - Principle stakeholders, Infrastructure in India and World, Dimensions of smart cities, Global standards and performance benchmarks, Practice codes, Infrastructure development, Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city, Various types of infrastructure systems, Infrastructure assessment.

Module 2: SMART GOVERNANCE AND SMART MOBILITY

(09 Periods)

Smart Governance: Definition, smart governance to citizens, Industries and commerce, Smart governance within government, Emerging trends in smart governance, Future of smart governance, Guidelines and standards for smart governance; IOT and ICT Application – Broadband city, Use of sensors, Intelligent city governance.

Smart Mobility: Intelligent transportation systems, Accessibility, Smart vehicles and fuels, GIS, GPS, Navigation system, Public transport, Traffic safety management, Logistics flows in cities, Mobility services, E-ticketing.

Module 3: SMART ECONOMY AND SMART ENVIRONMENT

(09 Periods)

Smart Economy: City branding, Market places and crowd funding, Innovation, entrepreneurship – E-business, E-commerce, Online integrated business platforms and networks; Local and global interconnectedness, Productivity, Flexibility of labour market.

Smart Environment: Network and environmental monitoring, Energy efficiency, Urban planning and urban refurbishment, Smart buildings and building renovation, Resource management, Environmental protection.

Module 4: SMART BUILDINGS, SMART ENERGY AND SMART WATER

(09 Periods)

Smart Buildings: Definition, Sustainable city – A green approach, Housing, Sustainable green building - Solar energy for smart city, Waste water management, solid waste management, 3Rs Policy, Green ratings.

Smart Energy: Current energy demand, Alternate energy sources, Renewable energy, Production, Solar energy, Wind energy, Energy from solid waste, Applications, Challenges in smart energy

Smart Water: Storage and conveyance system of water, Sustainable water and sanitation, Sewage systems, Flood management, Conservation system.

Module 5: SMART LIVING, SMART PEOPLE AND CASE STUDIES

(09 Periods)

Smart Living: Definition, Cultural facilities, World-class education, Tourist attractions, World-class hospitals, Latest technologies, Quality housing, Community and urban life management, Social cohesion.

Smart People: Definition, Human development index, Level of qualification, Graduate enrolment ratio, Lifelong learning, ICT Skills, Quality of smart people – Flexibility, Creativity to contribute to education, Democratic nature; Personality dimensions – Extroversion, Agreeableness, Consciousness, Emotional Stability, Open to experience.

Case Studies: Helsinki – Finland; Zurich - Switzerland; Oslo - Norway; Amsterdam - The Netherlands; New York - United States; Seoul (World's first Smart City) - South Korea.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Prepare a report on smart city infrastructure for south Indian cities.
2. Prepare a review on need for changes in transportation and governing policies in India.
3. Write a report on energy conservation and economy stability in world's first smart city.
4. Write a report on need and technologies to be adopted for green buildings in a smart city.
5. Prepare a case study report on Hyderabad, Telangana.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Li Xian Yi, *Smart City on Future Life - Scientific Planning and Construction*, Posts and Telecom Press, 2012.
2. Arpan Kumar Kar, Manmohan Prasad Gupta, P. Vigneswara Ilavarasan and Yogesh K. Dwivedi, *Advances in Smart Cities*, CRC Press, Taylor & Francis Group, Boca Raton, 2017.

REFERENCE BOOKS:

1. Nicos Komninos, *The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities)*, Routledge Taylor & Francis Group, London, 2015.
2. Eleonora Riva Sanseverino, *Smart Rules for Smart Cities – Managing Efficient Cities in Euro-Mediterranean Countries*, Springer for innovation, Springer, Italy, 2014.
3. Smart Cities Mission: A Step Towards Smart India, National Portal of India
4. Anthony M. Townsend, *Smart Cities – Big Data, Civic Hackers and The Quest for a New Utopia*, W. W. Norton & Company, Inc., New York, 2013.
5. IoT Technician (Smart City) – MHRD, Govt. of India, 2nd Edition, 2022.

VIDEO LECTURES:

1. City of the Future: Singapore – Full Episode | National Geographic - YouTube
2. Integrated Waste Management for a Smart City - Course (nptel.ac.in)

WEB RESOURCES:

1. Smart Cities (nationalgeographic.org)
2. NPTEL :: Civil Engineering - NOC: Sustainable Materials and Green Buildings
3. Smart cities (europa.eu)
4. Top 7 Smart Cities in the World in 2023 (earth.org)

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EC101706	SMART SENSORS FOR ENGINEERING APPLICATIONS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on Basics of sensors, characteristics of sensors and their responses; Smart sensors for Engineering, Science and Health Monitoring Applications; Applications of smart sensors and advancements in sensing Techniques.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyse the characteristics of transducers and estimate the response of sensors.
- CO2.** Understanding the working of various sensors in the context of their specialised domains.
- CO3.** Apply smart sensors for real time applications.
- CO4.** Apply the advanced techniques to smart sensors to provide solution to real time applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	-	-	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: CONCEPTS OF SENSORS

(08 Periods)

Introduction to sensors and transducers. Need for sensors in the modern world. Different fields of sensors based on the stimuli, various schematics for active and passive sensors. Static and dynamic characteristics of sensors. **zero, I and II order sensors:** Response to impulse, step, ramp and sinusoidal inputs. Environmental factors and reliability of sensors.

Module 2: SENSORS IN ENGINEERING

(07 Periods)

Physical principles of sensors, Electric Sensors: Resistive, Capacitive, Inductive. Piezoelectric sensor. Photo elastic sensors, Fluid Mechanic sensors.

Module 3: HUMAN AND BIOMIMETIC SENSORS

(10 Periods)

Human sensors: vision, Taste and smell, Hearing, Somatic, Biomimetic Sensors, Electrochemical, Thermoelectric sensors, Optic sensors.

Module 4: APPLICATIONS OF SMART SENSORS

(11 Periods)

WSN Based Physiological Parameters Monitoring System: Measurement of Human Body Temperature. Intelligent Sensing System for Emotion Recognition: Aim of the Emotion Recognition System, Development of Intelligent Sensing System for Emotion Recognition. WSN Based Smart Power Monitoring System.

Module 5: ADVANCEMENTS IN SENSING TECHNOLOGY

(09 Periods)

Ecological Monitoring Using Wireless Sensor Networks: Overview, Challenges, and Opportunities.

Development of an Embedded System-Based Gateway for Environmental Monitoring in Wild Fields. Advancements in Structural Health Monitoring.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Build a wireless sensor system for Environmental pollution monitoring.
2. Design a smart temperature measurement system using required accessories.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Patrick F Dunn, *Fundamentals of sensors for engineering and science*, CRC Press, 2012.
2. Subhas C. Mukhopadhyay, Krishanthi P. Jayasundera, and Anton Fuchs, *Smart Sensors, Measurement and Instrumentation*, Springer, 2013.

REFERENCE BOOKS:

- 1 Subhas Chandra Mukhopadhyay, *Intelligent Sensing, Instrumentation and Measurements*, Springer, Kluwer Academic Publishers, 2013.
- 2 Henry Bolte, *Sensors – A Comprehensive Sensors*, John Wiley.

VIDEO LECTURES:

- 1 <https://www.youtube.com/watch?v=oRydUfgMdgA>
- 2 https://onlinecourses.nptel.ac.in/noc22_ee36/

WEB RESOURCES:

1. <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1199&context=nasapub#:~:text=The%20smart%20materials%20examined%20include,%2C%20magneto%2Doptical%20materials%2C%20and>
2. <https://www.youtube.com/watch?v=q8UuRkOQ9A0>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8433768/>
4. <https://www.mdpi.com/1424-8220/21/17/5890>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EE101703	SUSTAINABLE ENERGY SYSTEMS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course designed emphasizes the operating principle of a range of non-conventional energy resources, energy harvesting and conversion principles and key performance characteristics. The energy conversion technologies will include energy conversion from, Solar, Wind, Ocean, Biomass, Geothermal and Fuel cells. The course also emphasizes on various types of hybrid energy storage systems with their relative advantages and disadvantages.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand the fundamental concepts of renewable energy sources and their endurance for sustainability.
- CO2** Understand the various methods of harvesting solar energy, energy conversion principles, and operational aspects and environmental impacts of solar technologies.
- CO3** Understand the various methods of harvesting wind energy, conversion principles, operational aspects, and environmental impacts of wind energy systems.
- CO4** Understand the various methods of harvesting ocean energy, Biomass energy and geothermal energy, energy conversion technologies, operational aspects, and their impacts on the environment.
- CO5** Understand the principle of harvesting energy from fuel cells and the operational aspects of hybrid energy storage systems.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	--	2	2	-	1
CO2	3	-	-	-	2	2	2	-	1
CO3	3	-	-	-	2	2	2	-	1
CO4	3	-	-	-	2	2	2	-	1
CO5	3	-	-	-	2	2	2	-	1
Course Correlation Mapping	3	-	-	-	2	2	2	-	1

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO SUSTAINABLE ENERGY SOURCES

(07 Periods)

Impact of conventional sources on Environment—acid rain, ozone layer depletion, Global warming, greenhouse effect and nuclear waste; Limitation of fossil fuels; Renewable energy sources; Renewable sources and their sustainable development.

Module 2: ENERGY FROM SOLAR

(10 Periods)

Introduction, solar radiation, Measurement of solar radiation—Pyranometer; Solar energy collectors; Flat plate collectors— Liquid and air (non-porous) types; Focusing type— Parabolic and Point types; Solar photovoltaic system— PV cell and its types, Configuration of solar panel, PV system; Applications: Solar pump, Solar water heater

Module 3: ENERGY FROM WIND

(08 Periods)

Introduction, power extraction from the wind, Wind turbines— Horizontal axis wind turbine—Propeller type and Vertical axis wind turbine— Darrieus rotor type; Basic components of wind energy conversion systems, Applications: Energy storage, Water pumping; Environmental impacts.

Module 4: ENERGY FROM OCEAN, BIOMASS AND GEOTHERMAL RESOURCES

(12 Periods)

Energy from ocean: Introduction, ocean thermal energy conversion (OTEC): Open and closed cycle power plants; Tidal energy: Schematic diagram of tidal power plant; Advantages and disadvantages.

Energy from Biomass: Introduction, biomass conversion technologies-direct, Thermochemical and Biochemical conversions; Biogas generation—Anaerobic digestion process.

Geothermal energy: Introduction, Geothermal resources, Geothermal power plants— Vapour dominated and liquid dominated; Environmental issues.

Module 5: FUEL CELLS AND HYBRID ENERGY SYSTEMS

(08 Periods)

Fuel Cells: Introduction, principle and operation of fuel cell, classification of fuel cells, advantages and disadvantages of fuel cells.

Hybrid energy systems: Need for hybrid systems, configuration and coordination, Block diagram approach of Stand-alone PV-wind system, PV-Diesel and Wind-diesel; energy storage systems — Ultra capacitors, SMES, Battery.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. The students shall visit a solar power plant, understand the operational aspects and should prepare a technical report on the plant visited.
2. The students shall visit a wind farm, understand the operational aspects, and should prepare a technical report on the plant visited.
3. The students shall visit a bio-mass energy conversion plant, understand the operational aspects and should prepare a technical report on the plant visited.
4. The students shall prepare a technical report on the need of a hybrid plant and find new avenues for a new hybrid system.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Rai, G.D., *Non-conventional Energy Sources*, Khanna Publishers, New Delhi, 2017.
2. G.N. Tiwari and M.K. Ghosal, *Renewable energy resources: Basic principles and applications*, Alpha Science International Ltd., 2005.

REFERENCE BOOKS:

1. JhonTwidell and Tony Wier, *Renewable Energy Resources*, Taylor & Francis, 2nd edition, London and Newyork, 2006.
2. K.M. Mittal, *Non-conventional Energy Systems-Principles, Progress and Prospects*, Wheeler Publications, 1997.
3. S.Rao, Dr.B.B. Parulekar, *Energy Technology*, Third edition, Khanna Publications, 2013.
4. R. K. Rajput, *A textbook of power system engineering*, Laxmi publications (P) Ltd, 2016

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/103103206>
2. <https://nptel.ac.in/courses/121106014>
3. <https://youtu.be/mh51mAUexK4>
4. <https://youtu.be/UW4HYJ36q0Y>

WEB RESOURCES:

1. www.mnre.gov.in
2. www.ireda.in

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CS101702	WEB DESIGN FUNDAMENTALS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course is designed to introduce the student to the technologies and facilities of web design: CSS, javascript, and jquery. Students will understand the web design process and use these software technologies together to produce web design projects.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the fundamentals of HTML 5 and the principles of web design.
- CO2.** Construct basic websites using HTML and Cascading Style Sheets.
- CO3.** Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.
- CO4.** Learn how to use HTML5 and other Web technologies to develop interactive and responsive web pages.

CO-PO Mapping Table

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	-	-	-	-	-	-
CO2	3	3	-	-	-	-	2	-	-
CO3	3	3	3	-	-	-	-	-	2
CO4	2	3	3	-	-	-	-	2	-
Course Correlation Mapping	3	3	3	-	-	-	2	2	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION

(09 Periods)

Elements – Data types - Working with Text - Arranging Text - Displaying Lists - VAR Element - BDO Element - SPAN Element – DIV Element.

Module 2: LINKS AND URLs

(09 Periods)

Hyperlinks – URLs - Linking to a Mail System - Creating Tables - Inserting Images in a Web Page – Colors – Form Elements - Multiple-Choice Elements – Multimedia

Module 3: DYNAMIC HTML**(09 Periods)**

Features of JavaScript - Programming Fundamentals - JavaScript Functions, Events, Image Maps, and Animations – JS Objects - Document Object - Validation, Errors, Debugging, Exception Handling, and Security

Module 4: CASCADING STYLE SHEET**(09 Periods)**

CSS Syntax - CSS Selectors - Backgrounds and Color Gradients - Fonts and Text Styles - Creating Boxes and Columns - Displaying, Positioning, and Floating an Element - Table Layouts - : Effects, Frames, and Controls in CSS

Module 5: ADVANCED FEATURES OF HTML5**(09 Periods)**

Creating Editable Content - Checking Spelling Mistakes - Custom Data Attributes - Client-Side Storage - Drag and Drop Feature - Web Communication -**jQuery** - Fundamentals of jQuery - Callback Functions - jQuery Selectors - jQuery Methods to Access HTML Attributes.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Design a blog layout that includes header, navigation menu, content area, sidebar. Apply appropriate styling to each section.
2. Develop a java script based quiz that presents MCQs to the user and provides immediate feedback on their answers. Keep track of the score and display the final results at the end.
3. Build a web page that displays an image gallery. Each image should be a clickable link that opens the image in a larger view when clicked.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES**TEXT BOOKS:**

1. DT Editorial Services, *HTML 5 Black Book*, Dream tech Press, 2nd Edition, 2016.

REFERENCE BOOKS:

1. Jennifer Niederst Robbins, *HTML5 Pocket Reference*, O'Reilly, 5th Edition, 2018.
2. Ben Frain, *Responsive Web Design with HTML5 and CSS3*, Packt, 2nd Edition, 2020.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=h_RftxdJTzs
2. <https://www.youtube.com/watch?v=dlkWNdnO8ek>

WEB RESOURCES:

1. <https://www.w3schools.com/html/>
2. <https://www.w3schools.com/css/>

3. <https://www.geeksforgeeks.org/web-technology/>
4. <https://www.smashingmagazine.com/2021/03/complete-guide-accessible-front-end-components/>
5. <https://css-tricks.com/>
6. <https://davidwalsh.name/css-optional>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25SS101707	INDIAN KNOWLEDGE SYSTEM IN SCIENCE	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course aims to raise awareness among students about the diverse aspects of the Indian Knowledge System in the context of science.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Understand a sense of rootedness and pride in India, along with an appreciation for its rich, diverse, ancient, and modern culture, knowledge systems, and traditions.
- CO2** Demonstrate the rich scientific and technological heritage of the country.
- CO3** Analyse the Indian concept of multidisciplinary learning systems, integrating them with modern science.
- CO4** Demonstrate the importance of intellectual property rights in safeguarding Indian knowledge.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	2
CO4	1	1	-	-	-	-	-	3	3
Course Correlation Mapping	2	2	3	-	3	-	-	3	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: ANCIENT PHILOSOPHY OF KNOWLEDGE

(09 Periods)

Vedas, Vedangas, sutras – Gurukulparampara

Module 2: ASTRONOMY IN INDIA**(12 Periods)**

Astronomy in India: The Beginnings of Indian Astronomy - The Early Historical Period-The Siddhāntic Era - The Kerala School - Aryabhatta - Varahamihira- Bhaskara I – Brahmagupta- Bhaskara II – Brief notes on Astronomical instruments

Module 3: CHEMISTRY IN INDIA**(12 Periods)**

Early Chemical Techniques, Atomism in Vaiśeṣika - Rishi Kanad- Nagarjuna- Al-Bīrūnī', Vāgbhaṭa- Sushruta- Carak Metallurgy in India - Definition, Metallurgy in Harappan Civilization, Metallurgy of Gold- Copper-Zinc- Bronze - Iron and steel.

Module 4: DEVELOPMENTS IN MATHEMATICS**(12 Periods)**

Number systems- Geometry- works of Pingala- Baudhayana- Jaina Mahavira-Sridharacharya – Madhava Siddhanthas and Calender systems

Total Periods: 45**EXPERIENTIAL LEARNING**

- 1 List out the aspects of ancient philosophy of the Vedas on the charts and explain in detail.
- 2 Discuss different astronomical instruments.
- 3 Describe different metals with respect to civilizations.
- 4 Imagine you are a mathematician and illustrate different number systems.
- 5 Assume and interpret different siddhanthas and calendar systems.

RESOURCES**TEXTBOOK:**

- 1 "Indian Knowledge Systems": by ParthaPratim Ray (2024 edition).
- 2 "Introduction to Indian Knowledge System: Concepts and Applications": by B. Mahadevan and others (various editions available, with a 2022 edition noted).

REFERENCE BOOKS:

1. Concise History of Science in India – Bose, Sen &Subbarayappa- INSA Publications (2009 edition)
2. Encyclopedia of Classical Indian Sciences- Roddam Narasimha, Universities Press, 2007.

VIDEO LECTURES:

- 1 <https://iksindia.org/lectures-and-videos.php>
- 2 <https://www.youtube.com/watch?v=D3f3jIcEZho>

WEB RESOURCES:

- 1 <https://nep.puchd.ac.in/iks.pdf>
- 2 <https://www.millenniumassessment.org/documents/bridging/papers/balasubramian.a.pdf>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25SS101708	INTRODUCTION TO INDIAN KNOWLEDGE SYSTEMS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: The course introduces students to key areas of the Indian Knowledge System (IKS), such as research methods, astronomy, literature and arts, agriculture and food, Ayurveda, and architecture.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1** Demonstrate the various pramanas used in the Indian Knowledge System.
- CO2** Analyse fields of IKS related to Astronomy, Arts, Ayurveda, and Architecture.
- CO3** Understand the Earth and Atmosphere related specifically to earthquakes, clouds, rainfall, soil, agriculture, and food science
- CO4** Explore different fields of study in IKS further with the references and the resources provided during the course.
- CO5** Analyse various materials in āyurveda, rasaśāstra, and vāstuvidyā

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	2
CO4	1	1	-	-	-	-	-	3	3
CO5	1	1	-	-	-	-	-	3	3
Course Correlation Mapping	2	2	3	-	3	-	-	3	3

Correlation Levels: *3: High; 2: Medium; 1: Low*

COURSE CONTENT

Module 1: ASTRONOMY AND MATHEMATICS

(10 Periods)

Introduction to various fields in the traditional Indian Knowledge system. Methods and sources - Ancient Indian Observational astronomy. Foundation concepts - nakṣatra, graha, time units, phenomena like meteors, eclipses- Mathematical thinking - numerical and spatial thinking, śulbasūtra, zero, sundials, water clock, time measurement.

Module 2: LANGUAGE, LITERATURE AND ART**(10 Periods)**

Formation of words in sāṃskṛta and some ideas from Pāṇini and Patañjali. Technical words and examples of their usage- Music Vedic chants, sāma, some concepts in ancient treatises like nāradīyaśikṣā, nāṭyaśāstra. Basics of related concepts like dance, meter and rasa in poetry.

Module 3: EARTH AND ATMOSPHERE**(05 Periods)**

Anomalous phenomena, Earthquakes, clouds, rainfall, soil, agriculture, and food science

Module 4: ARCHITECTURE AND CIVIL ENGINEERING**(10 Periods)**

Sindhu-Sarasvatī cities, description in purāṇa, arthaśāstra. A glance at select texts like nāradaśilpa, Mayamata, and mānasāra.

Module 5: MATERIAL SCIENCE**(10 Periods)**

Knowledge and use of various materials in āyurveda, rasaśāstra and vāstuvidyā.

Total Periods: 45**EXPERIENTIAL LEARNING**

- 1 List out the aspects of astronomy and mathematics on the charts and explain in detail.
2. Discuss different technical words and examples of their usage
3. Prepare a poster of anomalous phenomena of Earth and the atmosphere.
4. Demonstrate the role of architecture in the modern world.
5. Illustrate how Materials science can draw upon principles from physics, chemistry, and engineering to understand and manipulate materials.

RESOURCES**TEXTBOOK:**

1. Introduction to Indian Knowledge System - A Textbook for UG Students as per NEP 2020 (English, Paperback, Dr. Rohidas Nitonde).
2. "Introduction to Indian Knowledge System: Concepts and Applications": by B. Mahadevan and others (various editions available, with a 2022 edition noted).

REFERENCE BOOKS:

1. **Indian Knowledge System Principles and Practices Hardcover -Big Book, 18 December 2024 by Dr. Ajay Kumar Singh.**
2. Encyclopedia of Classical Indian Sciences- Roddam Narasimha, Universities Press, 2007.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=Gexiwsa7Gc0>
2. <https://www.youtube.com/watch?v=D3f3jIcEZho>

WEB RESOURCES:

1. <https://nep.puchd.ac.in/iks.pdf>
2. <https://www.millenniumassessment.org/documents/bridging/papers/balasubramian.a.pdf>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25LG101702	QUANTITATIVE APTITUDE AND VERBAL ABILITY	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course explores essential quantitative, verbal, and analytical reasoning skills for competitive exams and placements. It covers arithmetic, algebra, geometry, data interpretation, probability, and logical problem-solving. Verbal modules focus on grammar, vocabulary, reading comprehension, and critical reasoning techniques.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1. Demonstrate knowledge of number systems, percentages, ratios, and averages to solve real-time quantitative problems.**
- CO2. Apply algebraic techniques, progressions, and geometric concepts to compute and analyze mathematical scenarios.**
- CO3. Utilize combinatorics, probability, and data interpretation for decision-making under constraints.**
- CO4. Apply core grammar rules, sentence structures, reading comprehension, and critical reasoning techniques to communicate effectively.**

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	2	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-
CO3	3	3	2	3	2	-	-	-	-
CO4	3	2	2	2	2	-	-	-	3
Course Correlation Mapping	3	2	2	3	2	-	-	-	3

Correlation Levels: **3: High; 2: Medium; 1: Low**

COURSE CONTENT

Module 1: NUMBER SYSTEMS, PERCENTAGES, RATIOS & AVERAGES (9 Periods)

Number system, power cycle, remainder cycle, factors, multiples, HCF, LCM, Percentages, fraction-to-decimal conversions, increase/decrease calculations, simple and compound interest, Ratio, proportion, variation, problems on ages, profit and loss vocabulary, partnership, cost/selling price, Averages, weighted averages, mixtures and alligations.

Module 2: ALGEBRA, PROGRESSIONS, GEOMETRY (9 Periods)

Logarithms, rules and simplifications, solving quadratic equations, Arithmetic and geometric progressions, nth term, sum formulas, Geometry and mensuration, triangles, circles, area, perimeter, volume, surface area, Time and work, efficiencies, pipes and cisterns, division of wages, Speed, distance, relative motion, trains, boats and streams, races.

Module 3: COMBINATORICS, PROBABILITY, AND DATA INTERPRETATION (9 Periods)

Permutation and combination, counting principles, factorials, arrangements, selections, Probability concepts, events, rules of probability, real-life applications, Data interpretation from tables, pie charts, bar graphs, Data sufficiency techniques, evaluating adequacy of given data, Basic logical reasoning within quantitative problem-solving.

Module 4: CORE VERBAL GRAMMAR AND SENTENCE STRUCTURE (9 Periods)

Sentence correction, subject-verb agreement, modifiers, parallelism, tenses, comparisons, Articles and prepositions, omission rules, compound structures, interrogatives, Active and passive voice, direct and indirect speech rules, Sentence completion, para-jumbles, context clues, logical connectors, Vocabulary building, synonyms, antonyms, word usage, analogies.

Module 5: READING COMPREHENSION AND CRITICAL REASONING (9 Periods)

Reading comprehension types, speed reading, tone/inference-based questions, Critical reasoning – arguments, assumptions, conclusions, strengthen/weaken/inference, Word roots, prefixes, suffixes, sentence structure clues, Logical structuring of arguments, spotting fallacies, Application of reasoning in RCs, data-based questions, verbal puzzles.

Total Periods: 45

EXPERIENTIAL LEARNING

1) NUMBER SYSTEMS, PERCENTAGES, RATIOS & AVERAGES

A trader has 3 varieties of rice 13529 kg, 9617 kg, 7987 kg by weights. Find the minimum number of bags of equal size in which he can store the rice without mixing.

- a) 163
- b) 191
- c) 246
- d) 212

2) NUMBER SYSTEMS, PERCENTAGES, RATIOS & AVERAGES

The ratio of the ages of A and B is 3:4. After 5 years, the ratio becomes 4:5. What are their present ages?

- a) 15 and 20
- b) 18 and 24
- c) 30 and 40
- d) 20 and 25

3) ALGEBRA, PROGRESSIONS, GEOMETRY

Solve for x:

If $2x + 3 = 7$, then what is the value of x?

- a) 1
- b) 2
- c) 3
- d) 4

4) ALGEBRA, PROGRESSIONS, GEOMETRY

The perimeter of a rectangle is 36 cm. If the length is 10 cm, what is the width?

- a) 8 cm
- b) 9 cm
- c) 6 cm
- d) 7 cm

5) COMBINATORICS, PROBABILITY, AND DATA INTERPRETATION

A card is drawn at random from a standard deck of 52 playing cards. What is the probability that it is a red king?

- a) 1/13
- b) 1/26
- c) 1/52
- d) 2/13

6) COMBINATORICS, PROBABILITY, AND DATA INTERPRETATION

The number of students in five different classes is as follows:

Class A – 40, Class B – 35, Class C – 50, Class D – 45, Class E – 30.

What is the average number of students per class?

- a) 38
- b) 40
- c) 42
- d) 45

7) CORE VERBAL GRAMMAR AND SENTENCE STRUCTURE

Identify the grammatically correct sentence:

- a) He go to the gym every morning.
- b) He goes to the gym every morning.
- c) He going to the gym every morning.
- d) He gone to the gym every morning.

8) CORE VERBAL GRAMMAR AND SENTENCE STRUCTURE

Despite the heavy rain, the match _____.

- a) has cancel
- b) was cancelled
- c) will be cancelled
- d) continued as scheduled

9) READING COMPREHENSION AND CRITICAL REASONING

Passage:

The Earth's climate has changed throughout history. However, the current trend of global warming is particularly alarming because it is occurring at an unprecedented rate. Scientists overwhelmingly agree that human activities, especially the burning of fossil fuels, are the primary cause of this rapid change.

According to the passage, what is the main cause of current global warming?

- a) Natural changes in the climate

- b) Increase in solar activity
- c) Volcanic eruptions
- d) Human activities like burning fossil fuels

10) READING COMPREHENSION AND CRITICAL REASONING

A new study shows that students who take handwritten notes retain more information than those who type notes. Therefore, schools should ban laptops during lectures to improve student learning.

Which of the following, if true, most seriously weakens the argument?

- a) Many students find typing faster than writing by hand.
- b) Some students need laptops to access course materials.
- c) The study did not account for the difficulty level of the lectures.
- d) The students who typed their notes reviewed them more often than those who wrote by hand.

RESOURCES

TEXTBOOK:

1. "R.S. Aggarwal", *Quantitative Aptitude for Competitive Examinations*, S. Chand Publishing, 2025.
2. "Abhijit Guha", *Quantitative Aptitude for Competitive Examinations*, 7th edition, Tata McGraw Hill Education, 2021.

REFERENCE BOOKS:

1. "Arun Sharma", *How to Prepare for Quantitative Aptitude for CAT*, 11th Edition, McGraw Hill Education, 2024.
2. "Nishit Sinha", *Quantitative Aptitude for CAT*, 5th edition, Pearson Education, 2020.

SOFTWARE/TOOLS:

1. Microsoft Excel or Google Sheets (for solving DI sets)
2. Any Scientific Calculator (if permitted)

Online Aptitude Test Platforms like:

3. a. India Bix (<https://www.indiabix.com>)
3. b. Lofoya (<https://www.lofoya.com>)
3. c. Test book (<https://testbook.com>)

VIDEO LECTURES:

1. NPTEL: Aptitude Learning (Verbal & Quant)
2. Unacademy: Quantitative Aptitude by Arun Sharma
3. YouTube: Talent Sprint Aptitude Classes
4. YouTube: Study Smart – Full Aptitude Playlist
5. Udemy: Quantitative Aptitude for Competitive Exams

WEB RESOURCES:

1. <https://www.indiabix.com/aptitude/questions-and-answers/>
2. <https://www.geeksforgeeks.org/aptitude/>
3. <https://www.lofoya.com>

4. <https://www.placementseason.com/aptitude-questions>
5. <https://www.campusgate.co.in/p/quantitative-aptitude.html>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25LG101703	LOGICAL REASONING AND RECRUITMENT ESSENTIALS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course develops essential logical reasoning, analytical skills, and practical communication for competitive exams and placements. It covers data arrangements, coding-decoding, pattern recognition, counting principles, probability, and data interpretation. Learners also acquire skills in logical connectives, syllogisms, time and direction sense, along with group discussions, resume writing, and interview preparation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** **Apply concepts of data arrangements, blood relations, ranking, and direction sense to solve spatial and logical reasoning problems.**
- CO2.** **Analyze patterns in coding-decoding, series, analogies, odd-one-out, and visual reasoning to improve abstraction and recognition skills.**
- CO3.** Apply principles of combinatorics, probability, data interpretation, logical connectives, syllogistic reasoning, and time-space analysis to construct effective solutions and derive valid conclusions.
- CO4.** Demonstrate effective communication skills in group discussions, resume writing, and personal interviews through structured activities.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	2	-	-	-	-
CO2	3	2	3	2	2	-	-	-	-
CO3	3	3	2	3	2	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-
Course Correlation Mapping	3	2	2	3	2	-	-	-	-

Correlation Levels: **3: High; 2: Medium; 1: Low**

COURSE CONTENT

Module 1: DATA ARRANGEMENTS AND BLOOD RELATIONS (08 Periods)

Linear arrangement, circular arrangement, multi-dimensional arrangement, coded and descriptive blood relations, family trees, ranking, and ordering problems. Focus on directional logic, positional comparisons, and attribute-based placement. Enhances spatial reasoning and logical deduction skills.

Module 2: CODING-DECODING, SERIES, ANALOGY, ODD ONE OUT & VISUAL REASONING (08 Periods)

Letter coding, number coding, substitution patterns, alphanumeric series, analogy-based reasoning, identifying odd one out in sequences, visual reasoning including mirror images, paper folding, figure sequences. Builds pattern recognition and abstraction abilities.

Module 3: COUNTING PRINCIPLES, P&C, PROBABILITY, DATA INTERPRETATION & SUFFICIENCY (09 Periods)

Fundamental counting principle, permutation and combination, probability theory and applications, interpreting pie charts, tables, and bar graphs, data sufficiency problems requiring logical assessment of given facts. Develops analytical thinking and quantitative aptitude.

Module 4: LOGICAL CONNECTIVES, SYLLOGISMS, VENN DIAGRAMS, CLOCKS, CALENDARS & DIRECTION (08 Periods)

IF-THEN logic, syllogistic reasoning with Venn diagrams, calendar-based date/day calculations, clock-angle problems, direction sense and cube-based spatial puzzles. Trains logical sequencing and time-space orientation.

Module 5: RECRUITMENT ESSENTIALS – GD, RESUME & INTERVIEW SKILLS (12 Periods)

Basics of group discussion, resume writing guidelines, and key sections, personal interview structure, HR and technical questions, body language tips, mock GD and interview sessions for real-time practice and evaluation. Equips students with communication and interview readiness.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1) DATA ARRANGEMENTS AND BLOOD RELATIONS

Six people – A, B, C, D, E, and F – are sitting in a row, facing north.

- B is sitting to the immediate right of D.
- C is at one of the ends.
- A is sitting between E and F.
- D is not at either end.
- E is sitting to the left of A.

Who is sitting in the middle?

Options:

- A) A
- B) B

- C) D
- D) F

2) **DATA ARRANGEMENTS AND BLOOD RELATIONS**

Pointing to a man, Mira says, "He is the son of my mother's only daughter." How is the man related to Mira?

Options:

- A) Son
- B) Nephew
- C) Cousin
- D) Brother

3) **CODING-DECODING, SERIES, ANALOGY, ODD ONE OUT & VISUAL REASONING**

In a certain code language, **GAMES** is written as **HZNFT**.

How is **PLANE** written in that code?

Options:

- A) QMBOF
- B) QMBOD
- C) QNCOD
- D) OKZMD

4) **CODING-DECODING, SERIES, ANALOGY, ODD ONE OUT & VISUAL REASONING**

Which word does **not** belong to the group?

Options:

- A) Apple
- B) Mango
- C) Banana
- D) Carrot

5) **COUNTING PRINCIPLES, P&C, PROBABILITY, DATA INTERPRETATION & SUFFICIENCY**

If the sales of Company A in 2021 were 80 units and in 2022 were 120 units, what was the percentage increase?

Options:

- A) 33.3%
- B) 50%
- C) 40%
- D) 60%

6) **COUNTING PRINCIPLES, P&C, PROBABILITY, DATA INTERPRETATION & SUFFICIENCY**

The number of students in five different classes is as follows:

Class A – 40, Class B – 35, Class C – 50, Class D – 45, Class E – 30.

What is the value of x?

Statement I: $x^2 = 49$

Statement II: x is a negative number

- A)** Only I is sufficient
- B)** Only II is sufficient
- C)** Both I and II together are sufficient
- D)** Each alone is sufficient

7) **LOGICAL CONNECTIVES, SYLLOGISMS, VENN DIAGRAMS, CLOCKS, CALENDARS &**

DIRECTION

Statements:

1. All engineers are logical.
2. Some logical people are creative.
3. No creative person is careless.

Conclusion:

- I. Some engineers are creative.
- II. No engineer is careless.

Choose the correct option:

- A) Only I follows
- B) Only II follows
- C) Neither I nor II follows
- D) Both I and II follow

8) **LOGICAL CONNECTIVES, SYLLOGISMS, VENN DIAGRAMS, CLOCKS, CALENDARS & DIRECTION**

Ravi starts from his home at 3:00 PM and walks 4 km East, then turns left and walks 3 km. He then turns left again and walks 4 km. What direction is he facing, and what time will it be if each km takes him 15 minutes?

- A)** Facing North, 3:45 PM
- B)** Facing West, 4:00 PM
- C)** Facing South, 4:00 PM
- D)** Facing West, 3:45 PM

9) **RECRUITMENT ESSENTIALS – GD, RESUME & INTERVIEW SKILLS**

Improves Communication Skills – Students learn to express their thoughts clearly and confidently in a group setting.

Builds Critical Thinking – It enhances analytical skills by encouraging students to think on their feet, structure arguments, and respond to different viewpoints.

Boosts Teamwork & Listening Skills – GD teaches the importance of active listening, respecting others' opinions, and working collaboratively, which are essential in professional environments.

10) **RECRUITMENT ESSENTIALS – GD, RESUME & INTERVIEW SKILLS**

Boosts Confidence – Simulated interviews reduce anxiety and prepare students to face real interviews with ease.

Improves Self-Presentation – Students learn how to present their strengths, goals, and experiences effectively.

Provides Constructive Feedback – Personalized feedback helps identify areas for improvement in communication, attitude, and body language.

RESOURCES

TEXTBOOK:

1. "R.S. Aggarwal", *Quantitative Aptitude for Competitive Examinations*, S. Chand Publishing, 2025.
2. "Abhijit Guha", *Quantitative Aptitude for Competitive Examinations*, 7th edition, Tata McGraw Hill Education, 2021.

REFERENCE BOOKS:

1. "Arun Sharma", *How to Prepare for Quantitative Aptitude for CAT*, 11th Edition, McGraw Hill Education, 2024.

2. "Nishit Sinha", *Quantitative Aptitude for CAT*, 5th edition, Pearson Education, 2020.

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- b. Lofoya (<https://www.lofoya.com>)
- c. Test book (<https://testbook.com>)

VIDEO LECTURES:

1. NPTEL: Aptitude Learning (Verbal & Quant)
2. Un academy: Quantitative Aptitude by Arun Sharma
3. YouTube: Talent Sprint Aptitude Classes
4. YouTube: Study Smart – Full Aptitude Playlist
5. Udemy: Quantitative Aptitude for Competitive Exams

WEB RESOURCES:

1. <https://www.indiabix.com/aptitude/questions-and-answers/>
2. <https://www.geeksforgeeks.org/aptitude/>
3. <https://www.lofoya.com>
4. <https://www.placementseason.com/aptitude-questions>
5. <https://www.campusgate.co.in/p/quantitative-aptitude.html>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25EC101707	QUANTUM AI	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course introduces the fundamentals of Quantum Artificial Intelligence (Quantum AI), an emerging field that combines quantum computing with artificial intelligence to develop intelligent systems capable of solving complex problems more efficiently than classical methods. Students will explore core concepts of quantum computation, classical and quantum problem-solving, reversible logic, quantum probability, and quantum-inspired cognitive models.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the foundational concepts of Quantum AI, including its advantages, working principles, challenges, and its relation to classical and quantum computation.
- CO2.** Analyze classical computation frameworks such as decision problems, P vs NP, and the Church–Turing–Deutsch principle, and apply them to knowledge representation and production systems.
- CO3.** Apply the concepts of reversible computation and probabilistic models like Bayes's theorem and Naïve Bayes to categorize and process information effectively.
- CO4.** Evaluate quantum problem-solving methods using heuristic search, quantum tree search, and production systems for cognitive architectures and structured problems like the n-puzzle.
- CO5.** Explore quantum cognition approaches including quantum probability, decision-making strategies, quantum walk, and quantum neural computation to understand emerging models of intelligent behavior.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	-	-	-	-	2
CO2	3	3	2	2	-	-	-	-	2
CO3	2	3	2	2	-	-	-	-	2
CO4	3	3	3	3	2	-	-	-	2
CO5	3	2	2	3	2	-	-	-	3
Course Correlation Mapping	3	3	3	3	2	-	-	-	3

Correlation Level: **3-High;** **2-Medium;** **1-Low**

COURSE CONTENT

Module 1: INTRODUCTION (08 Periods)

Definition of quantum AI, Advantages of QAI (Quantum AI), How Quantum AI Works, Why is Quantum AI Important, Current Challenges, Future of Quantum AI, Motivation and Goals, Classical computation, Quantum computation.

Module 2: COMPUTATION, PROBLEM SOLVING AND PRODUCTION (10 Periods) SYSTEM.

Cantor's diagonal argument, Decision problems,, P and NP, Church-Turing-Deutsch principle, Knowledge Representation, Rules ,Logic-based operators ,Frames, Categorial representation, Binary vector representation, Deduction systems, Reaction systems, Human problem-solving, Example, Proto logic, Binding problem, Icons, Euclidian geometry of the world.

Module 3: REVERSIBLE ALGORITHMS AND PROBABILITY (08 Periods)

Reversible Computation, Boolean gates, Reversible Boolean gates, Toffoli gate, Circuit, Conditional probability, Bayes's rule, Joint distribution, Naive Bayes and counting, Counting and categorization.

Module 4: QUANTUM PROBLEM-SOLVING (10 Periods)

Symbols and Quantum Reality, Uninformed Tree Search, Heuristic functions, Invention of heuristic functions, Quality of heuristic, Principles of quantum tree search, Iterative quantum tree search, No constant branching factor, Quantum Production System, 3-puzzle, Extending for any n-puzzl, Pure production system, Cognitive architecture, Representation.

Module 5: QUANTUM COGNITION AND RELATED APPROACHES (09 Periods)

Quantum Probability, Decision Making, Unpacking Effects, Quantum Walk : Random walk, Quantum insect, Quantum walk on a graph, Quantum walk on one dimensional lattice, Quantum walk and search, Quantum walk for formula evaluation, Adiabatic Computation, Quantum Neural Computation.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Build a quantum random number generator
2. Simulate a quantum walk

RESOURCES

TEXT BOOK:

1. Andreas Wichert, principles of quantum artificial intelligence, Copyright © 2014 by World Scientific Publishing Co. Pte. Ltd., ISBN 978-981-4566-74-2.

REFERENCE BOOK:

1. Noson S.Yanofsky, Mirco A. Mannucci, "Quantum Computing for Computer Scientists"

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=F3nwNK28LzA&pp=0gcJCf0Ao7VqN5tD>
2. https://www.youtube.com/channel/UCgUUiDMmN9AsC2LyQSh_KXw/playlists

WEB RESOURCES:

1. https://www.researchgate.net/publication/262883357_Principles_of_Quantum_Artificial_Intelli

gence_World_Scientific

2. https://www.worldscientific.com/worldscibooks/10.1142/8980?srsltid=AfmBOop7WiTj56KDDqGnXwRcFMrOlyhVcN5HyIE3S9JO67M_AI45Lws
3. <https://www.coursera.org/articles/what-is-quantum-ai>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CA101702	SOFTWARE ENGINEERING FOR AI	3	-	-	-	3
Pre-Requisite	Software engineering					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course introduces the principles and practices of software engineering specifically tailored for AI-based systems. It covers the full lifecycle of AI software development, integrating traditional software engineering methods with modern AI and machine learning workflows. Students will learn how to define requirements, design modular and interpretable systems, engineer data pipelines, develop and test AI models, and deploy them responsibly. Emphasis is placed on maintainability, scalability, fairness, and ethical considerations in building AI-driven applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze the fundamental differences between conventional software engineering and AI-based systems,
- CO2.** Apply incremental and exploratory system engineering methodologies, to design AI systems.
- CO3.** Analyze exploratory programming practices for managing evolving AI software systems.
- CO4.** Evaluate the design and engineering aspects of machine learning systems and expert systems.
- CO5.** Design AI-driven practical software using engineering toolboxes, support environments.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	-	2	-	-	2
CO2	3	3	2	2	2	-	-	-	2
CO3	2	3	3	2	2	-	-	-	2
CO4	3	3	2	3	2	-	-	-	2
CO5	3	3	3	3	2	2	-	-	3
Course Correlation Mapping	3	3	3	3	2	2	-	-	3

Correlation Level: **3-High;** **2-Medium;** **1-Low**

COURSE CONTENT

Module 1: INTRODUCTION TO COMPUTER SOFTWARE FOR AI, AI (10 periods) PROBLEMS AND CONVENTIONAL SE PROBLEMS

Computers and software systems, An introduction to Software engineering, Bridges and buildings versus software systems, the software crisis A need for AI systems What is an AI problem, Ill-defined specifications, correct versus 'good enough' solutions, Context-free problems, SAV methodology, the myth of complete specification, what is verifiable, SAT methodology, testing for reliability, the strengths, the weaknesses

Module 2: INCREMENTAL AND EXPLORATORY METHODOLOGY FOR SYSTEM ENGINEERING (09 periods)

Classical methodology and AI problems, The RUDE cycle, Malleable software, AI muscles on a conventional skeleton Conventional paradigms Automatic programming, Transformational implementation, The "new paradigm" of Blazer, Cheatham and Green, Operational requirements of Kowalski, The POLITE methodology

Module 3: EXPLORATORY PROGRAMMING (09 periods)

Reverse engineering, Reusable software Design knowledge, Stepwise abstraction, The problem of decompiling, Controlled modification, Structured growth Self-adaptive software, The threat of increased software problems

Module 4: MACHINE LEARNING AND EXPERT SYSTEMS (09 periods)

Practical machine learning examples, Multisession inductive programming, Expert Systems: Expert systems as AI software, Engineering expert systems, The lessons of expert systems for engineering AI software

Module 5: AI INTO PRACTICAL SOFTWARE (08 periods)

Support environments, Reduction of effective complexity, Moderately stupid assistance, An engineering toolbox, Self-reflective software, Over engineering software, Future Holds

Total Periods: 45

RESOURCES

TEXT BOOK:

1. Derek Partridge, "Artificial Intelligence and Software Engineering", Glenlake Publishing Company, 1998.

REFERENCE BOOKS:

1. "The role of Artificial Intelligence in Software Engineering", K. Nitalksheswara Rao, 2020

2. "Farid Meziane &Sunil Vadhera, "Artificial Intelligence Applications for Improved Software Engineering Development", Information Science Reference, 2009

VIDEO LECTURES

1. <https://www.youtube.com/watch?v=Ccku34DU7k4>
2. <https://www.youtube.com/watch?v=WNxc85aFFbM>
3. <https://www.youtube.com/watch?v=KIC-sFz5OT8>
4. <https://www.youtube.com/playlist?list=PLDS2JMJnJzdkQPdkhcuwcbJpjB84g9ffX>

WEB RESOURCES

1. <https://www.geeksforgeeks.org/software-engineering/ai-in-software-engineering>
2. <https://www.coursera.org/learn/team-software-engineering-with-ai>
3. <https://ckaestne.github.io/seai/S2020/>
4. <https://www.seerene.com/ai4se>
5. <https://www.coursera.org/specializations/generative-ai-for-software-developers>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25CB101703	ADVANCED ARTIFICIAL INTELLIGENCE	3	-	-	-	3
Pre-Requisite	Artificial intelligence					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course offers an in-depth exploration of advanced concepts and methodologies in Artificial Intelligence (AI), preparing students for real-world applications. Beginning with a comprehensive introduction to the foundations and evolution of AI, the course covers cognitive modeling, expert systems, and intelligent robotics. Students delve into advanced reasoning mechanisms including deductive, inductive, abductive, and common-sense reasoning that are essential for building intelligent systems capable of human-like decision-making.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Summarize the evolution and history of Artificial Intelligence and its major research domains.
- CO2.** Apply reasoning techniques to real-world and AI problem contexts.
- CO3.** Apply Game Theory models such as zero-sum and evolutionary games to decision-making problems in AI.
- CO4.** Apply Bayesian and Gaussian Process models in real-world transfer learning applications.
- CO5.** Design solution strategies using AI platforms for domain-specific scientific challenges.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	-	-	-	-	-	-	2
CO2	3	3	3	2	-	-	-	-	2
CO3	2	3	3	2	2	-	-	-	2
CO4	3	3	2	3	2	-	-	-	2
CO5	3	2	3	3	2	-	-	-	3
Course Correlation Mapping	3	3	3	3	2	-	-	-	3

Correlation Level: **3-High;** **2-Medium;** **1-Low**

COURSE CONTENT:

Module 1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

(10 Periods)

Brief History of AI, Basic Content of Artificial Intelligence Research: Cognitive Modeling, Knowledge Representation, Automatic Reasoning, New Generation Artificial Intelligence, Expert System, Natural Language Processing, Intelligent Robot, Distributed Artificial Intelligence, Internet Intelligence Game ,AI for Science .

Module 2: CAUSAL REASONING

(09 Periods)

Deductive Reasoning, Inductive Reasoning, Abductive Reasoning, Reasoning by Analogy, Non-Monotonic Reasoning, Common Sense Reasoning.

Module 3: GAME THEORY

(09 Periods)

History of Game Theory, Basic Concepts of Game Theory, Applications of Game Theory, Representation of Games: Extensive Form, Normal Form, Characteristic Function Form, Alternative Game Representations, Type of Game Theory, Zero-Sum Game, Evolutionary Game Theory, Game Dynamics: MDA Model, Applications.

Module 4: TRANSFER LEARNING

(09 Periods)

History, Important Concepts, Similarity Measure, Classifications, Negative Transfer, Inductive Transfer Learning, Transfer Learning, Model-Based Transfer Learning, Bayesian Models. Gaussian Process (GP), Deep Transfer Learning, Heterogeneous Transfer Learning, Multi-task Transfer Learning, Domain Adaptation Transfer Learning.

Module 5: ARTIFICIAL INTELLIGENCE FOR SCIENCE

(08 Periods)

Introduction, Knowledge Discovery, Protein Structure Prediction, Drug Development, Genetic Research, Biological Breeding, New Materials, Superconducting Materials, Graphene, Liquid Metal, Climate Change Climate Model, Long-Term Impacts, Solution Strategy, Platform of Artificial Intelligence for Science.

Total Periods: 45

EXPERIENTIAL LEARNING

Real-World Case Study Analysis on

1. AI in healthcare
2. AI in finance or e-commerce (credit scoring, dynamic pricing)

RESOURCES

TEXT BOOK:

1. Zhongzhi SHI, Advanced Artificial intelligence, World Scientific Publishing Co. Pte. Ltd, 3rd edition, ISBN 9789811293986 (hardcover), 3rd edition.

REFERENCE BOOKS:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 4th (2020) edition, Pearson publications.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press

VIDEO LECTURES

1. <https://www.youtube.com/watch?v=1HpYwa52LeY>
2. <https://www.youtube.com/watch?v=kOkehUZrjBM>
3. https://www.youtube.com/playlist?list=PLxf3-FrL8GzRALeq_9BtdQcIN6SF4bTCG

WEB RESOURCES

1. <https://people.engr.tamu.edu/guni/csce625/slides/AI.pdf>
2. <https://dokumen.pub/advanced-artificial-intelligence-3nbsped-9789811293986-9789811293993-9789811294006.html>
3. https://nou.edu.ng/coursewarecontent/CIT%20903%20Advanced%20Artificial%20Intelligence_0.pdf
4. <https://home.schoolnutritionandfitness.com/index.jsp/uploaded-files/M2E709/AdvancedArtificialIntelligenceBook.pdf>

Course Code	Course Title	L	T	P	S	C	CO- PO- PSO Map ping Tabl e:
25CE101706	INDIAN KNOWLEDGE SYSTEM IN TOWN PLANNING AND ARCHITECTURE	3	-	-	-	3	
Pre-Requisite	-						
Anti-Requisite	-						
Co-Requisite	-						

COURSE DESCRIPTION: This course explores the profound and time-tested wisdom of the Indian Knowledge System (IKS) as it applies to town planning and architecture. Drawing from ancient texts like the Vastu Shastra, Artha shastra, Manasara, and Silpa Shastra, the course delves into how traditional Indian principles harmonized built environments with nature, climate, cosmology, and societal needs. The course provides a historical and philosophical framework to understand the design of cities, temples, dwellings, water management systems, and public spaces in ancient and medieval India.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge of traditional Indian architectural and urban planning systems.
- CO2.** Interpret ancient design treatises and relate their principles to real-world examples.
- CO3.** Integration of culture, environment, and functionality in traditional planning.
- CO4.** Apply IKS principles to modern urban and architectural contexts with sustainability in focus.
- CO5.** Interpret the concept of ancient stone carving and their significance in architecture.

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-
CO5	3	1	-	-	-	-	-	-	-
Course Correlation Mapping	3	2	-	-	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: ANCIENT TEXT AND TOWN PLANNING

(09 Periods)

Introduction to ancient text in the context of Town Planning and Governance; terminologies; Indic languages in which the knowledge is embedded; Chronology of development of ancient text and changing principles.

Module 2: PRINCIPLES OF TOWN PLANNING**(09 Periods)**

Ancient India progressed towards urbanisation with cities of various sizes and shapes. Elaboration of basic understanding of the layouts in terms of geometry, formulae and theory based on population, geography, and various communities shall be understood.

Module 3: ANCIENT TOWNS AND PRESENT PLANNING PRACTICES**(09 Periods)**

Evolution of the cities following the ancient town planning principles in urban centres. Interconnection between ancient knowledge of town planning and present planning practices to establish the relationship between theory and practice.

Module 4: CLAY ARCHITECTURE**(09 Periods)**

Terracotta and Terracotta, Brick structures and urns from the Indus Valley and Megalithic sites in south India, Sculptures of terracotta and bronze from Harappa, Terracotta or unbaked clay-made objects and rituals.

Module 5: STONE AND GARDEN**(09 Periods)**

Stone: Memorials, Architectural Remnants and Objects- Types of stone in India: Mathura Sandstone, Deccani Basalt, Rajasthani Marble, Stone carving for architecture and their social significance. Garden: Islam, the garden of paradise and afterlife, Tombs, palace, garden and waterways from the Mughal and Deccani context.

Total Periods: 45

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Heritage Walks & On-Site Case Studies (Nearby towns)
2. Hands-on mapping of **temple towns**
3. Students make small prototype using traditional techniques.
4. Students document traditional water harvesting system

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES**TEXT BOOKS:**

1. Ali, Daud and Emma Flatt eds, Garden and landscape practices in pre-colonial India: histories from the Deccan, New Delhi: Routledge 2020.
2. Dehejia, Vidya, Chola: Sacred Bronzes of Southern India, London: Royal Academy of Arts 2006.

REFERENCE BOOKS:

1. Goswamy, B. N., and Eberhard Fischer, Pahari Paintnings: The Horst Metzger collection in the Museum Rietberg, New Delhi: Niyogi Books 2017.
2. Hardy, Adam, The Temple Architecture of India. Chichester (GB), J. Wiley and Sons 2007.
3. Pandey, Shailaja, Mayamata : An Indian treatise on housing architecture and iconography, Chaukhamba Surbharati Prakashan 2007.
4. Sharma, Sudarshan Kumar, Samarangana Sutradhara, Parimal Publications 2008.
5. Sharma B.L, Vishvakarma - Vastushastra, Parimal Publications 2010.
6. Jugnu, Shri Krishna, Aparajitpraccha, Parimal Publications 2011.
7. Patrick Olivelle, King, governance, and law in ancient India : Kauṭilya's Arthashastra : a new annotated translation, Oxford University Press 2013.
8. Apte, Prabhakar, Samarangana Sutradhara, IGNCA 2023.

VIDEO LECTURES:

1. <https://iksindia.org/lectures-and-videos.php>
2. <https://www.youtube.com/watch?v=4NT9reg4G3s>
3. https://onlinecourses.swayam2.ac.in/imb23_mg53/preview
4. https://www.youtube.com/@IKS_Media_MoE/videos

WEB RESOURCES:

1. <https://nitkkr.ac.in/ndian-knowledge-systems-iks>
2. <https://iksindia.org/research-proposal-form.php>
3. https://en.wikipedia.org/wiki/Indian_Knowledge_Systems

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM201005	DISCRETE MATHEMATICS	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course addresses the challenges of the relevance of Boolean, Lattice and algebraic systems to computer science and their corresponding systems. To apply number theory, graph theory and their related concepts and algorithm to develop security levels and intelligent systems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Apply mathematical logic and predicate calculus to validate precise statements
- CO2.** Analyze the basic structures of lattice and Boolean algebra.
- CO3.** Demonstrate the importance of algebraic properties with regard to working within various number systems.
- CO4.** Formulate recurring Problems and solve their recurrence relations.
- CO5.** Apply the concepts of graph theory and trees to implement computer algorithms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes									Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	-	1	-	-	-	-	-	-	-	3
CO2	3	3	-	2	2	-	-	-	-	2	-	3
CO3	3	2	-	2	2	-	-	-	-	1	-	3
CO4	3	2	-	2	-	-	-	-	-	3	-	2
CO5	3	3	-	2	-	-	-	-	-	2		3
Course Correlation Mapping	3	3	-	2	2	-	-	-	-	2	-	3

Correlation Levels:

3: High;

2: Medium;

1: Low

COURSE CONTENT

Module 1: MATHEMATICAL REASONING

(07 Periods)

Concepts of mathematical logic, Normal Forms, The Predicate Calculus, Rule of Inference, Consistency, Proof of Contradiction, quantifiers.

Module 2: LATTICES AND BOOLEAN ALGEBRA

(09 Periods)

Lattices: Partially Ordered Relations, Hasse Diagram, Lattices as Posets, Properties of Lattices

Boolean Algebra: Basic Definitions, Truth Tables, Boolean Functions, Representation and Minimization of Boolean Functions.

Module 3 ALGEBRAIC STRUCTURES AND NUMBER THEORY

(11 Periods)

Algebraic Structures: Binary Operations and Algebraic Structures Groups, Subgroups.

Number Theory: Division Algorithm, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Euler Totient Function, Modular Arithmetic (Fermat's Theorem and Euler's Theorem (without proof))

Module 4 RECURRENCE RELATIONS

(09 Periods)

Generating Functions of Sequences, calculating coefficients of generating function, Homogeneous Recurrence relation, solving recurrence relations by substitution and Generating functions, Methods of Characteristic Roots.

Module 5 GRAPHS AND TREES

(09 Periods)

Graphs: Representation of Graphs and Graph Isomorphism, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Planar Graphs, Euler's Formula and Graph Coloring.

Trees: Introduction to Trees, Properties of Trees, Spanning Trees, Counting trees, Depth-First Search, Breadth-First Search, Minimum Spanning Trees.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Let $a > 1$ be a positive integer. Pretend you want to divide n people into some number of teams, each of size a or $a + 1$. Show that this is possible provided n is larger than values in the Fibonacci polynomial $a^2 - a - 1 = a(a-1) - 1$.
2. Identify the relations on the set of bits $B = \{0, 1\}$ that are partial orders and those that are equivalence relations.
3. Pretend you are writing traffic accident software and want to categorize accidents by the day of the week on which they occur. Pretend there are n accident reports to categorize.
 - (a) What is the size of the sample space? That is, in how many ways can the accident reports be distributed over 7 days?
 - (b) In how many ways can all n accidents occur on one single day?
 - (c) In how many ways can all n accidents occur on only two days?
 - (d) Let's look at the other end: In how many ways can all n accidents occur on seven, and no less, days.

RESOURCES

TEXT BOOKS:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw Hill, 8th Edition, 2019.
2. Jon Pierre Fortney, Discrete Mathematics for Computer Science, CRC Press, Taylor & Francis Group, 1st Edition, 2021.

REFERENCE BOOKS:

1. Richard Johnsonbaugh, Discrete Mathematics , Prentice Hall, 8th Edition, 2019.
2. Narasimha Deo, Graph Theory with application to Engineering and Computer Science, Prentice Hall India 2016.
3. J.P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill, 37th Edition, 2017

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106106183>
2. <https://nptel.ac.in/courses/106106094>

WEB RESOURCES:

1. <https://www.coursera.org/learn/discrete-mathematics>
2. <https://people.cs.pitt.edu/~milos/courses/cs441/>
3. <https://web.stanford.edu/class/cs103x/cs103x-notes.pdf>

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
25SS101702	GENDER AND ENVIRONMENT	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: Gender and the environment relationship, Gendered Roles in the Family & Community, Gender and sustainable development, Gender in environmental justice, Gender & Environmental Security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Apply the knowledge of gender & environmental connections by analyzing key issues and topics within global environmental politics in environmental decision-making.
- CO2.** Demonstrate knowledge of the concepts of gender and sustainable development through debates and policy documents.
- CO3.** Analyze the concept of environmental security and justice by identifying the sources of insecurity.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	3	3	-	-	-	-	-
CO2	3	-	-	-	-	2	3	1	-	2	-	-
CO3	3	1	-	-	-	3	3	-	-	-	-	2
Course Correlation Mapping	3	1	-	-	-	3	3	1	-	2	-	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: GENDER AND ENVIRONMENT RELATIONSHIP (09 Periods)

Introduction – Gender and Environment – Development of gender roles – Society, gender & environment – Understanding environmental politics – Gender-environment connections–Eco-feminism – Cultural eco-feminism – Social eco-feminism – Feminist political ecology

Module 2: GENDERED ROLES IN THE FAMILY & COMMUNITY (09 Periods)

Organization of the household – Domestic division of labour – Food: growing, harvesting, shopping, preparing, and cooking

Gender & Power – Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making

Module 3: GENDER AND SUSTAINABLE DEVELOPMENT (09 Periods)

Concept of sustainability & its achievement – Concept of sustainable development – Ecological Modernization – Gender & sustainability debates – Gender & sustainable development debates
- Gender in policy documents – Gender, poverty & equity in sustainable development

Module 4: GENDER IN ENVIRONMENTAL JUSTICE (09 Periods)

Normative Concerns (Fairness, Inequality & Justice) –Making sense of Environmental justice – Ecological debt, Transnational harm, & human rights – Ecological justice – Gender &Environmental Justice – Gender, Vulnerability & risk – Women in environmental justice movements – Knowledge & participation – Gender, sustainability & justice as guiding concepts.

Module 5: GENDER AND ENVIRONMENTAL SECURITY (09 Periods)

Connections between security & the environment – **Gender, environment & security:** Sustainability as security – poverty & insecurity – Insecurity as injustice – Competing ways of thinking security – Reflecting on sources of insecurity – **Case Study** – Food Security -**Case Study** – The impacts of natural disasters

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a poster presentation on the impact of globalization on family structure and society.
2. Prepare a presentation on the family setup of different countries and their peculiar customs.
3. Prepare poster presentation on “Ancient hominines walked like humans but climbed like apes.”
4. Find out the problems of present society and being part of future generations how you may help to strengthen environmental security.

RESOURCES

TEXT BOOKS:

1. Nicole Detraz, *Gender and the Environment*, Polity Press, Cambridge, UK. 2017
2. Susan Buckingham- Hatfield, *Gender and Environment*, Rutledge, London. 2000

REFERENCE BOOKS:

1. Promillakapur ed., *Empowering Indian Women*, Publication Division, Government of India, New Delhi. 2000.
2. Ronnie Verwooy, Ed., *Social and Gender Analysis Natural Resource Management: Learning Studies and Lessons from Asia*, Sage, New Delhi. 2006
3. Swarup Hemlata and Rajput, Pam, *Gender Dimensions of Environmental and Development Debate: The Indian Experience*, In Sturat S. Nagel, (ed). *India's Development and Public Policy*. Ashgate, Burlington. 2000