

R23 (B. Tech CSE)

Department: Computer Science & Engineering

Curriculum Structure & Syllabus

(Effective from 2023-24 admission batch)

1 st Year 1 st Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS101	Programming for Problem Solving	3	0	0	3	3
2	SCI	Multidisciplinary	CH(CS)101	Engineering Chemistry	2	0	0	2	2
3	SCI	Multidisciplinary	M(CS)101	Engineering Mathematics – I	3	0	0	3	3
4	HUM	Ability Enhancement Course	HU101	Professional Communication	2	0	0	2	2
5	HUM	Value added course	HU102	Values and Ethics	2	0	0	2	2
6	HUM	Value added course	HU103	Constitution of India	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	CS191	Programming for Problem Solving Lab	0	0	3	3	1.5
2	HUM	Ability Enhancement Course	HU191	Professional Communication Lab	0	0	2	2	1
3	SCI	Skill enhancement course	CH(CS)191	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill enhancement course	ME(CS)191	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
Total of Theory & Practical								23	18

**HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project;*

1 st Year 2 nd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS201	Data Structures	3	0	0	3	3
2	ENGG	Minor	EE(CS)201	Basic Electrical & Electronics Engineering	3	0	0	3	3
3	SCI	Multidisciplinary	PH(CS)201	Engineering Physics	3	0	0	3	3
4	SCI	Multidisciplinary	M(CS)201	Engineering Mathematics –II	3	0	0	3	3
5	HUM	Value added course	HU204	Environmental Science	2	0	0	2	2
6	HUM	Value added course	HU205	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	CS291	Data Structures Lab	0	0	3	3	1.5
2	ENGG	Minor	EE(CS)291	Basic Electrical & Electronics Engineering Lab	0	0	3	3	1.5
3	HUM	Ability Enhancement Course	HU292	Design Thinking	0	0	2	2	1
4	SCI	Skill enhancement course	PH(CS)291	Engineering Physics Lab	0	0	3	3	1.5
5	ENGG	Skill enhancement course	ME(CS)291	Engineering Graphics & Design Lab	0	0	3	3	1.5
Total of Theory & Practical								29	22

2 nd Year 3 rd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS301	Computer Organization and Architecture	3	0	0	3	3
2	ENGG	Major	CS302	Design and Analysis of Algorithms	3	1	0	4	4
3	SCI	Minor	M(CS)301	Discrete Mathematics	3	0	0	3	3
4	ENGG	Minor	EC(CS)301	Digital Logic and Electronics	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Major	CS391	Computer Organization and Architecture Lab	0	0	3	3	1.5
2	ENGG	Major	CS392	Design and Analysis of Algorithms Lab	0	0	3	3	1.5
3	ENGG	Minor	EC(CS)391	Digital Electronics Lab	0	0	3	3	1.5
4	ENGG	Skill Enhancement Course	CS393	IT Workshop Lab (SciLab/MATLAB/C++)	0	1	3	4	2.5
Total of Theory, Practical								26	20

2 nd Year 4 th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS401	Operating Systems	3	0	0	3	3
2	ENGG	Major	CS402	Computer Networks	3	0	0	3	3
3	ENG	Major	CS403	Formal Language and Automata Theory	3	0	0	3	3
4	SCI	Minor	M(CS)401	Probability and Statistics	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(CS)401	Principles of Management	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	CS491	Operating Systems Lab	0	0	3	3	1.5
2	ENGG	Major	CS492	Computer Networks Lab	0	0	3	3	1.5
3	ENGG	Major	CS493	Programming using Python	0	0	3	3	1.5
4	ENGG	Minor	M(CS)491	Numerical Methods Lab	0	0	3	3	1.5
5	HUM	Ability Enhancement Course	HU(CS)491	Soft Skill & Aptitude	2	0	0	2	1
Total of Theory, Practical								28	21

3 rd Year 5 th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS 501	Artificial Intelligence	3	0	0	3	3
2	ENGG	Major	CS 502	Database Management Systems	3	0	0	3	3
3	ENGG	Major	CS 503	Object Oriented Programming using Java	3	0	0	3	3
4	ENGG	Major	CS 504 A CS 504 B CS 504 C	Compiler Design Cryptography and Network Security Computer Graphics	3	0	0	3	3
5	HUM	Minor	HU(CS)501	Economics for Engineers	2	0	0	2	2
B. PRACTICAL									
6	ENGG	Major	CS 591	Artificial Intelligence Lab	0	0	3	3	1.5
7	ENGG	Major	CS 592	Database Management Systems Lab	0	0	3	3	1.5
8	ENGG	Major	CS 593	Object Oriented Programming using Java Lab	0	0	3	3	1.5
9	PRJ	Internship	CS581	Internship	0	0	2	2	2
Total of Theory, Practical and Mandatory Activities/Courses								25	20.5

3 rd Year 6 th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS 601	Web and Internet Technology	3	0	0	3	3
2	ENGG	Major	CS 602	Machine Learning	3	1	0	4	4
3	ENGG	Major	CS 603	Software Engineering	3	0	0	3	3
4	ENGG	Major	CS 604 A CS 604 B CS 604 C	Mobile Computing Natural Language Processing Cloud Computing	3	0	0	3	3
5	ENGG	Minor	CS 605	Cyber Law and Ethics	3	0	0	3	3
B. PRACTICAL									
6	ENGG	Major	CS 691	Web and Internet Technology Lab	0	0	3	3	1.5
7	ENGG	Major	CS 692	Machine Learning Lab	0	0	3	3	1.5
8	ENGG	Major	CS 693	Software Engineering Lab	0	0	3	3	1.5
Total of Theory, Practical and Mandatory Activities/Courses								25	20.5

4 th Year 7 th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS 701	Neural Networks and Deep Learning	3	0	0	3	3
2	ENGG	Major	CS 702 A CS 702 B CS 702 C	Advanced Algorithms Advanced Computer Architecture Advanced Operating Systems	3	0	0	3	3
3	ENGG	Minor	CS 703 A CS 703 B CS 703 C	Information Theory and Coding Ad-Hoc and Sensor Networks Data Mining and Data Warehouse	3	0	0	3	3
4	HUM	Minor	HU(CS)701	Human Resource Development and Organizational Behavior	2	0	0	2	2
B. PRACTICAL									
5	ENGG	Major	CS 791	Neural Networks and Deep Learning Lab	0	0	3	3	1.5
6	ENGG	Major	CS 792 A CS 792 B CS 792 C	Advanced Algorithms Lab Advanced Computer Architecture Lab Advanced Operating Systems Lab	0	0	3	3	1.5
7	PRJ	Project	CS 793	Major Project-I	0	0	12	12	6
Total of Theory, Practical and Mandatory Activities/Courses								29	20

4 th Year 8 th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS 801 A CS 801 B CS 801 C	Real Time Systems Data Analytics Soft Computing	3	1	0	4	4
2	ENGG	Major	CS 802 A CS 802 B CS 802 C	VLSI Design & Application Bio-informatics Robotics	3	1	0	4	4
3	ENGG	Minor	CS 803 A CS 803 B CS 803 C	Introduction to IoT Image Processing Optimization Techniques	3	0	0	3	3
B. PRACTICAL									
4	ENGG	Minor	CS 893 A CS 893 B CS 893 C	Internet of Things Lab Image Processing Lab Optimization Techniques Lab	0	0	3	3	1.5
5	PRJ	Project	CS 881	Major Project-II	0	0	12	12	6
6	PRJ	Internship	CS882	Grand Viva	0	0	0	0	1.5
Total of Theory, Practical and Mandatory Activities/Courses								26	20

Curriculum & Syllabus for B. Tech under Autonomy (NEP 2020 Implemented)

Computer Science and Engineering

(Effective from 2023-24 admission batch)

Department: Computer Science & Engineering
Curriculum Structure & Syllabus
(Effective from 2023-24 admission batch)

1st Year 1st Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS101	Programming for Problem Solving	3	0	0	3	3
2	SCI	Multidisciplinary	CH(CS)101	Engineering Chemistry	2	0	0	2	2
3	SCI	Multidisciplinary	M(CS)101	Engineering Mathematics – I	3	0	0	3	3
4	HUM	Ability Enhancement Course	HU101	Professional Communication	2	0	0	2	2
5	HUM	Value added course	HU102	Values and Ethics	2	0	0	2	2
6	HUM	Value added course	HU103	Constitution of India	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	CS191	Programming for Problem Solving Lab	0	0	3	3	1.5
2	HUM	Ability Enhancement Course	HU191	Professional Communication Lab	0	0	2	2	1
3	SCI	Skill enhancement course	CH(CS)191	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill enhancement course	ME(CS)191	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
Total of Theory & Practical								23	18

*HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project;

Course Name: Programming for problem solving

Course Code: CS101

Contact (Periods/Week):3L/Week

Total Contact Hours: 36

Credits: 3

Course Outcome(s):

CO1: To identify the working principle of input and output devices of Computers memorize the basic terminology used in computer programming.

CO2: To express programs in C language and use different data types for writing the programs.

CO3: To implement programs using the dynamic behaviour of memory by the use of pointers.

CO4: To explain the difference between call by value and call by address.

CO5: To write programs using basic data files and developing applications for real world problems.

CO-PO-PSO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2						2	3	2	3	3
CO2	2	2	3	3	3							3	2	2	3
CO3	2	3	2	2	2							3	2	3	2
CO4	3	2	2	3	3							2	2	2	2
CO5	2	2	2	1	1						2	3	3	3	3

Course Content:

Module-1: Fundamentals of Computer (9L)

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices.

Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems. Introduction to complements system, Representation of signed and unsigned numbers in signed magnitude signed 1's complement system and signed 2's complement system.

Arithmetic– Addition and Subtraction (using 1's complement and 2's complement). Representation of Characters-ASCII Code, Basics of Compiler, Interpreter and Assembler

Problem solving – Basic concept of Algorithm. Representation of algorithm using flowchart and pseudo code, Some basic examples.

Module-2: Introduction to C Programming (5L)

Overview of Procedural vs Structural language; History of C Programming Language. Variable and Data Types: The C characters identifiers and keywords, data type & sizes, variable names, declaration, statements. Operators & Expressions: Arithmetic operators, relational operators, Logical operators, increment and decrement operators, bitwise operators, Assignment operators, conditional operators, special operators-type Conversion, C expressions, precedence and associativity. Input and Output: Standard input and output, formatted output–printf, formatted input scanf.

Module-3: Branch and Loop (5L)

Branching: Concept of Statement and Blocks in C, Simple if, if -else, nested if-else and if-else ladder. Switch Case: break and continue; switch-case, concept of go to and labels Loops- while, for, do while.

Module-4: Program Structures (4L)

Function: Basics of Functions, function types, function prototypes, formal and actual parameter, function calling, functions returning values, functions not returning values. Recursion and Recursive Function. Storage Class in C: Storage Class-auto, external, static and registers to rage class, scope rules and lifetime of variables
C pre-processor: Pre-processing directive and macro, parameterized macro.

Module-5: Array and Pointer (7L)

Arrays: One dimensional array, Two-dimensional arrays Passing an array to a function Pointers: Pointers, Pointer and Array, Pointer and functions.
Strings: Character array and string, array of strings, Passing a string to a function, String related functions, Pointer and String. Dynamic memory allocation: Malloc, calloc, realloc and free with example.

Module-6: Structures, Unions and Enum (3L)

Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and enum, difference between structure and union.

Module-7: File in C (3L)

Files handling-opening and closing a file indifferent mode, formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function.

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Kanetkar Y.- Let us C, BPB Publication, 15th Edition

Reference Books:

1. Brian W.Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad– MASTERINGC, TMH, 2nd Edition

Course Name: Engineering Chemistry

Paper Code: CH(CS)101

Total Contact Hours: 24

Credit: 2

Prerequisites:

COURSE OBJECTIVE

To understand the basic principles of elements, organic reactions, drug synthesis and technological aspects of modern chemistry

To apply the knowledge of different engineering materials, advanced polymers, and nanomaterials to solve complex engineering problems

To analyse and evaluate quality parameters of water and its treatment

Apply the knowledge of free energy, energy storage device, semiconductors, fuels and corrosion to design environment friendly & sustainable devices

Apply the knowledge of different instrumental techniques to analyse unknown engineering materials.

COURSE OUTCOME

CO1. Able to understand the basic principles of elements, organic reactions drug synthesis and computational chemistry

CO2. Able to apply the knowledge of different engineering materials, advanced polymers, and nanomaterials to solve complex engineering problems

CO3. Able to analyse and evaluate water quality parameters and its treatment

CO4. Able to the knowledge of free energy, energy storage device, fuels and corrosion to design environment friendly & sustainable devices

CO5. Able to apply the knowledge of different instrumental techniques to analyse unknown engineering materials

CO v/s PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	2	2	2	-	-	-	-	-	2	2
2	3	3	3	3	-	-	2	-	-	-	2	2
3	3	3	-	-	-	-	3	-	-	-	3	2
4	3	3	3	2	-	-	3	-	-	-	3	2
5	3	3	3	3	2	-	-	-	-	-	2	2

COURSE CONTENT

Module 1 - Elements and their properties (6L)

1. Elements and their properties (3L)

Bohr's theory for one electron system, Hydrogen spectrum, Quantum numbers, atomic orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle, Electronic configuration and Magnetic properties.

2. Periodic Table for Engineers (3L)

Modern Periodic table, Periodic properties, study of advanced functional materials like Silicones, Silicates, Zeolite and alloys like steel, mischmetall, Neodymium alloy and their applications.

Module 2 - Energy devices and Semiconductors (6L)

1. Use of free energy in chemical equilibria (3L)

Laws of Thermodynamics, Enthalpy, Entropy, Spontaneity, Electrochemical Cell, Dry Cell, Mercury Cell, Lead Storage batteries, Ni-Cd Cells, Fuel Cells, Solar Cells, Nernst equation and applications, Electrochemical sensors

2. Crystals and Semiconductors (3L)

Crystals and their defects, Stoichiometric and Non-stoichiometric defects, Band theory and Doping, n- type and p-type semiconductors, Superconductors

Module 3 –Industrial Applications of Chemistry (8L)

1. Advanced Polymeric materials (3L)

Classification, Engineering Plastics, conducting polymers, bio polymers, polymer composites

2. Industrial corrosion (2L)

Classification, Effects of corrosion, Preventive measures

3. Analysis of Water Quality (1L)

Physicochemical and Biological parameters

4. Nano materials (1L)

Synthesis of Nano materials, Applications in modern devices

5. Basic Computational Chemistry (1L)

Introduction of computational chemistry and their applications

Module 4 – Organic Reaction Products and their spectroscopic analysis (4L)

1. Organic Reactions (2L)

Substitution, Elimination and Addition reactions

2. Drug designing and synthesis (1L)

Paracetamol, Aspirin

3. Spectroscopic Analysis (1L) UV – Visible Spectra, IR spectra

Course Name: Engineering Mathematics - I

Paper Code: M(CS)101

Contact (L: T: P): 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra, and calculus.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties related to matrix algebra and calculus.

CO2: Determine the solutions of the problems related to matrix algebra and calculus.

CO3: Apply the appropriate mathematical tools of matrix algebra and calculus for the solutions of the problems.

CO4: Analyze different engineering problems linked with matrix algebra and calculus.

CO-PO/PSO Mapping:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	1	2	-	-	-	-	-	-	-	1
CO	2.75	2.25	1.5	2	-	-	-	-	-	-	-	1.25

Weightage Values: Strongly mapped: '3', Moderately mapped: '2', Weakly mapped: '1', Not mapped: '-'

Course Content:**Module I: Linear Algebra (11L)**

Echelon form and normal (canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigen values and eigenvectors; Diagonalization of matrix, Cayley-Hamilton theorem.

Module II: Single Variable Calculus (5L)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Power series; Taylor's series.

Module III: Multivariable Calculus (Differentiation) (13L)

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

Module IV: Multivariable Calculus (Integration) (7L)

Double Integral, Triple Integral; Change of order in multiple integrals; Line Integral, Surface Integral, Volume Integral. Change of variables in multiple integrals.

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

Course Name: Professional Communication Paper**Code: HU101****Contact: 2:0:0****Total Contact Hours: 24****Credit: 2**

Pre-requisites:	Basic (10+2) level of knowledge of English grammar, vocabulary reading and writing skills.
Course Objectives	The course aims to impart domain and industry-specific communications skills in a globalized context and to promote the understanding of business communication practices and cross-cultural dynamics.
Course Outcomes:	By pursuing this course the students shall be able to
	1. Define, describe and classify the modalities and nuances of communication in a workplace context.
	2. Review, appraise and understand the modes, contexts and appropriacy of communicating across cultures and societies.
	3. Identify, interpret and demonstrate the basic formats, templates of business and official communication.
	4. Identify, compare and illustrate reading strategies and basic writing strategies.
	5. Interpret, analyze and evaluate semantic-structural, interpersonal and multicultural dynamics in business communication.

Course Content:**Module1:****Verbal and Nonverbal communication****4L**

Definition, Relevance and Effective Usage

Components of Verbal Communication: Written and Oral Communication

Components of Non-verbal Communication: Kinesics, Proxemics, Chronemics, Haptics Paralanguage

Barriers to Effective Communication

Module2:**Workplace Communication Essentials and Cross-Cultural Communication****4L**

Communication at the Workplace—Formal and Informal Situations

Language in Use—Jargon, Speech Acts/Language Functions, Syntactical and Grammatical Appropriacy

Cultural Contexts in Global Business: High Context and Low Context Cultures Understanding Cultural

Nuances and Stereotyping Achieving Culturally Neutral Communication in Speech and Writing

Module3: **4L**
 Reading Strategies and Basic Writing Skills Reading: Purposes and Nature of Reading
 Reading Sub-Skills—Skimming, Scanning, Intensive Reading
 Reading General and Business Texts (Reading for Comprehension and Detailed Understanding) Basic
 Writing Skills—Paragraph and Essay writing, writing technical documents
 Writing Technicalities—Paragraphing, Sentence Structure and Punctuation

Module4: **4L**
Report Writing
 Nature and Function of Reports Types of Reports
 Researching for a Business Report Format, Language and Style Report Documentation

Module5:
Employment Communication
 a. Writing Business Letters—(Enquiry, Order, Sales, Complaint, Adjustment, Job Application, Offer) **2L**
 b. Creating an Employee Profile—Preparing a CV or Résumé.
 Creating a Digital/Online Profile—LinkedIn (Résumé/Video Profile) **2L**
 c. Writing Other Interoffice Correspondence--E-mails: types, convention, and etiquette, Memo, Notices and Circulars **2L**
 d. Preparing Meeting Documentation—Drafting Notice and Agenda of Meetings, Preparing Minutes of Meetings. **2L**

References:-

1. Meenakshi Raman and Sangeetha Sharma. Technical Communication. 3rd edition. New Delhi: Oxford University Press, 2015.
2. Mark Ibbotson. Cambridge English for Engineering. Cambridge: Cambridge University Press, 2008.
3. Mark Ibbotson. Professional English in Use: Engineering. Cambridge: Cambridge UP, 2009.
4. Lesikar et al. Business Communication: Connecting in a Digital World. New Delhi: Tata McGraw-Hill, 2014.
5. John Seeley. Writing Reports. Oxford: Oxford University Press, 2002.
6. Judith Leigh. CVs and Job Applications. Oxford: Oxford University Press, 2002.
7. Judith Leigh. Organizing and Participating in Meetings. Oxford: Oxford University Press, 2002.
8. Michael Swan. Practical English Usage. Oxford: OUP, 1980.
9. Pickett, Laster and Staples. Technical English: Writing, Reading & Speaking. 8th ed. London:

Longman, 2001.

10. Diana Booher. E-writing: 21st Century Tools for Effective Communication.

Links:-

1. Purdue University's Online Writing Lab (OWL)-<https://owl.purdue.edu/>
2. Business English Pod-<https://www.businessenglishpod.com/>

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	2	1	1	2	3	-	2
CO2	-	-	-	-	-	1	1	2	2	3	-	3
CO3	-	-	-	-	-	3	3	1	1	3	2	3
CO4	-	-	-	-	-	3	3	1	-	3	-	3
CO5						2	2	2	2	3	-	3

Course Name: Values and Ethics Course

Code: HU102

Contacts: 2:0:0

Total Contact Hours: 24 Credit: 2

Prerequisite: None

Module: 1 Introduction:(4L)

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

Types of values-Social, Psychological, Aesthetic, Spiritual, and Organizational

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

Module 2: Universal Human Harmony. (4L)

Basic Human Aspirations, Happiness and Prosperity, Self-Exploration, Self and the Body

Understanding the harmony in the Nature.

Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature.

Values Crisis in contemporary society Nature of values: Value Spectrum of a good life (Maslow's Pyramid)

Module: 3 Ethical Concerns: (6L)

Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics. Rapid Technological growth and depletion of resources, Reports of the Club of Rome.

Problems of Technology transfer- Technology assessment impact analysis -Human Centered Technology.

Module: 4 Ethics of Profession: (4L)

Work Ethics and Work Values, Business Ethics, Human values in organizations: Social and ethical responsibilities of Technologists. Codes of professional ethics.

Types of Ethical issues-Internal Ethics of Business–

Whistle Blowing, Impact of Ethics on Business Policies and Strategies– Ethical Leadership – Characteristics

Module: 5 Self Development AND Gender Awareness (6L)

Definition of Gender, Basic Gender Concepts and Terminology, Exploring Attitudes towards Gender, Social Construction of Gender

Gender Roles and Relations, Types of Gender Roles, Gender Roles and Relationships Matrix, Gender-based Division and Valuation of Labour. Gender Development Issues, Identifying Gender Issues

Text Books:

1. Beneria, Lourdes. (2004). Gender, Development, and Globalization: Economics as if All People Mattered. Routledge Press. (GDGE)
2. Molyneux and Razavi. (2002). Gender Justice, Development and Rights. Oxford University Press (GJDR or WGD)
3. Visvanathan, Duggan, Wieggersma and Nisonoff. (2011).
4. The Women, Gender and Development Reader. 2nd Edition. Zed Press (WGD)
5. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
6. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.

7. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Course Outcomes:

CO 1	Understand the significance of values, various approaches to ethics and its applications in life and profession.
CO2	Able to distinguish Self and the Body, to understand Harmony in the Self
CO3	To identify and eradicate environmental concerns through technology
CO4	Demonstrate work ethics and analyse business strategies
CO5	Ability to understand gender terminologies and to identify gender issues

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

Paper Name: Constitution of India Paper**Code: HU103****Credit: 01****No. of lectures: 12**

Module 1: History of Making of the Indian Constitution: History. Drafting Committee, (Composition & Working) **3L**

Philosophy of the Indian Constitution: Preamble Salient Features

Module 2: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy **6L**

The Right to Equality

The Right to Freedom: I (Article 19)

The Right to Freedom: II (Articles 20, 21 and 22) The

Right against Exploitation

The Right to freedom of Religion

Cultural and Educational rights The

Right to Property

The Right to Constitutional Remedies

Fundamental Duties

Module-3: Organs of Governance: **3L**

Parliament - Composition - Qualifications and Disqualifications -Powers and Functions – Executive- President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

Text / Reference Books:

- 1) Indian Constitution by D. D. Basu, The Publisher, LexisNexis
- 2) Constitution of India by Subhas C Kasyap, Vitasta Publishing
- 3) The Constitution of India, P.M Bakshi, Universal Law Publishing Co.Ltd, New Delhi, 2003.
- 4) Indian Constitution Text Book - Avasthi, Avasthi,Publisher: LAKSHMI NARAIN AGARWAL
- 5) Introduction to the Constitution of India, Brij Kishore Sharma, PHI

Course Name: Programming for problem solving Lab Course

Code: CS191

Contact Hours: 3L/Week Total

Contact Hours: 36 Credits: 1.5

Course Outcomes	Name of Course Outcomes
CO1	To identify the working of different operating systems like DOS, Windows, Linux
CO2	To express programs in C language
CO3	To implement programs connecting decision structures, loops
CO4	To experiment with user defined functions to solve real time problems
CO5	To write C programs using Pointers to access arrays, strings, functions, structures and files

CO-PO-PSO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2						2	3	2	3	3
CO2	2	2	3	3	3							3	2	2	3
CO3	2	3	2	2	2							3	2	3	2
CO4	3	2	2	3	3							2	2	2	2
CO5	2	2	2	1	1						2	3	3	3	3

Course Content:

Module- 1: Familiarization with some basic commands of DOS and Linux. File handling and Directory structures, file permissions, creating and editing simple C program in different editor and IDE, compilation and execution of C program. Introduction to Code block.

Module-2: Problem based on

- Basic data types
- Different arithmetic operators.
- Printf() and scanf() functions.

Module-3: Problem based on conditional statements using

- if-else statements
- different relational operators
- different logical operators

Module-4: Problem based on

- a) **for** loop
- b) **while** loop
- c) **do-while** loop

Module-5: Problem based on

- a) How to write a menu driven program using switch-case statement
- b) How to write a function and passing values to a function
- c) How to write a recursive function.

Module-6: Problem based on

- a) How to use array (both 1-D and 2-D).
- b) How to pass an array to a function.

Module-7: Problem based on manipulation of strings in different way.**Module-8:** Problem based on

- a) How to handle compound variable in C
- b) How to handle file in C
- c) How to use command line argument in C

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Kanetkar Y.-Let us C, BPB Publication, 15th Edition

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
K R Venugopal & S R Prasad–MASTERING C, TMH, 2nd Edition

Paper Name: Professional Communication Lab Paper

Code: HU191

Contact: (0:0:2)

Total Contact Hours: 26 Credit: 1

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focusing on language skill acquisition techniques and error feedback.

Course Outcome:

By pursuing this course the students will be able to:

CO1: Recognize, identify and express advanced skills of Technical Communication in English through Language Laboratory.

CO2: Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in societal and professional life.

CO3: Articulate and present the skills necessary to be a competent Interpersonal communicator. CO4: Deconstruct, appraise and critique communication behaviours.

CO5: Adapt, negotiate and facilitate with multifarious socio-economical and professional arenas with effective communication and interpersonal skills.

Course Contents:

Module 1: Introduction to the Language Lab

- a. The Need for a Language Laboratory
- b. Tasks in the Lab
- c. Writing a Laboratory Note Book

Module 2: Active Listening

- a. What is Active Listening?
- b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
- c. Listening in Business Telephony

Module 3: Speaking

- a. Speaking—Accuracy and Fluency Parameters
- b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
- c. Fluency-focused activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
- d. Accuracy-focused activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
- e. Group Discussion: Principles and Practice
- f. Giving a Presentation—Learning Presentation Basics and Giving Micro Presentations

Module 4: Lab Project Work

- a. Writing a Book Review
- b. Writing a Film Review
- c. Scripting a Short Presentation (2 minutes)
- d. Making a short video CV (1-2 minutes)

References:

1. IIT Mumbai, **Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

CO-PO Mapping

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

Course Name: Engineering chemistry lab Paper

Code: CH(CS)191

Total Contact Hours: 24

Credit: 1

Course Objective

- Study the basic principles of pH meter and conductivity meter for different applications
- Analysis of water for its various parameters & its significance in industries
- Learn to synthesis Polymeric materials and drugs
- Study the various reactions in homogeneous and heterogeneous medium

Course Outcome

CH191.1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.

CH191.2: Able to analyse and determine the composition and physical property of liquid and solid samples when working as an individual and also as a team member

CH191.3: Able to analyse different parameters of water considering environmental issues

CH191.4: Able to synthesize drug and sustainable polymer materials.

CH191.5: Capable to design innovative experiments applying the fundamentals of modern chemistry

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	3	1	-	2	3	-	-	-	-	1
2	2	2	1	1	-	1	-	-	-	1	-	1
3	-	-	-	-	-	-	-	-	3	3	2	2
4	2	1	2	2	-	-	1	-	-	-	-	2
5	3	3	3	3	1	1	1	1	-	-	2	2

COURSE CONTENT

1. Determination of the concentration of the electrolyte through conductance measurement.
2. Determination of water quality measurement techniques.
3. Determination of the concentration of the electrolyte through pH measurement.
4. Estimation of Cu in brass
5. Estimation of Fe₂O₃ in Cement
6. Isolation of graphene from dead dry batteries and their use for temporary soldering.

7. Synthesis of Silver Nanoparticles doped organic thin film for organic transistors.
8. Estimation of corrosion in a given sample metal.
9. Preparation of Si-nano crystals for future memory devices.
10. Green Synthesis of ZnO based Polymer Nano composites.
11. Synthesis of polymers for electrical devices and PCBs.
12. Determination of Partition Coefficient of acetic acid between two immiscible liquids.
13. Drug design and synthesis
14. Rheological properties of the Newtonian fluids
15. Innovative Experiments

Course Name: Workshop and Manufacturing**Practices Lab Course Code: ME(CS)191****Contact: 0:0:3****Credits: 1.5****Prerequisite: Physics & Mathematics (10+2 Level)**

CO1: Gain basic knowledge of Workshop Practice and Safety useful for our daily living.

CO2: Understand the use of Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc.

CO3: Apply and performing operations like such as Marking, Cutting etc used in manufacturing processes.

CO4: Analyze the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.

CO5: Get hands on practice of in Welding and apply various machining processes which give a lot of confidence to manufacture physical prototype sin project works.

Course Content:

3P

(i) Theoretical discussions:

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

(ii) Workshop Practice:

At least 6 modules should be covered

Module 1 - Machine shop

6P

Typical jobs that may be made in this practice module:

- i. To make a pin from a mild steel rod in a lathe.
- ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and /ormilling machine.

Module 2 - Fitting shop

6P

Typical jobs that may be made in this practice module: To make a Gauge from MS plate.

Module 3 – Carpentry Shop

6P

Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like.

Module 4 - Welding & Soldering shop

6P

Typical jobs that may be made in this practice module:

- i. Arc Welding: To join two thick (approx 5mm) MS plates by manual metal arc welding.
- ii. Gas Welding: To join two thin mild steel plates or sheets by gas welding.
- iii. House wiring, soft Soldering

Module 5 – Smithy & Casting

6P

Typical jobs that may be made in this practice module:

- i. A simple job of making a square rod from a round bar or similar.
- ii. One/ two green sand moduls to prepare, and a casting be demonstrated.

Module 6 – CNC Machining & Laser Cutting

6P

Typical jobs that may be made in this practice module:

- i. At least one sample shape on mild steel plate should be made using CNC Milling / CNC Lathe Machine
- ii. At least one sample shape on glass should be made using laser cutting machine.

Module 7 – 3D Printing

6P

- i) Exposure to a 3D printing machine,
- ii) 3D printing of at least one sample model using available materials.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:

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

Reference Books:

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

CO-PO/PSO Mapping:

CO Codes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3						2		2	2					
CO2	3						2		2	2					
CO3	3						2		2	2			2		2
CO4	3						2		2	2			2		2
CO5	3	2	2				2		2	2					

1 st Year 2 nd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS201	Data Structures	3	0	0	3	3
2	ENGG	Minor	EE(CS)201	Basic Electrical & Electronics Engineering	3	0	0	3	3
3	SCI	Multidisciplinary	PH(CS)201	Engineering Physics	3	0	0	3	3
4	SCI	Multidisciplinary	M(CS)201	Engineering Mathematics –II	3	0	0	3	3
5	HUM	Value added course	HU204	Environmental Science	2	0	0	2	2
6	HUM	Value added course	HU205	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	CS291	Data Structures Lab	0	0	3	3	1.5
2	ENGG	Minor	EE(CS)291	Basic Electrical & Electronics Engineering Lab	0	0	3	3	1.5
3	HUM	Ability Enhancement Course	HU292	Design Thinking	0	0	2	2	1
4	SCI	Skill enhancement course	PH(CS)291	Engineering Physics Lab	0	0	3	3	1.5
5	ENGG	Skill enhancement course	ME(CS)291	Engineering Graphics & Design Lab	0	0	3	3	1.5
Total of Theory & Practical								29	22

Course Name: Data Structures

Course Code: CS201

Contact (Periods/Week):=3L/Week Total

Contact Hours: 36

Credits: 3

Course Objectives:

1. To learn the basics of abstract data types.
2. To learn the principles of linear and nonlinear data structures.
3. To build an application using sorting and searching.

Course Outcomes	Name of Course Outcomes
CO1	To identify how the choices of data structure & algorithm methods impact the performance of program.
CO2	To express problems based upon different data structure for writing programs.
CO3	To implement programs using appropriate data structure & algorithmic methods for solving problems.
CO4	To explain the computational efficiency of the principal algorithms for sorting, searching, and hashing.
CO5	To write programs using dynamic and static data structures and building applications for real world problems.

CO-PO-PSO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	
CO 1	3	2		2	3						1	3	1	1	1	
CO 2	3	2	2	2	2							2	3	2	2	
CO 3	2	3	3	2	3						1	2	3	3	3	
CO 4	2	2	2	3	1							1	2	1	2	
CO 5	2	3	3	3	2						1	2	3	3	3	
	2.40	2.40	2.50	2.40	2.20								2.00	2.40	2.00	2.20

Course Content:

Module 1: Introduction [4L]

Concepts of data and information; Concept of Abstract Data Type, Data Structure and Data Type. Classification of Data Structures- Primitive and Non-Primitive Data Structure, Linear and Non-Linear Data Structure. Need of Data Structures. (1L)

Concept of algorithms and programs, Different methods of representing algorithm; Algorithm analysis, time and space analysis of algorithms – Asymptotic notations like Big Oh (O), Small Oh(o), Big Omega(Ω), Small Omega(ω) and Theta(Θ) notation (definition and significance). (3L)

Module 2: Non-Restricted Linear Data Structure[9L]

List or Linear List: Definition and Example, List as ADT. Representation of Linear List- Sequential Representation and Linked Representation.

Array: Introduction to sequential representation, Linearization of multidimensional array. Application of array-representation of polynomial using array, Representation of Sparse matrix using array.

Linked List: Introduction to linked representation, Implementation of different types of linked list- Singly linked list, Doubly linked list, Circular linked list, Circular Doubly Linked List. Application of Linked list- Representation of polynomial.

Module 3: Restricted Linear Data Structure [6L]

Stack: Definition of Stack, implementations of stack using array and linked list, Applications of stack- infix to postfix conversion, Postfix Evaluation

Recursion: Principles of recursion - use of stack, tail recursion. Tower of Hanoi using recursion. Queue: Definition of Queue; Implementation of queue using array-physical, linear and circular model; Implementation of queue using linked list.

Dequeue - Definition and different types of dequeue.

Module 4: Nonlinear Data structures [9L]

Trees and Binary Tree:

Basic terminologies; Definition of tree and binary tree. Difference between tree and binary tree, Representation of binary tree (using array and linked list)

Binary tree traversal (pre-, in-, post- order); Threaded binary tree- definition, insertion and deletion algorithm; Binary search tree- Definition, insertion, deletion, searching algorithm;

Height balanced binary tree: AVL tree- definition, insertion and deletion with examples only.

m –Way Search Tree: B Tree – Definition, insertion and deletion with examples only; B+ Tree – Definition, insertion and deletion with examples only.

Heap: Definition (min heap and max heap), creation, insertion and deletion algorithm. Application of heap (priority queue and sorting).

Graphs: Definition and representation (adjacency matrix, incidence matrix and adjacency list).

Graph traversal– Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge).

Module 5: Sorting and Searching [8L]

Sorting Algorithms: Definition and need of sorting, different types of sorting algorithm (internal, external, stable, in-place, comparison based); Factors affecting sorting Methods, Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Radix sort – algorithm with analysis (time complexity) Searching: Factors affecting searching Methods; Sequential search –algorithm with analysis (time complexity); improvement using sentinel.

Binary search and Interpolation Search algorithm with analysis (time complexity)

Hashing: Introduction and purpose of Hashing and Hash functions (division, folding and mid-square), Collision resolution techniques.

Text book:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

Reference Books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design in C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson.

Course Name: Basic Electrical & Electronics Engineering Course

Code: EE(CS)201

Contact: 3:0:0

Total Contact Hours: 36 Credit: 3

Prerequisite: Basic 12th standard Physics and Mathematics, Concept of components of electric circuit.

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

CO	Statement
CO1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO2	To solve simple ac circuits in steady state
CO3	Impart the knowledge of Basic Electronics Devices and ICs.
CO4	Analyze the simple electronics circuits

MODULE 1: Elementary Concepts of Electric Circuits

6L

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

MODULE 2: Electrical machine

8L

Transformer: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.

DC Machines: Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

MODULE 3: Fundamentals of Semiconductor Devices:

6L

Introduction to Semiconductor: Concept of energy band diagram; Comparison among metal, insulator, semiconductor; Semiconductors-classifications and Fermi energy level; Charge neutrality and Mass-Action law in semiconductor; Current flow in semiconductor due to drift & diffusion process; Einstein relation.

MODULE 4: PN Junction Diode:

4L

Principle of operation; V-I characteristics; principle of avalanche & Zener breakdown; Junction resistances and capacitances; V-I characteristics of Zener diode.

MODULE 5: Bipolar Junction Transistors:

4L

PNP and NPN structures; Principle of operation; Current gains in CE, CB and CC mode; input and output characteristics; Biasing & Stability Analysis-Concept of Fixed Bias, Collector to base Bias & voltage divider bias.

Course Name: Engineering Physics Course**Code: PH(CS)201****Contact: (3:0:0)****Total Contact Hours: 36****Credits: 3****Prerequisites:** Knowledge of Physics up to 12th standard.**Course Objectives:**

The aim of courses in Physic-I is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):

After attending the course students' should be able to

CO	Description
CO1	explain basic principles of laser and optical fibers.
CO2	understand the properties of Nano material.
CO3	analyze different crystallographic structures according to their co-ordination number and packing factors.
CO4	analyze the structure, function and characteristics of different storage devices.
CO5	justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics.

CO-PO Mapping:

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

Course Content:**Module 1 (12L) Modern Optics**

1.01- Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and equations, working principle of laser, meta stable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. 6L

1.02-Fibre optics-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems. 3L

1.03-Holography-Theory of holography, viewing of holography, applications

3L

Module 2 (6L) Solid**State Physics**

2.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems. 3L

2.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction. 3L

Module 3 (8L) Quantum**Mechanics**

3.01 Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems. 4L

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions-Qualitative discussion; uncertainty principle, relevant numerical problems, Introduction of Schrödinger wave equation (only statement). 4L

Module 4 (4L)**Physics of Nano materials**

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical).

Module 5 (6L)**Storage and display devices**

Different storage and display devices-Magnetic storage materials, Hard disc (examples related to computers compared with semiconductor storage viz. Pendrive), Operation and application of CRT, CRO, Liquid crystal display (LCD), LED, OLED, Plasma display, Thin film transistor display).

Recommended Text Books for Physics I:**Text Books:**

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics – Md. N Khan and S Panigrahi.

Course Name: Engineering Mathematics - II Paper**Code: M(CS)201****Contact (L: T: P): 3:0:0****Total Contact Hours: 36****Credit: 3****Prerequisites:**

The students to whom this course will be offered must have the concept of (10+2) standard calculus.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equations, Laplace transform and numerical methods. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties related to ordinary differential equations, Laplace transform and numerical techniques.

CO2: Determine the solutions of the problems related to ordinary differential equations, Laplace transform and numerical techniques.

CO3: Apply appropriate mathematical tools of ordinary differential equations, Laplace transform and numerical techniques for the solutions of the problems.

CO4: Analyze engineering problems by using ordinary differential equation, Laplace transform and numerical Methods.

CO-PO/PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	1	2	-	-	-	-	-	-	-	1
M(CS) 201	2.75	2.25	1.5	2	-	-	-	-	-	-	-	1.25

Weightage Values: Strongly mapped: '3', Moderately mapped: '2', Weakly mapped: '1', Not mapped: '-'. '4'.

Course Content:**Module I: First Order Ordinary Differential Equations (ODE) (9L)**

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

Solution of first order and higher degree ODE: solvable for x , solvable for y and solvable for x and Clairaut's equation.

Module II: Second Order Ordinary Differential Equations (ODE) (8L)

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

Module III: Laplace Transform (LT) (12L)

Concept of improper integrals; Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $tf(t)$, LT of $f(t)$, LT of derivatives of $f(t)$, LT of integral of $f(t)$, Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods (7L)

Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward and backward interpolation, Lagrange's interpolation. **Numerical integration:** Trapezoidal rule, Simpson's 1/3 rule. **Numerical solution of ordinary differential equation:** Euler method, Fourth order Runge - Kutta method.

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
6. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
7. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
8. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
9. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
10. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.

Course Name: Environmental Science Paper

Code: HU204

Contact (L: T: P): 2 : 0 : 0 Total

Contact Hours: 24 Credit: 3

Course Objective(s)

This course will enable the students to,

- Realize the importance of environment and its resources.
- Apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Know about environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Solve scientific problem-solving related to air, water, land and noise pollution.

Course Outcome

CO	Statement
CO1	Able to understand the natural environment and its relationships with human activities
CO2	The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk
CO3	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
CO4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

CO – PO Mapping

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Able to understand the natural environment and its relationships with human activities	2	2	3	-	-	2	3	3	-	-	1	2
2	The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk	3	3	3	1	1	2	3	3	-	-	1	2

3	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues	3	3	3	2	1	2	3	3	-	-	1	2
4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.	1	1	1	1	2	2	3	3	-	-	1	2
AVERAGE		2	2	2	1	1	2	3	3	-	-	1	2

Module 1 - Resources and Ecosystem (6L)

1. Resources (2L)

Types of resources, resistance to resources, Human resource, Population Growth models: Exponential Growth, logistic growth

2. Ecosystem (3L)

Components of ecosystem, types of ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Food chain, Food web.

3. Energy and Environment(1L)

Conventional energy sources, coal and petroleum, Green energy sources, solar energy, tidal energy, geothermal energy, biomass

Module 2 – Environmental Degradation (9L)

1. Air Pollution and its impact on Environment (3L)

Air Pollutants, primary & secondary pollutants, Criteria pollutants, Smog, Photochemical smog and London smog, Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion.

2. Water Pollution and its impact on Environment (3L)

Water Pollutants, Oxygen demanding wastes, heavy metals, BOD, COD, Eutrophication, Hardness, Alkalinity, TDS and Chloride, Heavy metal poisoning and toxicity.

3. Land Pollution and its impact on Environment (2L)

Solid wastes, types of Solid Waste, Municipal Solid wastes, hazardous wastes, bio-medical wastes, E-wastes

4. Noise Pollution and its impact on Environment (1L)

Types of noise, Noise frequency, Noise pressure, Noise intensity, Noise Threshold limit, Effect of noise pollution on human health.

Module 3 – Environmental Management (6L)

1. Environmental Impact Assessment (1L)

Objectives of Environmental management, Components of Environmental Management, Environmental Auditing, Environmental laws and Protection Acts of India

2. Pollution Control and Treatment (2L)

Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator, etc., Waste Water Treatment, Noise pollution control.

3. Waste Management (3L)

Solid waste management, Open dumping, Land filling, incineration, composting, E-waste management, Biomedical Waste management.

Module 4 – Disaster Management (3L)

1. Study of some important disasters (2L)

Natural and Man-made disasters, earthquakes, floods drought, landside, cyclones, volcanic eruptions, tsunami, Global climate change. Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

2. Disaster management Techniques (1L)

Basic principles of disasters management, Disaster Management cycle, Disaster management policy, Awareness generation program

Text Books:

1. Basic Environmental Engineering and Elementary Biology (For MAKAUT), Gourkrishna Dasmohapatra, Vikas Publishing.
2. Basic Environmental Engineering and Elementary Biology, Dr. Monindra Nath Patra & Rahul Kumar Singha, Aryan Publishing House.
3. Textbook of Environmental Studies for Undergraduate Courses, Erach Barucha for UGC, Universities Press

Reference Books:

1. A Text Book of Environmental Studies, Dr. D.K. Asthana & Dr. Meera Asthana, S.Chand Publications.
2. Environmental Science (As per NEP 2020), Subrat Roy, Khanna Publisher

Paper Name: Indian knowledge System Paper

Code: HU205

Credit: 01

No. of lectures: 12

Module-1 (3L)

An overview of Indian Knowledge System (IKS): Importance of Ancient Knowledge - Definition of IKS - Classification framework of IKS - Unique aspects of IKS.

The Vedic corpus: Vedas and Vedangas - Distinctive features of Vedic life. Indian philosophical systems: Different schools of philosophy.

Module-2 (3L)

Salient features of the Indian numeral system - Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers.

Highlights of Indian Astronomy: Historical development of astronomy in India

Module-3 (3L)

Indian science and technology heritage - Metals and metalworking - Mining and ore extraction – Physical structures in India - Irrigation and water management - Dyes and painting technology - Surgical Techniques - Shipbuilding

Module-4 (3L)

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, Traditional Knowledge in agriculture, Traditional societies depend on it for their food and healthcare needs.

References:

1. Introduction to Indian knowledge system: concepts and applications-Mahadevan B.Bhat, Vinayak Rajat, Nagendra Pavana R.N.,PHI
2. Traditional Knowledge system in India, Amit Jha, Atlantic Publishers
3. S. N. Sen and K. S. Shukla, History of Astronomy in India, Indian National Science Academy, 2nd edition, New Delhi, 2000

Course Name: Data Structures Lab Course

Code: CS291

Contact (Periods/Week): 3L/Week Total

Contact Hours: 36

Credits: 1.5

Course Outcomes	Name of Course Outcomes
CO1	To identify the appropriate data structure as applied to specified problem definition.
CO2	To summarize operations like searching, insertion, deletion, traversing mechanism used on various data structures.
CO3	To implement practical knowledge of data structures on the applications.
CO4	To illustrate how to store, manipulate and arrange data in an efficient manner.
CO5	To write programs to access queue and stack using arrays and linked list, binary tree and binary search tree.

CO-PO-PSO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	3	-	-	-	-	-	-	2	1	1	1
CO2	3	2	2	3	3	-	-	-	-	-	3	2	3	2	2
CO3	2	3	3	-	2	-	-	-	-	-	-	2	3	3	3
CO4	2	2	1	3	2	-	-	-	-	-	2	3	2	1	2
CO5	2	2	3	1	2	-	-	-	-	-	-	3	3	3	3
	2.4	2.4	2.4	2.3	2.4	-	-	-	-	-	2.5	2.4	2.4	2	2.2

Course Content:

Module 1: Implementing Non-Restricted Linear Data Structure [2 Lab]

Problem based on Implementation of Non-Restricted Linear Data Structure like- Implementation of list as data structure using array. Implementation of list as data structure using linked list of different types. Implementation of polynomial as data structure using array and linked list. Implementation of sparse matrix as data structure using array.

Module 2: Implementing Restricted Linear Data Structure [3 Lab] Problem based on Implementation of Restricted Linear Data Structure like- Implementation of stack as data structure using array. Implementation of stack as data structure using linked list. Implementation of queue as data structure using array (physical, linear and circular model). Implementation of queue as data structure using linked list. Converting infix to post-fix and evaluating post-fix expression using stack. Implementing Tower-of-Hanoi problem.

Module 3: Implementing Non-Linear Data Structure [2 Lab]

Problem based on Implementation of Non-Linear Data Structure like Implementation of Binary Tree as data structure using array and linked list. Implementation of Binary Search Tree (BST) as data structure using linked list. Implementation of Heap as data structure using array. Implementation of Priority Queue as data structure using Heap.

Module 4: Implementing Sorting and Searching algorithm [5 Lab] Problem based on Implementation of Sorting and Searching algorithm

Implementation of Bubble sort using appropriate data structure. Implementation of Selection sort using appropriate data structure.

Implementation of Insertion sort using appropriate data structure. Implementation of Quick sort using appropriate data structure.

Implementation of Merge sort using appropriate data structure. Implementation of Heap sort using appropriate data structure. Implementation of Radix sort using appropriate data structure. Implementation of Sequential Search using appropriate data structure. Implementation of Binary Search using appropriate data structure. Implementation of hashing with collision resolution using linear and quadratic probing.

Text books:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications.
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson- freed 2nd Edition, Universities Press.

Reference books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private.
3. Limited Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson.
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

Course Name: Basic Electrical & Electronics Engineering Lab Course

Code: EE(CS)291

L-T-P: 0-0-3

Total Lecture: 36

Credit: 1.5

CO	Statement
CO1	To Analyze a given network by applying KVL and KCL.
CO2	To Examine the Operation of DC Motor.
CO3	To Examine the Operation of Basic Electronics Devices and ICs.
CO4	To design simple electronics circuits.

List of Experiments: -

1. Familiarization with different passive and active electrical & electronic components.
2. Familiarization with different Electrical & Electronics Instruments.
3. Verification of KVL and KCL.
4. Forward and reversal of DC shunt motor.
5. Speed control of DC shunt motor.
6. Study of the P-N junction diode V-I characteristics (Forward & Reverse Bias).
7. Study of the Characteristics of Zener diode (Forward & Reverse Bias).
8. Study of the Input and Output characteristics of BJT in CE mode.
9. Determination of offset voltage, offset current & bias current of OPAMP (IC741).
10. Determination of CMRR and slew rate of OPAMP(IC741).
11. Determination of inverting and non-inverting gain of OPAMP(IC741).
12. Extramural Experiment.

Textbooks:

1. Handbook of Laboratory Experiments in Electronics Engineering Vol. 1, Author Name: A.M. Zungeru, J.M. Chuma, H.U. Ezea, and M. Mangwala, Publisher -Notion Press Electronic Devices and Circuit Theory by Robert Boylestad Louis Nashelsky, 7th Edition, Prentice Hall
2. Experiments Manual for use with Grob's Basic Electronics 12th Edition by Wes Ponick, Publisher- McGraw Hill, 2015
3. Laboratory Manual for 'Fundamentals of Electrical & Electronics Engineering': A handbook for Electrical & Electronics Engineering Students by Manoj Patil (Author), Jyoti Kharade (Author), 2020
4. The Art of Electronics, Paul Horowitz, Winfield Hill, Cambridge University Press, 2015.
5. A Handbook of Circuit Math for Technical Engineers, Robert L. Libbey CRC Press, 05- Jun-1991

Reference Books

1. Basic Electrical and Electronics Engineering, Author: S. K. Bhattacharya, Publisher: Pearson Education India,2011
2. Practical Electrical Engineering
3. By Sergey N. Makarov, Reinhold Ludwig, Stephen J. Bitar, Publisher: Springer International Publishing, 2016
4. Electronics Lab Manual (Volume 2) By Navas, K. A. Publisher: PHI Learning Pvt. Ltd. 2018
5. Practical Electronics Handbook, Ian R. Sinclair and John Dunton, Sixth edition 2007, Published by Elsevier Ltd.

CO-PO Course Articulation Matrix Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	3	2	-	2	-	-	2	-	2	3
CO2	3	3	2	3	-	2	-	-	3	-	2	2
CO3	3	2	2	3	-	2	-	-	2	-	3	3
CO4	3	3	2	2	-	2	-	-	3	-	2	3

Course Name: Engineering Physics

Course Code: PH(CS)291

Contact Hours: 0:0:3

Credit: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objectives:

The aim of course is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):

After attending the course students' will be able to

CO1 : demonstrate experiments allied to their theoretical concepts

CO2 : conduct experiments using LASER, Optical fiber.

CO3 : participate as an individual, and as a member or leader in groups in laboratory sessions actively

CO4 : analyze experimental data from graphical representations, and to communicate effectively them in Laboratory reports including innovative experiment.

CO5: Design solutions for real life challenges.

CO-PO Mapping:

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

Course Content:

General idea about Measurements and Errors (One Mandatory):

Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.

Experiments on Classical Physics (Any 4 to be performed from the following experiments):

1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of Young's moduli of different materials.
3. Determination of Rigidity moduli of different materials.
4. Determination of wavelength of light by Newton's ring method.
5. Determination of wavelength of light by Laser diffraction method.
6. Optical Fibre-numerical aperture, power loss.

Experiments on Quantum Physics (Any 2 to be performed from the following experiments):

7. Determination of Planck's constant using photoelectric cell.
8. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
9. Determination of Stefan's Constant.
10. Study of characteristics of solar cell.

Perform at least one of the following experiments:

11. Calibration of an oscillator using Lissajous Figure.
12. Determination of specific charge of an electron (e/m) by J. J Thompson Method.

**In addition it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Study of dispersive power of material of a prism.
2. Study of viscosity using Poiseuille's capillary flow method/using Stoke's law.
3. Determination of thermal conductivity of a bad/good conductor using Lees-Charlton / Searle apparatus.
4. Determination of the angle of optical rotation of a polar solution using polarimeter.
5. Any other experiment related to the theory.

Text Books:

1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing)
3. Practical Physics by R. K. Kar (Book & Allied Publisher)

Paper Name: Design thinking Paper**Code: HU292****Credit: 01****L:T:P:: 0:0:2**

Module 1: Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting.	2
Module 2: Memory: process, Sensory memory, STM and LTM, Problems in retention, Memory enhancement techniques.	4
Module 3: Emotions: Experience & Expression Understanding Emotions, Empathy, And Concept of Emotional Intelligence.	2
Module 4: Basics of Design Thinking Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test.	6
Module 5: Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving	4
Unit 6: Prototyping & Testing -Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing	2
Module-7: Design thinking for strategic innovations Growth –Change- Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience -Value redefinition - Extreme Competition – Standardization – Strategy– Business Model design.	4

References:

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) second Edition, 2013.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013
4. George, E, Dieter, Linda, C, Schmidt. (2017). Engineering Design, McGraw Hill publisher, 4th edition

Course Name: Engineering Graphics & Design Lab Course

Code: ME(CS)291

Contact: 0:0:3

Credits: 1.5

Prerequisites: Basic knowledge of geometry

Course Outcomes: Upon successful completion of this course, the student will be able to: CO1: Learn the basics of drafting

CO2: Understand the use of drafting tools which develops the fundamental skills of industrial drawings.

CO3: Apply the concept of engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.

CO4: Analyse the concept of projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.

CO5: Evaluate the design model to different sections of industries as well as for research & development.

Course Contents:

Basic Engineering Graphics: (3P)

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

Module 1: Introduction to Engineering Drawing (6P)

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections (6P)

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

Module 3: Sections and Sectional Views of Right Angular Solids (6P)

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics: (3P)

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics: (3P)

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering (6P)

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerance; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Module 6: Demonstration of a simple team design project (3P)

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

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

Reference Books:

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

CO-PO/PSO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2			2									2	2	2
CO2	2			2									2	2	2
CO3	3			2									2	2	2
CO4	3			3									3	3	2
CO5	3	2		3	2								3	3	2

2 nd Year 3 rd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS301	Computer Organization and Architecture	3	0	0	3	3
2	ENGG	Major	CS302	Design and Analysis of Algorithms	3	1	0	4	4
3	SCI	Minor	M(CS)301	Discrete Mathematics	3	0	0	3	3
4	ENGG	Minor	EC(CS)301	Digital Logic and Electronics	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Major	CS391	Computer Organization and Architecture Lab	0	0	3	3	1.5
2	ENGG	Major	CS392	Design and Analysis of Algorithms Lab	0	0	3	3	1.5
3	ENGG	Minor	EC(CS)391	Digital Electronics Lab	0	0	3	3	1.5
4	ENGG	Skill Enhancement Course	CS393	IT Workshop Lab (SciLab/MATLAB/C++)	0	1	3	4	2.5
Total of Theory, Practical								26	20

Course Name: Computer Organization and Architecture

Course Code:CS301

Contact: 3:0:0

Total Contact Hours: 36L

Credits: 3

Prerequisite: Digital Electronics

Course Outcomes (COs):

After attending the course students should be able to

CO1	Illustrate the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law and apply this knowledge in designing solutions for real life engineering problems.
CO2	Summarize the basic concept of pipeline, instruction pipeline, arithmetic pipeline hazards detection and prevention and use this knowledge for designing and implementing mathematical and engineering problems leading to lifelong learning.
CO3	Identify the concept of Instruction-Level Parallelism to solve engineering problems.
CO4	Illustrate and compare the concept of Multiprocessor architecture and parallel architecture and apply this knowledge for developing an approach by means of existing and new methods as a team work.
CO5	Understand the concept of message passing architecture and interconnection network and design an optimized model for building a new solution as a professional engineering practice as a team.

Course Contents:

Module 1[8L]:

Introduction to CPU and concepts of ALU [2L], Instruction format and Instruction Cycle [1L], Addressing Modes [1L] Fixed- point multiplication -Booth's algorithm. [2L], Fixed-point division - Restoring and non-restoring algorithms [1L], Floating-point number representation-IEEE754 format and Floating-point arithmetic operation [1L].

Module 2 [7L]:

Introduction to basic computer architecture [1L], Stored Program Concepts: Von Neumann & Harvard Architecture [1L], RISC VS CISC [1L],Amdahl law [1L], Performance measurement parameters – MIPS, MFLOPS, SPEC ratings, CPI etc. [2L] Micro programmed and hardwired control unit [1L].

Module 3[8L]:

Introduction to memory-RAM and ROM [1L], Register transfer, memory transfer, Tri-state bus buffer, Memory Hierarchy: Secondary memory [1L], Main Memory [1L], Cache Memory [1L], Mapping Technique in cache memory: Direct, Full Associative and Set Associative [2L], Performance Implementation in Cache Memory [1L], Virtual memory Concepts [1L], page replacement policies [1L].

Module 4[9L]:

Pipelining: Basic concepts, instruction and arithmetic pipeline[2L], data hazards, control hazards and structural hazards, techniques for handling hazards[2L]Pipeline vs. Parallelism, Levels of parallelism [1L], Instruction- Level Parallelism: Basic Concepts, Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures [2L], Array and Vector Processors[1L]

Module 5[4L]:

Multiprocessor architecture: taxonomy of parallel architectures; Flynn Classification [1L], Centralized and Shared-

memory architecture: synchronization [1L], Interconnection Network (Omega, Baseline, Butterfly, Crossbar) [2L].

Text Books:

1. Hwang - Advanced Computer Architecture Parallelism Scalability Programmability, Tata McGraw- Hill Education Private Limited ISBN-13: 978-0-07-053070-6 ISBN-10:0-07-053070-X
2. Hwang & Briggs—Computer Architecture & Parallel Processing, TMH
- 3.

Reference Books:

1. Patterson D.A. and Hennessy, J.L.—Computer architecture a quantitative approach, 2nd ed. Morgan Kaufman, 1996
2. Hayes J. P., —Computer Architecture & Organization, McGrawHill
3. Siegel, H.J., —Interconnection Network for Large Scale parallel Processing, 2nd Ed. McGrawHill, 1990
4. Design and Analysis of Parallel Algorithm-Schism G. Akl

CO-PO Mapping

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

CO-PSO Mapping

Cos	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Design & Analysis of Algorithm

Course Code:CS302

Contact: 3:1:0

Total Contact Hours: 36L

Credits: 4

Prerequisites: To know data-structure and basic programming ability

Course Outcomes (COs):

After attending the course students should be able to

CO1	To understand and illustrate the concepts of time and space complexity, worst case, average case and best-case complexities and the asymptotic notation.
CO2	To analyze and apply the design principles and concepts to various basic algorithm design viz. dynamic programming, greedy methods etc.
CO3	To understand and analyze various string matching and graph algorithms.
CO4	To understand, illustrate and analyze the different complexity classes
CO5	To discuss, implement and analyze, verify the efficiency of the randomized and approximation algorithms.

Course Content:

Module-1 [4L]

Algorithm Development & Complexity Analysis: [4L] Stages of algorithm development for solving a problem: Describing the problem, identifying a suitable technique, Design of an algorithm, Proof of Correctness of the algorithm. Time and Space Complexity, Different Asymptotic notations – their mathematical significance. Solving Recurrences: Substitution Method, Recurrence Tree Method, Master Theorem (Statement Only).

Module-2 [14L]

Algorithm Design Techniques Brute force techniques – Traveling Salesman Problem, Divide and Conquer - Matrix multiplication: Strassen algorithm, Greedy techniques - Fractional Knapsack problem, Job Sequencing with Deadline, Graph Coloring, Finding Minimum Cost Spanning Tree using Prim's and Kruskal's algorithm, Dynamic programming - 0/1 Knapsack problem, Matrix chain multiplication, Travelling Salesman Problem, Backtracking-N-Queens Problem, Knights Tour on Chess Board.

Module-3 [3L]

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

Module-4 [5L]

Graph Algorithms Single Source Shortest Path -Dijkstra Algorithm, All pair shortest path – Floyd-Warshall Algorithm. Network Flows, Maximum Flows – Ford-Fulkerson Algorithm, Push Re-label Algorithm, Minimum Cost Flows – Cycle Cancelling Algorithm.

Module-5 [5L]

Complexity Classes: The Class P, The Class NP, Reducibility and NP-completeness – SAT (without proof), 3-SAT, Vertex Cover, Independent Set, Maximum Clique.

Module-6 [5L]

Approximation and Randomized Algorithms [3L], Approximation Algorithms - The set-covering problem – Vertex cover, K-center clustering. Randomized Algorithms - The hiring problem, Finding the global Minimum. Recent Trends [2L]

Text book:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman. 3. "Algorithm Design" by Kleinberg and Tardos.

Reference Books:

1. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi
2. Design Analysis and Algorithms by Hari Mohan Pandey.

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

COURSE NAME: DISCRETE MATHEMATICS

COURSE CODE: M(CS) 301

CONTACT: 3:0:0

TOTAL CONTACT HOURS: 36

CREDITS: 3

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard Mathematics.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with the knowledge of Abstract Algebra, Combinatorics, Recurrence Relation, Propositional Logic, Number Theory and Graph Theory.

Course Outcome(s):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties of abstract algebra, recurrence relation, propositional logic, number theory and graph theory.

CO2: Explain the theoretical working of the concepts of abstract algebra, recurrence relation, propositional logic, number theory and graph theory.

CO3: Apply the concepts of abstract algebra, recurrence relation, number theory, propositional logic and algorithms of graph theory in Computer Science.

CO4: Examine the Poset, Lattices, algebraic structures and graphs using the underlying concepts.

Course Content:

Module-I: Set Theory [11L]

Posets& Lattices: [6L]

Relation: Types of Relations, Properties of Binary Relation, Equivalence Relation, Partial Ordering Relation and Posets, Lattices.

Combinatorics: [2L]

Principle of Inclusion Exclusion, Pigeon Hole Principle.

Generating Functions and Recurrence Relations: [3L]

Generating functions, Recurrence relations: Formulation of different counting problems in terms of recurrence relations, Solution of recurrence relations with constant coefficients by Generating functions method.

Module-II: Propositional Logic[5L]

Basics of Boolean Logic, Idea of Propositional Logic, well-formed formula, Logical Connectives, Truth tables, Tautology, Contradiction, Algebra of proposition, Logical Equivalence, Normal Forms: Disjunctive Normal Forms (DNF) and Conjunctive Normal Forms (CNF).

Module-III: Number Theory [4L]

Well-Ordering Principle, Divisibility theory and properties of Divisibility, Fundamental theorem of Arithmetic, Prime and Composite Numbers, Greatest Common Divisor and Euclidean Algorithm, Congruence, Residue Classes.

Course Name: Digital Logic and Electronics

Course Code: EC(CS)301

Contact: 3:0:0

Credit: 3

Total Contact Hours: 36L

Pre-requisite:

Basic concepts of Logic gates, Truth Tables, Concept of basic components of a digital computer.

Course Outcome(s):

CO1: To realize basic gate operations and laws Boolean algebra.
CO2: To understand basic mechanism of digital computers and digital logic behind different arithmetic and control unit operations.
CO3: To design combinational circuits and combinational functions for larger more complex circuits.
CO4: To perform different operations with sequential circuits.
CO5: To understand fundamental concepts and techniques used in Logic families and PLDs

Course Content: –

Module – 1[8L]

Binary Number System [1L]; BCD, ASCII, EBDIC, Gray codes and their conversions [1L], Introduction and laws of Boolean algebra [1L], Boolean functions, Minterm and maxterm, Prime implicants, Representation in SOP and POS forms[2L], Minimization of logic expressions by Karnaugh Map and algebraic method [3L]

Module – 2[8L]

Combinational circuits:

Adder and Subtractor (half-full adder & subtractor) [2L], Serial & Parallel Adder, Carry look ahead adder and Parity Generator[2L], Encoder, Decoder, Multiplexer [2L], Demultiplexer, Comparator, Code Converters [2L]

Module – 3[12L]

Sequential Circuits:

Flip-Flops, SR, JK, Master slave JK, D, T, characteristic Tables, Excitation tables [5L]. Basic concept of Synchronous and Asynchronous counters, Up/Down Counters, Ring counter, Johnson counter, Design of Modulo-N Counter, Counter applications [5L]. Registers (SISO, SIPO, PIPO, PISO) [2L].

Module – 4[8L]

A/D and D/A conversion techniques – Basic concepts (D/A:R-2-R only [2L], A/D: successive approximation [2L])Logic families- TTL, ECL, MOS and CMOS - basic concepts [2L],Programmable logic Array, programmable Array logic, Sequential Programmable Devices [2L].

Text Book:

1. Saliva Hanan S, Digital Circuits and Design, Oxford
2. Morries Mano- Digital Logic Design- PHI

Reference Book:

1. R.P.Jain—Modern Digital Electronics, 2/e, Mc Graw Hill
2. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson

CO-PO Mapping

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

Course Name: Computer Organization and Architecture Lab Course

Code: CS391

Contact: 0:0:3

Credits: 1.5

Prerequisites:

Knowledge of designing different circuits in Computer Organization Lab

Course Outcomes (COs):

After attending the course students should be able to

CO1	Illustrate and use proper syntax in appropriate platforms for developing programs to solve problems related to Mathematics and Engineering fields leading to lifelong learning.
CO2	Apply the knowledge of algorithms in the computational area to efficient programming codes to design the problem using modern tools for solving complex engineering problems.
CO3	Outline different types of digital electronic circuits such as adder, subtract or, encoder decoder, multiplexer, demultiplexer, flip-flops, register, counter using various mapping and modern tools to prepare the most simplified circuit and optimize using various mapping and mathematical methods for solving the problem as a professional engineering practice as a team.
CO4	Apply the knowledge of digital electronic circuits to design memory and ALU and analyze the same to solve engineering-related computational problems as a team.
CO5	Interpret the result of the experiments, prepare laboratory reports based on observed output and analyze it to validate professional ethics and responsibilities and norms of the engineering practice.

List of Experiment:

1. Implement different types of Basic gates and simulate for truth table verification.
2. Implement half adder circuit and simulate for truth table verification.
3. Implement full adder circuit and simulate for truth table verification.
4. Implement half subtractor circuit and simulate for truth table verification.
5. Implement a full subtractor circuit and simulate for truth table verification.
6. Implement Multiplexer, De-Multiplexer circuit and simulate for truth table verification.
7. Implement Encoder, Decoder circuit and simulate for truth table verification.
8. Implement different types of flip flop and simulate for truth table verification.
9. Implement different types of parallel circuits (SISO, SIPO, PISO, PIPO) and simulate the result.
10. Implement ALU and simulate the result.
11. Implement a RAM chip and simulate the result.
12. Innovative Experiments.

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Design & Analysis of Algorithm Lab

Course Code: CS392

Contact: 0:0:3

Credit: 1.5

Prerequisite:

Programming knowledge

Course Outcomes (COs):

After attending the course students should be able to

CO1	To identify and prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
CO2	To understand and illustrate methods for analyzing the efficiency and correctness of algorithms (such as exchange arguments, recurrence, induction, and average case analysis)
CO3	To analyze and design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy.
CO4	To understand, compare, contrast, and choose appropriate implementation of the algorithmic design techniques to present an algorithm that solves a given problem.
CO5	To Identify and analyze criteria and specifications appropriate to new problems.

Course Content:

- A. Implementation of various Divide & Conquer Methods; viz. Matrix Multiplication.
- B. Implementations of various Dynamic Programming Methods, viz. Matrix Chain Multiplication Method, Travelling Salesman Problem etc.
- C. Implementations of various Branch & Bound Techniques, viz.
- D. Implementations of various Backtracking Methods, viz. n-Queen Problem.
- E. Implementations of Greedy Method, viz. Fractional Knapsack Problem, Job Sequencing Problem etc.
- F. Implementations of String-matching Algorithm viz. Naïve Algorithm, String Matching with Finite Automata etc.
- G. Implementations of Various Graph Algorithms, viz. Dijkstra 's Algorithm, Floyd Algorithm etc.
- H. Implementation of some Real-Life Trendy Problems

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Digital Electronics Lab

Course Code: EC(CS)391

Contact: 0:0:3

Credit: 1.5

Prerequisite:

Basic concepts of Logic gates, Truth Tables, function realization –minimization of Logic expressions by K-map, Concept of basic components of a digital computer, Binary Arithmetic

Course Outcomes (COs):

After attending the course students should be able to

CO1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
CO2	Analyze the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
CO3	Determination of input-offset voltage, input bias current and Slew rate, Common- mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
CO4	Able to know the application of Diode, BJT & OPAMP.
CO5	Familiarization and basic knowledge of Integrated Circuits

Course Content:

1. A) Realization of basic gates and universal gates.
B) Realization of basic gates using universal gates.
2. Design a Half adder and Full Adder circuit using basic gates and verify its output.
3. Design a Half subtractor and Full Subtractor circuit using basic gates and verify its output
4. Design an Adder/Subtractor composite unit.
5. Design of a Carry-Look-Ahead Adder circuit.
6. Realization of a) Encoder, b) Decoder c) Multiplexer, d) De-mux, e) Comparator and their Truth Table verification.
7. Realization of RS / JK / D flip flops using logic gates.
8. Design of Shift Register using J-K / D Flip Flop.
9. Realization of Synchronous Up/Down counters.
10. Design of MOD- N Counter
11. Study of DAC
12. Study of logic families and PLDs

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2		2
CO4	2	2	2
CO5	2	2	2

Course Name: IT Workshop Lab (SciLab/MATLAB/C++)

Course Code: CS393

Contact: 0:1:3

Credits: 2.5

Prerequisite

Computer Fundamentals and principles of computer programming

Course Outcomes (COs):

After attending the course students should be able to

CO1	Demonstrate a thorough understanding of modular programming by designing programs that require the use of programmer-defined functions.
CO2	Demonstrate a thorough understanding of arrays by designing and implementing programs that search and sort arrays.
CO3	Demonstrate a thorough understanding of the object-oriented programming concepts of encapsulation, data abstraction and composition by designing and implementing classes including the use of overloaded functions and constructors.
CO4	Demonstrate a thorough understanding of the concept of pointers and dynamic memory allocation the implementation of programmer-defined functions and classes by writing code, performing unit testing and debugging of multiple complex programs.
CO5	Demonstrate an understanding of the differences between C and C++ in the areas of strings, pass by reference/passing pointers, and structs by designing and implementing programs that use C strings, C++

Course Content:

1. Introduction of UNIX/Linux Operating System which includes preliminary commands, start-up & shutdown methodology, file.
2. Handling as well as introduction to editors like Vi editor, introduction to GNU C & C++ compiler, as well as introduction to GNU & GDB script.
3. Introduction to C++, basic loop control, executing programs.
4. Writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures & unions.
5. Object-Oriented Programming in C++, fundamentals of classes, constructors-destructors.
6. Dealing with member functions, operator overloading and polymorphism (both static & dynamic).
7. Dealing with inheritance, derived class handling.
8. Abstract class, virtual class, overriding, template class, name-space & exception handling.
9. Dynamic memory allocation, implementation of Linked Lists, using C++.
10. Reading and Writing to file, Numerical simulation.
11. Innovative experiments/Projects

Text Books

1. The C++ Programming Language by Bjarne Stroustrup Addison-Wesley publisher
2. Object-Oriented Programming in C++ b by Robert Lafore Publisher: Sams

Reference Books

1. Object Oriented Programming with C++ by Balaguruswamy McGraw Hill Education; Sixth edition Addison-Wesley publisher
2. C++ Programming Language (4th Edition) by Bjarne Stroustrup- Pearson publisher

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

2 nd Year 4 th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CS401	Operating Systems	3	0	0	3	3
2	ENGG	Major	CS402	Computer Networks	3	0	0	3	3
3	ENG	Major	CS403	Formal Language and Automata Theory	3	0	0	3	3
4	SCI	Minor	M(CS)401	Probability and Statistics	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(CS)401	Principles of Management	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	CS491	Operating Systems Lab	0	0	3	3	1.5
2	ENGG	Major	CS492	Computer Networks Lab	0	0	3	3	1.5
3	ENGG	Major	CS493	Programming using Python	0	0	3	3	1.5
4	ENGG	Minor	M(CS)491	Numerical Methods Lab	0	0	3	3	1.5
5	HUM	Ability Enhancement Course	HU(CS)491	Soft Skill & Aptitude	2	0	0	2	1
Total of Theory, Practical								28	21

Paper Name: Operating System

Paper Code: CS401

Contact Hours/Week: 3

Credit: 3

Total Contact Hours: 36L

Prerequisites:

1. Computer organization
2. Computer Architecture
3. Data Structures
4. Algorithms & Programming Concept

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the fundamental concepts of Operating System, Protection & Security and differentiate different types of Operating System.
CO2	Understand and implement process & thread; understand, apply, compare different process synchronization algorithm and inter process communication to solve engineering problems
CO3	Understand/explain/analyze different synchronization techniques, critical section problems and deadlock and apply them to solve engineering problems.
CO4	Understand/explain different memory management techniques including virtual memory management; also able to apply, compare, and implement different page replacement algorithms to solve engineering problems.
CO5	Understand/explain different I/O mechanisms, File structures and disk management techniques and solving engineering problems applying different disk scheduling algorithms.

Course Content:

Module – 1:[3L]

Functionalities of Operating System, Evolution of Operating System.

Types of Operating System: batch, multi-programmed, time-sharing, real-time, distributed, parallel, Structural overview, Protection & Security.[3L]

Module – 2: [9L]

Processes: Concept of processes, process states, PCB, process scheduling, co-operating processes, independent process, suspended process, Interaction between processes and OS, [2L]

Threads: overview, benefits of threads, user and kernel level threads. [1L]

CPU scheduling: Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, SRTF, RR, priority, multilevel queue, multilevel feedback queue scheduling). [6L]

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Computer Networks

Course Code: CS402

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisite:

1. Familiarity and knowledge of Operating Systems and Computer Architecture.
2. Also require a little bit of programming languages concepts like C, Java.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand basics of computer network and different architecture and topologies of computer network and analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
CO2	Understand/analyze different protocols of the data link layer and apply them to solve engineering problems.
CO3	Understand/analyze different protocols of Network and Transport Layer and apply them to solve engineering problems.
CO4	Understand/analyze different protocols of session and application layer and apply them to solve engineering problems.
CO5	Develop, Analyze, specify and design the topological and routing strategies using socket programming.

Course Contents:

Module 1: Introduction [6L]

Introduction (3L):

Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network.

Physical Layer: [3L]

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module 2: Data Link Layer [9L]

Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop- and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go- Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation.[5L] Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx, Bluetooth, RFID, Bridges, Virtual LANs, Switching.[4L]

Module 3: Network Layer [10L]

IP Addressing, IPv4 and IPv6. Difference IPv4 and IPv6, Conversion of IPv4 and IPv6, Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPv6, BOOTP and DHCP—Delivery protocols Other Protocols such as mobile IP in wireless Network. [5L]

Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing: RIP, OSPF, BGP; Routing for Mobile Hosts. [5L]

Module 4: Transport layer: [5L]

Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP: Congestion Control: Open Loop, Closed Loop packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. [4L]

Advanced topic such as Remote Procedure Call, Delay Tolerant Networks. [1L]

Module 5: Application Layer [5L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Text books:

1. B. A. Forouzan – —Data Communications and Networking (3rd Ed.) — TMH
2. S. Tanenbaum – —Computer Networks (4th Ed.) — Pearson Education/PHI

Reference books:

1. W. Stallings – —Data and Computer Communications (5th Ed.) — PHI/ Pearson Education
2. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
3. Comer – —Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.) — Pearson Education/PHI

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Formal Language and Automata Theory Course

Code: CS403

Contacts: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisites:

1. Digital Logic
2. Computer organization
3. Computer Fundamentals

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the fundamental concepts of Finite State Automata to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
CO2	Understand the fundamental concepts of Regular Expressions and its relation with DFA so that they can Develop regular expression for a specified language and Validate it.
CO3	Understand the fundamental concepts of Context Free Grammar so that they can Design grammar for a specified language and Validate it.
CO4	Explain or Illustrate the fundamental operating principles of Push Down Automata and Use it appropriately to Solve problems.
CO5	Understand the operating principles of Turing Machine and Design Turing Machines to Propose solutions to the related problems appropriately and validate the effectiveness as well as limitations of computations making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

Course Contents:

Module-1: [9L]

Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram, [1L]

Introduction to Finite State Model (FSM), Design of sequence detector, Finite State Machine, Finite Automata, Deterministic Finite Automata (DFA) and Non-deterministic Finite Automata (NFA), Transition diagrams, Transition tables and Language recognizers. [3L]

NFA with empty transitions, Equivalence between NFA with and without empty transitions. NFA to DFA conversion. [2L]

Minimization of FSM: Minimization Algorithm for DFA, Introduction to Myhill-Nerode Theorem [2L]

Limitations of FSM, Application of Finite Automata [1L]

Module-2: [7L]

Finite Automata with output – Moore & Mealy machine. Representation of Moore & Mealy Machine, Processing of the String through Moore & Mealy Machine, Equivalence of Moore & Mealy Machine – Inter- conversion. [2L]
Equivalent states and Distinguishable States, Equivalence and k-equivalence, Minimization of Mealy Machine [1L]

Minimization of incompletely specified machine–Merger Graph, Merger Table, Compatibility Graph [2L]
Lossless and Lossy Machine – Testing Table, Testing Graph [2L]

Module-3: [5L]

Regular Languages, Regular Sets, Regular Expressions, Algebraic Rules for Regular Expressions, Arden's Theorem statement and proof [1L]

Constructing Finite Automata (FA) for given regular expressions, Regular string accepted by FA [2L]

Constructing Regular Expression for a given Finite Automata [1L]

Pumping Lemma of Regular Sets. Closure properties of regular sets [1L]

Module-4: [10L]

Grammar Formalism-Context Free Grammars, Derivation trees, sentential forms. Rightmost and leftmost derivation of strings, Parse Tree, Ambiguity in context free grammars. [1L]

Minimization of Context Free Grammars. [1L]

Removal of null and unit production [1L]

Chomsky normal form and Greibach normal form. [1L]

Pumping Lemma for Context Free Languages. [1L]

Enumeration of properties of CFL, Closure property of CFL, Ogden's lemma & its applications [1L]

Regular grammars–right linear and left linear grammars [1L]

Pushdown Automata: Pushdown automata, definition. Introduction to DCFL, DPDA, NCFL, NPDA [1L]

Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L]

Equivalence of CFL and PDA, inter-conversion. [1L]

Module-5: [5L]

Turing Machine: Definition, model [1L]

Design of TM, Computable functions [1L], Church 's hypothesis, counter machine [1L] Types of Turing machines [1L]

Universal Turing Machine, Halting problem [1L]

Textbook:

1. Introduction to Automata Theory Languages and Computation, Hopcroft. E. and Ullman J.D., Pearson Education.

Reference Books:

1. Formal Languages and Automata Theory, C. K. Nagpal, Oxford
2. Switching and Finite Automata Theory, Zvi Kohavi, 2nd Edition, Tata McGraw Hill

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

COURSE NAME: PROBABILITY AND STATISTICS

COURSE CODE: M(CS) 401

CONTACT: 3:0:0

TOTAL CONTACT HOURS: 36

CREDITS: 3

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard Mathematics.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with the knowledge of probabilistic approaches and inferential statistics.

Course Outcome(s):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties related probability distribution and inferential statistics.

CO2: Explain the theoretical working of the concepts of probability distribution and inferential statistics.

CO3: Apply the appropriate mathematical tools using the concepts of probability distribution and inferential statistics in Computer Science.

CO4: Analyze the real-world problems using the underlying principles of both probabilistic and statistical approaches.

Course Content:

Module-I: Probability and Random Variables [10L]

Discrete and continuous random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, Moments, Moment generating functions, Binomial, Poisson, Uniform, Exponential and Normal distributions

Module-II: Two Dimensional Random Variables [9L]

Joint distributions, Marginal and conditional distributions, Covariance, Correlation and linear regression, T Transformation of random variables, Central limit theorem (for independent and identically distributed random variables).

Module-III: Sampling Theory & Estimation of Parameters [10L]

Sampling Theory: Random sampling, Parameter & Statistic, Standard error of statistic, Distributions of the sample mean and the sample variance for a normal population, Chi-Square distributions, t distributions and F distributions.

Estimation of Parameters: Unbiased and consistent estimators, Point estimation, Interval estimation, Maximum likelihood estimation of parameters (Binomial, Poisson and Normal), Confidence intervals and related problems.

Module-IV: Testing of Hypothesis [7L]

Simple and Composite hypothesis, Critical region, Level of significance, Type I and Type II errors, one sample and two sample tests for means and proportions, χ^2 - test for goodness of fit.

Project Domains:

1. Study of uncertainty in real world phenomena using Probability Distribution.
2. Application of Sampling Theory and Estimation of Parameters in engineering problems.
3. Application of Testing of Hypothesis in engineering problems.

Text Books:

1. Das, N.G., *Probability and Statistics*, The McGraw Hill Companies.
2. Gupta S. C. and Kapoor V. K., *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
3. Goon A.M., Gupta M. K. and Dasgupta, B., *Fundamental of Statistics*, The World Press Pvt. Ltd.
4. Kreyszig, E., *Advanced Engineering Mathematics*, 9th Edition; John Wiley & Sons, 2006.

Reference Books:

1. Lipschutz, S. and Lipson, M., *Schaum's Outline in Probability* (2nd Ed.); McGraw Hill Education.
2. Soong, T. T., *Fundamentals of Probability and Statistics for Engineers*; Wiley Publications.
3. Spiegel, M. R., *Theory and Problems of Probability and Statistics (Schaum's Outline Series)*; McGraw Hill Book Co.
4. Montgomery, D.C. and Runger, G.C., *Applied Statistics and Probability for Engineers*, Wiley Publications.

CO-PO Mapping:

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	3	2	1	-	-	-	-	-	-	-	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2
M(CS) 401	3	2.5	2	1.5	-	-	-	-	-	-	-	1.5

Weightage Values: Strongly mapped: '3', Moderately mapped: '2', Weakly mapped: '1', Not mapped: '-'.

Course Name: Principles of Management

Course Code: HU(CS)401

Contacts: 2:0:0

Total Contact Hours: 24

Credits: 2

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the basic concepts and technologies used in the field of management information Systems
CO2	Have the knowledge of the different types of management information systems
CO3	Understand the processes of developing and implementing information systems.
CO4	Be aware of the ethical, social, and security issues of information systems.
CO5	An ability to effectively integrate IT-based solutions into the user environment

Course Content:

Module-1: Management Concepts: Definition, roles, functions and importance of Management, Evolution of Management thought-contribution made by Taylor, Fayol, Gilbreth, Elton Mayo, McGregor, Maslow (4L)

Module - 2: Planning and Control: Planning: Nature and importance of planning, -types of planning, Levels of planning - The Planning Process. –MBO, SWOT analysis, McKinsey’s 7S Approach.

Organizing for decision making: Nature of organizing, span of control, Organizational structure –line and staff authority.

Basic control process -control as a feedback system – Feed Forward Control –Requirements for effective control – control (4L)

Module - 3: Group dynamics: Types of groups, characteristics, objectives of Group Dynamics. Leadership: Definition, styles & functions of leadership, qualities for good leadership, Theories of leadership (4L)

Module – 4: Work Study and work measurement: Definition of work study, Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim & Objectives, Use of stopwatch procedure in making Time Study. Performance rating, allowances and its types. Calculation of Standard Time. Work sampling (4L)

Module - 5: Marketing Management: Functions of Marketing, Product Planning and development, Promotional Strategy (2L)

Module - 6: Quality management: Quality definition, Statistical quality control, acceptance sampling, Control Charts –Mean chart, range chart, c chart, p chart, np chart, Zero Defects, Quality circles,, Kaizen & Six Sigma, ISO -9000 Implementation steps, Total quality management (6L)

Text Books:

1. Essentials of Management, by Harold Koontz & Heinz Weihrich Tata McGraw
2. Production and Operations Management-K. Aswathapa, K. Shridhara Bhat, Himalayan Publishing House

References:

1. Organizational Behavior, by Stephen Robbins Pearson Education, New Delhi
2. New era Management, Daft, 11th Edition, Cengage Learning
3. Principles of Marketing, Kotlar Philip and Armstrong Gary, Pearson publication

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

Course Name: Operating Systems Lab

Course Code: CS491

Allotted Hours: 36L

Prerequisites:

1. Computer organization
2. Computer Architecture
3. Data Structures
4. Algorithms & Programming Concept

Course Outcomes (COs):

After attending the course students should be able to

CO1	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
CO2	Understand the concepts of deadlock in operating systems.
CO3	Implement them in Multiprogramming system.
CO4	Create process creation and implement inter process communication
CO5	Analyze the performance of the various page replacement schemes

Course Content:

1. **Essential Linux Commands[9P]:** Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, kill, ps, who, sleep, grep, fgrep, find, sort, cal, banner, touch, file related commands – ws, sat, cut, grep etc. Mathematical commands –expr, factor, units, Pipes (use functions pipe, popen, pclose), named Pipes (FIFOs, accessing FIFO)
2. **Shell Programming [6P]:** Creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).
3. **Process [3P]:** Starting new process, replacing a process image, duplicating a process image.
4. **Semaphore [3P]:** Programming with semaphores (use functions semget, semop, semaphore_p, semaphore_v).
5. **POSIX Threads[6P]:** Programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel).
6. **Shared Memory [9P]:** Create the shared memory, Attach the shared memory segment to the address space of the calling process, Read information from the standard input and write to the shared memory, Read the content of the shared memory and write on to the standard output, Delete the shared memory

Books:

1. Yashavant P. Kanetkar, UNIX Shell Programming, 1st edition, BPB Publications
2. W. Richard Stevens, UNIX Network Programming, 2nd edition, Prentice Hall

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Computer Networks Lab

Course Code: CS492

Allotted Hours: 36L

Prerequisites:

1. Familiarity and knowledge of Computer Network and Computer Architecture
2. Also require strong knowledge of programming languages like C, Java and UNIX or Linux environment.

Course Outcomes (COs):

After attending the course students should be able to

CO1	To design and implement small size network and to understand various networking commands.
CO2	To provide the knowledge of various networking tools and their related concepts.
CO3	To understand various application layer protocols for its implementation in client/server environment
CO4	Understand the TCP/IP configuration for Windows and Linux
CO5	Learn the major software and hardware technologies used on computer networks

Course Contents:

1. Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations. [6L]
2. Socket Programming using TCP and UDP [18L]
3. Implementing routing protocols such as RIP, OSPF. [2L]
4. Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS [4L]
5. Server Configuration: only web server (If time permit, Instructor can do more than that) [6L]

Textbooks:

1. TCP sockets in C Programs-Practical guide for Programmers By Micheal, J Donahoo and Kenneth L calvert.
2. 2.Socket Programming by Raj Kumar Buyaa.

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Numerical Methods Lab

Course Code: M(CS)491

Allotted Hours: 30L

Prerequisite: Any introductory course on programming language (example. C/ Matlab).

Course Outcomes (COs):

After attending the course students should be able to

CO1	Describe and explain the theoretical workings of numerical techniques with the help of C
CO2	Compute basic command and scripts in a mathematical programming language
CO3	Apply the programming skills to solve the problems using multiple numerical approaches.
CO4	Analyze if the results are reasonable, and then interpret and clearly communicate the
CO5	Apply the distinctive principles of numerical analysis and the associated error measures.

Course Content:

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. LU Factorization method.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.

Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab/Scilab/Labview / Mathematica/NAG (Numerical Algorithms Group) / Python.

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

Paper Name: Soft Skills and Aptitude

Paper Code: HU (CS) 491

Credits: 1

Contact Hours: 2

Lecture: 24

Course Outcomes (COs)

CO1: Develop effective communication skills (verbal, written, and non-verbal) for professional environments.

CO2: Enhance problem-solving and analytical thinking through logical reasoning and aptitude training.

CO3: Demonstrate strong teamwork, leadership, and interpersonal skills in a corporate setting.

CO4: Manage time efficiently and handle workplace stress through practical strategies.

CO5: Build a professional profile (resume, LinkedIn, portfolio) to enhance employability.

Module 1: Communication & Corporate Etiquette (5L)

Objective: To develop professional communication skills and workplace etiquette.

Topics Covered:

- Fundamentals of Corporate Communication (Email, Meetings, Reports)
- Business Writing: Resume, Cover Letter, and Statement of Purpose (SOP)
- Public Speaking & Presentation Skills (With AI/Tech-based Tools)
- Group Discussion & Personal Interview Techniques
- Corporate Etiquette: Dress Code, Body Language, Networking
- Persuasion & Negotiation Skills in Interviews
- Handling Workplace Conflicts and Professional Conduct

Practical Exercises:

Mock GD & PI Sessions

Elevator Pitch Challenge

Drafting Business Emails and Reports

Role-playing Interview Scenarios

Module 2: Verbal & Analytical Ability for Competitive Exams (4L)

Objective: To strengthen verbal reasoning, numerical ability, and logical thinking for aptitude tests.

Topics Covered:

- Grammar & Sentence Correction
- Vocabulary Building & Contextual Usage
- Reading Comprehension Techniques
- Logical Reasoning: Syllogisms, Blood Relations, Seating Arrangements
- Quantitative Aptitude: Percentage, Ratio-Proportion, Time & Work

- Data Interpretation & Graphical Analysis
- Puzzles and Critical Thinking Exercises
- Decision-Making and Problem-Solving Strategies

Practical Exercises:

Weekly Verbal & Quantitative Aptitude Tests
Logical Puzzles and Reasoning Games
Speed Reading & Summary Writing
Mock Corporate Aptitude Tests

Module 3: Teamwork, Leadership & Conflict Resolution (5L)

Objective: To cultivate leadership, teamwork, and interpersonal effectiveness.

Topics Covered:

- Teamwork vs. Individual Contribution
- Leadership Styles & Decision Making
- Conflict Management & Negotiation Skills
- Emotional Intelligence (EQ) in Workplace Relationships
- Cross-Cultural Communication in Global Tech Companies
- Adapting to Change & Handling Difficult Conversations
- Empathy & Relationship Management in Professional Spaces

Practical Exercises:

Team-Based Problem-Solving Activities
Leadership Role-Play Scenarios
Conflict Resolution Case Studies
Workplace Adaptability Drills

Module 4: Time & Stress Management for Engineers (3L)

Objective: To develop productivity habits for balancing work and personal growth.

Topics Covered:

- Prioritization Techniques (Eisenhower Matrix, Pomodoro Technique)
- Handling Work Pressure & Burnout in IT Jobs
- Effective Goal-Setting & Productivity Hacks
- Mindfulness & Stress Reduction Techniques
- Work-Life Balance for Engineers
- Managing Deadlines & Overcoming Procrastination
- Stress-Handling Strategies in High-Stakes Environments

Practical Exercises:

Time-Blocking & Task Prioritization Drills

Stress-Management Workshops
 Industry Case Studies on Work-Life Balance
 Productivity Habit Challenges

Module 5: Profile Building & Career Readiness (7L)

Objective: To prepare students for industry placements and professional networking.

Topics Covered:

- Resume Optimization (ATS-Friendly Formats)
- LinkedIn & GitHub Profile Enhancement
- Personal Branding & Online Portfolio Development
- Industry Certifications & Upskilling (Coursera, Udemy, AWS, etc.)
- Networking Strategies & Building Corporate Connections
- Strategies for Effective Salary Negotiation
- Leveraging Internship & Freelance Experience for Career Growth

Practical Exercises:

Resume Review & LinkedIn Profile Audit
 Creating a Personal Website/Portfolio
 Mock HR & Technical Interviews
 Industry Networking & Mentorship Sessions

Evaluation & Assessment

- **Class Participation & Practical Assignments** – 20%
- **Aptitude & Verbal Ability Tests** – 20%
- **Mock GD & PI Performance** – 20%
- **Corporate Project & Leadership Activity** – 20%
- **Final Profile Submission (Resume, LinkedIn, Portfolio)** – 20%

Industry Integration & Certifications

- Guest Lectures from Corporate Trainers, HR Leaders & Entrepreneurs
- Collaboration with Placement Cells & Corporate Partners (e.g., TCS, Infosys, Wipro)
- Soft Skill Certifications (TCS iON, NPTEL, LinkedIn Learning)

Program Outcomes (POs) Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓		✓			✓		✓	✓	✓
CO2	✓	✓		✓	✓					✓		✓
CO3			✓			✓	✓	✓	✓	✓	✓	✓

CO4					✓	✓	✓	✓	✓	✓	✓	✓
CO5			✓		✓			✓	✓	✓	✓	✓
CO6	✓	✓		✓	✓				✓	✓		✓
CO7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

Program Specific Outcomes (PSOs) Mapping

COs	PSO1 (Software & System Development Skills)	PSO2 (Employability & Entrepreneurship Skills)	PSO3 (Professional & Ethical Responsibilities)
CO1		✓	✓
CO2	✓	✓	
CO3		✓	✓
CO4		✓	✓
CO5	✓	✓	✓

Program Educational Objectives (PEOs) Mapping

PEO1: To equip students with the ability to apply engineering knowledge, analyze problems, and develop solutions.

PEO2: To instill strong communication, leadership, and teamwork skills for corporate success.

PEO3: To develop ethical and socially responsible engineers who can contribute to sustainable growth.

PEO4: To encourage lifelong learning and adaptation to technological advancements.

COs	PEO1 (Engineering Knowledge & Problem Solving)	PEO2 (Communication & Teamwork)	PEO3 (Ethics & Sustainability)	PEO4 (Lifelong Learning & Career Growth)
CO1	✓	✓	✓	✓
CO2	✓			✓
CO3		✓	✓	✓
CO4		✓	✓	✓
CO5	✓	✓	✓	✓

3 rd Year 5 th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
1. THEORY									
1	ENGG	Major	CS 501	Artificial Intelligence	3	0	0	3	3
2	ENGG	Major	CS 502	Database Management Systems	3	0	0	3	3
3	ENGG	Major	CS 503	Object Oriented Programming using Java	3	0	0	3	3
4	ENGG	Major	CS 504 A CS 504 B CS 504 C	Compiler Design Cryptography and Network Security Computer Graphics	3	0	0	3	3
5	HUM	Minor	HU(CS)501	Economics for Engineers	2	0	0	2	2
2. PRACTICAL									
6	ENGG	Major	CS 591	Artificial Intelligence Lab	0	0	3	3	1.5
7	ENGG	Major	CS 592	Database Management Systems Lab	0	0	3	3	1.5
8	ENGG	Major	CS 593	Object Oriented Programming using Java Lab	0	0	3	3	1.5
9	PRJ	Internship	CS581	Internship	0	0	2	2	2
Total of Theory, Practical and Mandatory Activities/Courses								25	20.5

Course Name: Artificial Intelligence

Course Code: CS501

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisite:

1. Data Structure
2. Design and Analysis of Algorithms
3. Statistics

Course Objective(s):

The objective of the course is to enable students to

- Comprehend the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context
- Formulate a problem as State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.
- Use the strategies of AI-Heuristics to find acceptable solutions avoiding brute-force techniques.
- Design AI-Frameworks for Inferencing based on knowledge base.
- Analyze the effectiveness of an AI-Inferencing Model in offering solutions to the respective problem.

Course Outcomes(s):

CO1 To Understand and explain the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context for further exploration leading towards lifelong learning.

CO2 To Identify and formulate an engineering problem primarily to fit a State-Space Exploration Framework or an Inferencing Agent Design Framework within the scope of Artificial Intelligence paradigm.

CO3 To Explore relevant literature and **apply** the concept of Heuristic Techniques or Inferencing Models of Artificial Intelligence to **solve** problems.

CO4 To Develop Inferencing Models for **proposing** solutions to the problems of Artificial Intelligence.

CO5 To Implement Inferencing Models of Artificial Intelligence through **developing** feasible algorithms and **investigate** their effectiveness by **analyzing** their performances in solving the relevant problems.

Course Content:

Module-1: Introduction to Artificial Intelligence [2L]

Basic Concepts, History of Artificial Intelligence, Architecture of an Artificial Intelligent Agent, Applications of Artificial Intelligence

Module-2: Artificial Intelligence Problem Formulation as State-Space Exploration Problem for Goal Searching [8L]

Basic Concepts, State-Space Exploration Formulation for Water Jug Problem, Missionaries and Cannibals Problems, Farmer-Wolf-Goat-Cabbage Problem, 8-Puzzle Problem, Constraint Satisfaction Problem and Production System for Goal Searching.

Blind Search Techniques for Goal Searching: Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bi-directional Search.

Module-3: Heuristic Techniques for Goal Searching [8L]

Basic Concepts of Heuristic Techniques and Properties of Heuristic Functions, Hill Climbing Search. Best First Search, A* Search, AO* Search

Genetic Algorithm Based Evolutionary Search, Ant Colony Optimization, Particle Swarm Optimization.

Module-4: Adversarial Search for Game Playing [3L]

Basic Concepts, Minimax Search, Alpha-Beta Pruning.

Module-5: Knowledge Representation and Inference using Propositional Logic and Predicate Logic [5L]

Propositional Logic: Knowledge Representation and Inference using Propositional Logic

Predicate Logic: Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic

Module-6: Reasoning under Uncertainty [5L]

Bayesian Inferencing and Bayesian Belief Network, Dempster-Shafer Theory, Overview of Fuzzy Logic and Inferencing,

Module-7: Introduction to Natural Language Processing [2L]

Basic Concepts, Steps of Natural Language Processing, Morphological, Syntactic and Semantic Analysis, Discourse Integration and Pragmatic Analysis, Applications of Natural Language Processing.

Module-8: Introduction to Machine Learning [3L]

Basic concepts of Machine Learning Model, Supervised Learning, Unsupervised Learning, and Reinforced Learning, Overview of Artificial Neural Network

Textbook:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
2. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.

Reference Books:

1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill.

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										3			
CO2	2	3													
CO3	2	2	3	2											
CO4	2	2	2	3								2			
CO5	2	2	3	3								2			

Name of the Paper: Database Management System

Paper Code: CS502

Contact (Periods/Week): 3:0:0

Credit Point: 3

No. of Lectures: 36

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Outcomes:

On successful completion of the learning sessions of the course, the learner will be able:

CS502.1: To Express the knowledge of data models.

CS502.2: To Implement the concept of designing an efficient relational database system.

CS502.3: To Correlate real world queries with database system.

CS502.4: To Illustrate transaction processing, concurrency control and recovery management of a database.

CS502.5: To Assess the internal storage structure to implement a proper database for an organization.

Module 1:

Introduction [3L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module 2:

Entity-Relationship and Relational Database Model [11L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Module 3:

SQL and Integrity Constraints [6L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module 4:

Relational Database Design [8L]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study

Module 5:**Internals of RDBMS [9L]**

Physical data structures, Query optimization: join algorithm, statistics and cost based optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock based protocols; two phase locking, Dead Lock handling.

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

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", McGraw Hill.
2. Elmasri Ramez and Navathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.

Reference:

1. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B. Navathe, Addison Wesley Publishing.
2. Ramakrishnan: Database Management System, McGraw-Hill

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS502.1	3	3	3	3	3	2	-	-	3	-	-	2	3	2	2
CS502.2	3	3	3	2	3	2	-	-	2	-	-	1	3	2	2
CS502.3	3	3	3	3	3	-	-	-	2	-	-	2	3	1	1
CS502.4	2	2	2	2	3	1	-	-	2	-	-	1	3	1	2
CS502.5	3	2	2	2	3	1	-	-	1	-	-	1	3	2	2

Course Name: Object Oriented Programming using Java

Course Code: CS503

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisite: Partial Object-Oriented Programming using C++

Course Outcomes:

CS503.1: To define the process of interaction between Objects and System w.r.t. Object Oriented Paradigm.

CS503.2: To summarize basic concepts of Object Orientation in Java Programming along with different properties and features.

CS503.3: To implement various string handling functions as well as basic I/O operations in object-oriented environment.

CS503.4: To explain basic code reusability concept w.r.t. Inheritance, Package and Interface.

CS503.5: To construct Java programs utilizing core object-oriented concepts, with a focus on Exception Handling, Multithreading, and Applet-based Web Programming.

Course Contents:

Module 1: Introduction [2L]

Object Oriented Analysis (OOA) & Object-Oriented Design (OOD) - Concepts of object-oriented programming language, Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class, Object Oriented Programming concepts - Difference between Java and C++; Different features of Java.

Module 2: Java Basics [10L]

Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables, Java Operators & Control statements, Java loops, Array, Creation of class, object, method, Constructor- Definition, Usage of Constructor, Different types of Constructors, finalize method and garbage collection, Method & Constructor overloading, this keyword, use of objects as parameter & methods returning objects, Call by value & call by reference, Static variables & methods, Nested & inner classes.

Module 3: Basic String handling & I/O [5L]

Basic string handling concepts- Concept of mutable and immutable string, Methods of String class, Methods of String buffer class, Command line arguments, basics of I/O operations – keyboard input using Buffered Reader, Scanner class in Java I/O operation.

Module 4: Inheritance and Java Packages [8L]

Inheritance - Definition, Advantages, Different types of inheritance and their implementation, Super and final keywords, super() method, Method overriding, Dynamic method dispatch, Abstract classes & methods, Interface - Definition, Use of Interface, Multiple inheritance by using Interface, Java Packages - Definition, Creation of packages, Java Access Modifiers - public, private, default and protected, Importing packages, member access for packages.

Module 5: Exception handling, Multithreading and Applet Programming [11L]

Exception handling - Basics, different types of exception classes. Difference between Checked & Unchecked Exception, Try & catch related case studies, Throw, throws & finally, Creation of user defined exception, Multithreading - Basics, main thread, Thread life cycle, Creation of multiple threads - yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), is Alive(), Thread priorities, thread synchronization, Interthread communication, deadlocks for threads, Applet Programming - Basics, applet life cycle, difference between application & applet programming, Parameter passing in applets.

Textbooks:

1. Herbert Schildt – “Java: The Complete Reference” – 9th Ed. – TMH
2. E. Balagurusamy – “Programming with Java: A Primer” – 3rd Ed. – TMH.

Reference Books:

1. R.K. Das – “Core Java for Beginners” – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – “Object Oriented Modelling and Design” – Prentice Hall, India.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS503.1	3	3	2	3	3	-	-	-	-	-	3	1	2	2	3
CS503.2	2	3	3	2	2	-	-	-	-	-	2	2	2	2	3
CS503.3	3	3	2	2	1	-	-	-	-	-	1	3	2	2	3
CS503.4	2	2	3	2	3	-	-	-	-	-	2	2	2	2	3
CS503.5	3	3	2	3	1	-	-	-	-	-	1	3	3	3	3

Course Name: Compiler Design

Course Code: CS504A

Contact: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisites:

1. Mathematics
2. Concept of programming languages
3. Data structures
4. Computer architecture
5. Formal languages and automata theory
6. Some advanced math might be required if you adventure in code optimization

Course Objective(s):

- To make the student understand the process involved in a compiler
- To create an overall view of various types of translators, linkers, loaders, and phases of a compiler
- To understand the concepts of syntax analysis, various types of parsers especially the top-down approach
- To create awareness among students about various types of bottom-up parsers
- To understand the syntax analysis and, intermediate code generation, type checking, the role of symbol table and its organization, Code generation, machine independent code optimization and instruction scheduling

Course Outcomes:

On completion of the course students will be able

CS504A.1: To define compilers and various components of a compiler.

CS504A.2: To understand the roles of different phases of a compiler.

CS504A.3: To implement different algorithms for designing different phases of compilers.

CS504A.4: To build simple compilers using C programming languages.

Course Contents:

Module-1: Introduction to Compiler and Lexical Analyzer [7L]

Compilers, Cousins of the Compiler, Analysis-synthesis model, Phases of the compiler, Role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to DFA, Design of a lexical analyser generator (Lex).

Module-2: Syntax Analyzer and Semantic Analyzer [10L]

The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR, Canonical LR), Parser generators (YACC),

Error Recovery strategies for different parsing techniques, Syntax directed translation: Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S-attributed definitions, L-attributed definitions, Bottom-up evaluation of inherited attributes.

Module-3: Type Checker and Run-time Environment [7L]

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions, Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Symbol tables, dynamic storage allocation techniques.

Module-4: Intermediate Language Generator [4L]

Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Module-5: Code Optimizer and Code Generator [8L]

Consideration for Optimization, scope of optimization, local optimization, loop optimization, folding, DAG representation, Flow Graph, Data flow equation, global optimization, redundant sub expression elimination, induction variable elimination, copy propagation, basic blocks & flow graphs, transformation of basic blocks, DAG representation of basic blocks, peep hole optimization, Object code forms, machine dependent code optimization, register allocation and assignment, generic code generation algorithms, DAG for register allocation.

Text Books:

1. Aho, A. V., Sethi, R., & Ullman, J. D. Addison - Wesley, 2007. Compilers-Principles, Techniques, and Tools.
2. Holub, A. I. (1990). Compiler design in C (Vol.5). Englewood Cliffs, N J: Prentice Hall.

Reference Books:

1. Chattopadhyay, S. (2005). Compiler Design. PHI Learning Pvt. Ltd.
2. Tremblay, J. P., & Sorenson, P.G. (1985). Theory and Practice of Compiler Writing. McGraw-Hill, Inc.
3. Appel, A.W. (2004). Modern compiler implementation in C. Cambridge university press.
4. Barrett, W.A., Bates, R.M., Gustafson, D.A., & Couch, J.D. (1986). Compiler construction: theory and practice. SRA School Group.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS504A.1	3	1	3	3	2	-	-	-	-	-	3	3	3	3	3
CS504A.2	3	3	3	2	1	-	-	-	-	-	2	1	2	3	2
CS504A.3	-	2	2	2	2	-	-	-	-	-	1	3	3	3	3
CS504A.4	2	3	1	3	1	-	-	-	-	-	1	3	3	3	3

Course Name: Cryptography and Network Security

Course Code: CS504B

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisites

1. Knowledge of Computer Networks and Operating Systems fundamentals
2. Understanding of Discrete Mathematics concepts

Course Objective(s):

- To impart concepts on cryptography and Network security
- To gain knowledge of the standard algorithms used to provide confidentiality, integrity, and authenticity
- To recognize the various key distribution and management systems for security of a cryptosystem

Course Outcomes:

After completion of course, students would be able

CS504B.1: To understand the basic concepts in cryptography

CS504B.2: To apply the deployment of different encryption techniques to secure messages in transit across data networks

CS504B.3: To discuss various techniques used to assure Integrity and Authentication

CS504B.4: To analyze diverse security measures and issues in practice.

Course Contents

Module-1: Introduction [7L]

Introduction - Services, Mechanisms, and Attacks, OSI security architecture, Network security model

Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography)

Finite Fields and Number Theory: Groups, Rings, Fields, Modular arithmetic, Euclid's algorithm

Polynomial Arithmetic, Prime numbers, Fermat's and Euler's theorem

Testing for primality - The Chinese remainder theorem - Discrete logarithms

Module-2: Symmetric and Asymmetric Encryption Techniques [9L]

Data Encryption Standard- Block cipher principles, block cipher modes of operation

Advanced Encryption Standard (AES), Triple DES, Blowfish, RC5 algorithm

Public key cryptography: Principles of public key cryptosystems, The RSA algorithm

Key management - Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography

Module-3: Authentication, Hashing, and Digital Signatures [6L]

Authentication requirement, Authentication function, MAC, Hash function

Security of hash function and MAC, MD5, SHA, HMAC, CMAC
 Digital signature and authentication protocols, DSS, ElGamal, Schnorr

Module-4: Applied Network Security and Trusted Systems [7L]

Authentication applications, Kerberos, X.509

Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology- Types of Firewalls, Firewall designs principles

SET for E-Commerce Transactions

Intruder, Intrusion detection system

Virus and related threats, Countermeasures

Trusted systems, Practical implementation of cryptography and security

Module-5: Email, IP, and Web Security Protocols [7L]

E-mail Security: Security Services for E-mail-attacks possible through E-mail, Establishing keys privacy, authentication of the source

Message Integrity, Non-repudiation, Pretty Good Privacy, S/MIME

IP Security: Overview of IPSec, IPv4 and IPv6-Authentication Header, Encapsulation Security Payload (ESP)

Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding)

Web Security: SSL/TLS Basic Protocol, computing the keys, client authentication

PKI as deployed by SSL Attacks fixed in v3, Exportability, Encoding, Secure Electronic Transaction

Text Books:

1. Kahate, A. (2013). Cryptography and network security. Tata McGraw-Hill Education.
2. Forouzan, B. A., & Mukhopadhyay, D. (2015). Cryptography and network security. New York, NY: Mc Graw Hill Education (India) Private Limited.

Reference Books:

1. Stallings, W. (2006). Cryptography and network security, 4/E. Pearson Education India.
2. Daras, N. J., & Rassias, M. T. (Eds.). (2015). Computation, cryptography, and network security (pp. 253-287). Springer.
3. Kumar, A., & Bose, S. (2017). Cryptography and network security. Pearson Education India.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS504B.1	3	1	2	1	1	-	-	-	3	2	1	1	3	1	1
CS504B.2	3	2	3	2	3	-	-	-	2	1	1	1	3	1	1
CS504B.3	1	3	2	3	2	-	-	-	2	3	1	1	3	1	3
CS504B.4	2	3	1	3	1	-	-	-	1	1	1	1	3	1	3

Course Name: Computer Graphics

Course Code: CS504C

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisites:

Mathematics, Computer Fundamentals & Principle of Computer Programming.

Course Outcomes

On successful completion of the learning sessions of the course, the learner will be able

CS504C.1: To remember the foundations of computer graphics and different display technology and devices.

CS504C.2: To analyze the concept of geometric, mathematical and algorithmic approach necessary for programming computer graphics.

CS504C.3: To explain clipping with the comprehension of windows, view-ports in relation to images display on screen.

CS504C.4: To experiment and compare different hidden surface illumination methods

Course Content:

Module - 1: Introduction to Computer Graphics [5L]

Overview of computer graphics, Basic Terminologies in Graphics, lookup table, 3D viewing devices, Plotters, printers, digitizers, light pens etc., Active & Passive graphics, Computer graphics software. Light & Color models, Raster Scan and Random scan displays.

Module - 2: Scan Conversion [10L]

Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Midpoint Circle generation algorithm, Ellipse generating algorithm. Scan line polygon fill algorithm, boundary fill algorithm, flood fill algorithm.

Module - 3: 2D and 3D Transformation [8L]

Basic transformations: translation, rotation, scaling, Matrix representations & homogeneous coordinates, transformations between coordinate systems, reflection shear, Transformation of points, lines, parallel lines, intersecting lines.

3D transformations: translation, rotation, scaling.

Module - 4: 2D-Viewing, Clipping and Projection [8L]

Viewing pipeline, Window to viewport co-ordinate transformation. Clipping operations: Point clipping, Cohen Sutherland line clipping algorithm, Polygon clipping algorithm, Viewport clipping, Basic concepts of different type of projections.

Module - 5: Curve Generation and Hidden Surface Removal [5L]

Bezier curves, B-spline curves, Hidden Surface Removal: Z-buffer algorithm, Back face detection, BSP tree method, Painter's algorithm.

Text Books:

1. Hearn and P. M. Baker: Computer Graphics, 2nd ed. Prentice Hall of India, New Delhi, 1997.
2. W. M. Newman and R. F. Sproull: Principles of Interactive Computer Graphics, McGraw Hill, New Delhi, 1979.

Reference Books:

1. F. S. Hill: Computer Graphics, McMillan, New York, 1990.
2. D. P. Mukherjee: Fundamentals of Computer Graphics and Multimedia, Prentice Hall of India, New Delhi, 1999.
3. J. D. Foley et al.: Computer Graphics, 2nd ed., Addison-Wesley, Reading, Mass., 1993.
4. W. K. Giloi: Interactive Computer Graphics: Data Structure, Algorithms, Languages, Prentice Hall, Englewood Cliffs, 1978.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS504C.1	3	1	3	3	2	-	-	-	-	-	3	3	3	3	3
CS504C.2	3	3	3	2	1	-	-	-	-	-	2	1	2	3	2
CS504C.3	-	2	2	2	2	-	-	-	-	-	1	3	3	3	3
CS504C.4	2	3	1	3	1	-	-	-	-	-	1	3	3	3	3

Course Name: Economics for Engineers

Course Code: HU(CS)501

Contact: 2:0:0

Total Contact Hours: 24

Credits: 2

Pre-requisites:

MATH–College Algebra, Pre-Calculus Algebra and Trigonometry.

Course Outcomes:

On successful completion of the learning sessions of the course, the learner will be able to:

HU(CS)501: Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.

HU(CS)501: Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions.

HU(CS)501: Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and/or systems.

HU(CS)501: Evaluate the profit of a firm, carry out the break-even analysis and employ this tool to make production decision.

HU(CS)501: Discuss and solve advanced economic engineering analysis problems including taxation and inflation.

Course Contents:

Module 1: Introduction [3L]

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

Module 2: Demand and Supply Analysis [5L]

Demand - Types of demand – determinants of demand – Demand function – Demand Elasticity – Demand forecasting – Supply – Determinants of Supply - Supply Function - Supply Elasticity.

Module 3: Cost Analysis [5L]

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

Module 4: Elementary economic Analysis [4L]

Inflation-Meaning of inflation, types, causes, measures to control inflation.

National Income-Definition, Concepts of national income, Method of measuring national income.

Module 5: Financial Accounting [5L]

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

Module 6: Investment Decision [2L]

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

Textbooks:

1. Riggs, Bedworth, and, Randhwa, “Engineering Economics”, McGraw Hill Education, India
2. Principles of Economics, Deviga Vengedasalam; Karunakaran Madhavan, Oxford University Press

Reference Books:

1. Engineering Economy by William G. Sullivan, Elin M. Wicks, C. Patric Koelling, Pearson
2. R. Paneer Seelvan, “Engineering Economics”, PHI
3. Ahuja, H. L., “Principles of Micro Economics”, S. Chand & Company Ltd
4. Jhingan, M. L., “Macro Economic Theory”
5. Macro Economics by S. P. Gupta, TMH
6. Haniff and Mukherjee, Modern Accounting, Vol-1, TMG
7. Modern Economic Theory –K. K. Dewett (S. Chand)

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HU(CS)501.1	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
HU(CS)501.2	-	-	-	3	-	3	-	-	-	-	-	-	-	-	-
HU(CS)501.3	-	-	2	-	-	-	-	-	-	-	-	2	-	-	-
HU(CS)501.4	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
HU(CS)501.5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-

Course Name: Artificial Intelligence Lab

Course Code: CS591

Contact: 0:0:3

Total Contact Hours: 36

Credits: 1.5

Prerequisite: Data Structure, Design and Analysis of Algorithms, Statistics

Course Objective(s):

The objective of the course is to enable students to -

- Gain foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing.
- Formulate a problem by analyzing its characteristics to fit a State-Space Exploration Frame work or an Inferencing Frame work of Artificial Intelligence.
- Apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
- Build expert systems offering solutions to the challenging problems of Artificial Intelligence.
- Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies.

Course Outcomes:

On completion of the course students will be able

CS591.1: To understand the concept of simple programming using PROLOG/ LISP.

CS591.2: To understand the concept of AI based programs using PROLOG/ LISP.

CS591.3: To apply logic-based techniques in various real life problem domains.

CS591.4: To analyze logic-based techniques in various real life problem domains.

Course Content:

WEEK-1: Introduction to PROLOG Programming along with the IDE and its Basic Components

Assignments for understanding the Basic Components of Knowledge Representation and Inferencing in Artificial Intelligence using PROLOG Programming and its working strategy.

WEEK -2: Arithmetic, Boolean Expression, Decision Making Strategies

Assignments for understanding implementation of Arithmetic Expression, Boolean Expression, and Decision-Making Strategies.

WEEK -3: Recursion and Looping through Recursion

Assignments for understanding implementation of Recursion and Looping through Recursion.

WEEK -4: List of Data Items in PROLOG

Assignments for understanding the utility of List in solving various problems.

WEEK -5: Blind Search Techniques – BFS, DFS

Implementation of BFS and DFS Algorithms for Goal Searching to solve Puzzles (8-Puzzle, Water Jug Puzzle)

WEEK -6: Heuristic Search Techniques – A* Search

Implementation of A* Search Algorithm for Goal Searching to solve Puzzles (8-Puzzle, Route Finding Puzzle)

WEEK-7: Constraint Satisfaction Problem Solving

Implementation of Backtracking Strategies to solve Constraint Satisfaction Problems (Graph Colouring Problem, 8-Queens Problem)

WEEK -8: Game Playing

Implementation of Adversarial Search Algorithm with alpha-beta pruning strategy for Game Playing (Tic-Tac-Toe)

WEEK -9: Discussion on Project Problems and Allocation (Problem Description Report Submission)

WEEK -10: Designing Solution Model and Proposal Report Submission

WEEK -11: Project Implementation, Verification and Documentation

WEEK -12: Project Demonstration and Project Report Review

Textbook:

1. Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Edition, Addison-Wesley
2. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
3. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw-Hill.

Reference Books:

1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
2. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS591.1	3	1	3	3	2	-	-	-	-	-	3	3	2	1	2
CS591.2	3	2	3	2	2	-	-	-	-	-	2	3	2	2	3
CS591.3	-	3	-	2	2	-	-	-	-	-	1	3	2	3	-
CS591.4	2	2	3	2	3	-	-	-	-	-	2	2	3	-	1

Course Name: Database Management System Lab

Course Code: CS592

Contact: 0:0:3

Total Contact Hours: 36

Credits: 1.5

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objective(s):

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

Course Outcomes:

On completion of the course students will be able to

CS592.1: Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.

CS592.2: Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.

CS592.3: Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.

CS592.4: Analyze database system concepts and apply normalization to the database.

CS592.5: Apply and create different transaction processing and concurrency control applications.

Module 1:

Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)

Module 2:

Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, represent attributes as columns, identifying keys) and apply the normalization techniques.

Module 3:

Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables

Module 4:

Practicing DML commands- Insert, Select, Update, Delete

Module 5:

Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc., Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).

Module 6:

Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping, Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger

Module 7:

Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure, PL/SQL, Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS592.1	3	3	3	3	3	2	-	-	2	-	-	2	3	2	2
CS592.2	3	3	3	2	3	2	-	-	2	-	-	1	3	2	2
CS592.3	3	3	3	3	3	-	-	-	2	-	-	2	3	1	1
CS592.4	2	2	2	2	3	1	-	-	2	-	-	1	3	1	2
CS592.5	3	2	2	2	3	1	-	-	1	-	-	1	3	2	2

Course Name: Object Oriented Programming using Java Lab

Course Code: CS593

Contact: 0:0:3

Total Contact Hours: 36

Credits: 1.5

Prerequisites:

1. Computer Fundamentals
2. Basic understanding of Computer Programming and related Programming Paradigms
3. Problem Solving Techniques with proper logic Implementation.

Course Objective(s):

- It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
- It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
- It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
- It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance)

Course Outcomes:

On completion of the course students will be able

CS593.1: To describe the object-oriented approach in Java by outlining the relationship between classes, objects, and constructors.

CS593.2: To apply the concept of code reusability in Java through the use of inheritance and class hierarchies.

CS593.3: To implement Java programs using encapsulation, polymorphism, and relevant object-oriented keywords.

CS593.4: To analyze object-oriented features such as data abstraction, packages, and interfaces to determine their roles in Java programming.

CS593.5: To construct Java applications using exception handling, multithreading, and applet-based web programming techniques.

Course Contents:

Week – 1:

Basic Java programs such as

- i. printing “Hello, GNIT”.
- ii. checking whether a number is even or odd.
- iii. finding out the roots of a quadratic equation.
- iv. finding out the factorial of a given number.
- v. printing fibonacci series upto n terms.

- vi. Creating a class calculator that has 4 methods like add, sub, mul & div. Then doing the addition, subtraction, multiplication, and division of 2 integer numbers using these 4 methods.

Week – 2:

Java programs to implement default constructor, parameterized constructor using command line argument, 'this' keyword.

Week – 3:

Java programs to implement method overloading, constructor overloading, call by value, call by reference, recursion.

Week – 4:

Java programs to implement the difference between public and private access specifier, 'static' keyword, inner class.

Week – 5:

Java programs to implement simple inheritance, hierarchical inheritance, and multilevel inheritance.

Week – 6:

Java programs to implement 'super' keyword to access a superclass member, 'super' keyword to access a superclass constructor, method overriding.

Week – 7:

Java programs to implement run-time polymorphism, abstract class and method.

Week – 8:

Java programs to implement interface, multiple inheritance.

Week – 9:

Java programs to

- i. create two user-defined packages pkg1 and pkg2 and import both to another program which is outside the packages.
- ii. create multiple packages containing classes with identical names.
- iii. show how a protected variable of one package can be accessed in a subclass in another package.
- iv. show how to add multiple public classes to a single package.

Week – 10:

Java programs to implement ArithmeticException, ArrayIndexOutOfBoundsException, 'throw' and 'throws' keywords, finally block.

Week – 11:

Java programs to

- i. create 3 threads - the 1st thread to display GOOD MORNING for every 1 second, the 2nd thread to display HELLO for every 2 seconds and the 3rd thread to display WELCOME for every 3 seconds.

- ii. implement the above program by assigning priorities to the created threads such that the 1st thread executes first followed by the 2nd thread and lastly the 3rd thread.

Week – 12:

Java programs to

- i. develop an applet that display simple message.
- ii. develop an applet that will add two integer numbers.
- iii. develop an applet that will draw lines, rectangle and oval.

Textbooks:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming with Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R. K. Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS593.1	2	2	3	3	2	-	-	-	-	-	3	1	2	2	3
CS593.2	1	3	2	2	3	-	-	-	-	-	1	2	2	2	3
CS593.3	2	-	1	2	2	-	-	-	-	-	2	3	2	2	3
CS593.4	3	2	3	2	3	-	-	-	-	-	2	2	2	2	3
CS593.5	2	3	1	3	2	-	-	-	-	-	1	3	3	3	3