COURSE STRUCTURE

For

BACHELOR OF TECHNOLOGY COURSES
IN

COMPUTER SCIENCE &ENGINEERING

(Engineering & Technology)

[R19]

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES
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COMPUTER SCIENCE AND ENGINEERING

CHAPTER 1
General, Course Structure & Theme
&
Semester-wise credit distribution

A. **Definition of Credit:**

1	Hr. Lecture (L) per week	1 credit
1	Hr. Tutorial (T) per week	1 credit
1	Hr. Practical (P) per week	0.5 credit
2	Hours Practical(Lab)/week	1 credit

B. **Structure of Undergraduate Engineering program:**

S. No.		Credit Breakup for CSE students
1	Humanities and Social Sciences including Management courses	12
2	Basic Science Courses	27
3	Engineering Science Courses like drawing, basics of electrical/ mechanical/ computer etc	27.5
4	Professional Core Courses	51.5
5	Professional Elective Courses relevant to chosen specialization/branch	15
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	15
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	160

C. **Credit distribution in the First year:**

	Lecture	Tutorial	Laboratory/ Practical	Total Credits
Chemistry-I	3	1	3	5.5
Physics – I	3	1	3	5.5
Calculus	2	0	0	2
Linear Algebra	3	0	0	3
Differential Equations & Vector Calculus	4	0	0	4
Programming for Problem solving	3	0	4	5
English	2	0	2	3
Engineering Graphics	0	0	6	3
Engineering Workshop	2	0	2	3
Basic Electrical Engineering	3	1	2	5

D. **Course code and Definition:**

Course Category	Definitions
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management Courses
PCC-CS	Professional core courses
PEC-CS	Professional Elective Courses
OEC-CS	Open Elective Courses
LC	Laboratory Courses
MC	Mandatory Courses
SI	Summer Industry Internship
PROJ-CS	Project

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES

SI. No.	Code No.	Course Title	House per week				Total Credits	Semester
			L	T	P	Total		
1	HS1102	Communication Skills – I	2	0	0	2	0	1
2	HS1201	English	2	0	0	2	2	2
3	HS1801	English Lab	0	0	2	2	1	2
4	HS1202	Communication Skills – II	2	0	0	2	0	2
5	BM0001	Managerial Economics	3	0	0	3	3	4
6	HS3101	Soft Skills	2	0	0	2	0	5
7	BM0002	Humanities-II(Principles of Marketing)	3	0	0	3	3	5
8	BM0004	Personality Development	2	0	0	2	0	6
9	BM0003	Operational Research	3	0	0	3	3	
Total:			**19**	**0**	**2**	**21**	**12**	

BASIC SCIENCE COURSES [BSC]

Sl. No.	Code No.	Course Title	Hours per week				Total Credits	Semester
			L	T	P	Total		
1	CY1101	Chemistry-I	3	1	0	4	4	1
2	CY1701	Chemistry-I Lab	0	0	3	3	1.5	1
3	MA1102	Calculus	2	0	0	2	2	1
4	MA1101	Linear Algebra	3	0	0	3	3	1
5	PH1201	Physics-I	3	1	0	4	4	2
6	PH1801	Physics-I Lab	0	0	3	3	1.5	2
7	MA1201	Differential Equations & Vector Calculus	3	1	0	4	4	2
8	MA2102	Probability & Statistics	4	0	0	4	4	3
9	BSC701	Bioinformatics	3	0	0	3	3	7
Total:			**21**	**3**	**6**	**30**	**27**	

ENGINEERING SCIENCE COURSE [ESC]

SI. No.	Code No.	Course Title	Hours per week				Total Credits	Semester
			L	T	P	Total		
1	CS1101	Programming for Problem Solving	3	0	0	3	3	1
2	CS1701	Programming for Problem Solving Lab	0	0	4	4	2	1
3	ME1102	Engineering Workshop	2	0	2	4	3	1
4	EE1202	Basic Electrical Engineering	3	1	0	4	4	2
5	EE1802	Basic Electrical Engineering Lab	0	0	2	2	1	2
6	CE1801	Engineering Graphics	0	0	6	6	3	2
7	EC2105	Analog Electronic Circuits	4	0	0	4	3	3
8	EC2703	Analog Electronic Circuits Lab	0	0	3	3	1.5	3
9	EC2101	Digital Electronic Circuits	3	0	0	3	3	3
10	EC2701	Digital Electronic Circuits Lab	0	0	2	2	1	3
11	EC3106	Signals and Systems	3	0	0	3	3	5
		Total:	**18**	**1**	**19**	**38**	**27.5**	

PROFESSIONAL CORE COURSES [PCC]

SI. No.	Code No.	Course Title	Hours per week				Total Credits	Semester
			L	T	P	Total		
1	CS1802	IT Workshop	0	0	3	3	1.5	2
2	CS2101	Data Structure & Algorithms	3	0	0	3	3	3
3	CS2102	Discrete Mathematics	3	1	0	4	4	3
4	CS2701	Data Structure & Algorithms Lab	0	0	4	4	2	3
5	CS2201	Computer Organization and Architecture	3	0	0	3	3	4
6	CS2801	Computer Organization and Architecture Lab	0	0	4	4	2	4
7	CS2202	Database Management Systems	3	0	0	3	3	4
8	CS2802	Database Management Systems Lab	0	0	4	4	2	4
9	CS2203	Design and Analysis of Algorithms	3	0	0	3	3	4
10	CS2803	Design and Analysis of Algorithms Lab	0	0	4	4	2	4

11	CS2204	Data Analytics	3	0	0	3	3	4
12	CS3101	Operating Systems	3	0	0	3	3	5
13	CS3701	Operating Systems Lab	0	0	4	4	2	5
14	CS3102	Object Oriented Programming	3	0	0	3	3	5
15	CS3702	Object Oriented Programming Lab	0	0	4	4	2	5
16	CS3103	Formal Languages & Automata Theory	3	0	0	3	3	5
17	CS3201	Complier Design	3	0	0	3	3	6
18	CS3801	Complier Design Lab	0	0	4	4	2	6
19	CS3202	Computer Networks	3	0	0	3	3	6
20	CS3802	Computer Networks Lab	0	0	4	4	2	6
		Total:	**33**	**1**	**35**	**66**	**51.5**	

PROFESSIONAL ELECTIVE COURSES [PEC]

SI. No.	Code No.	Course Title	Hours per week				Total Credits	Semester
			L	T	P	Total		
1	PEC	Elective – I	3	0	0	3	3	5
2	PEC	Elective – II	3	0	0	3	3	6
3	PEC	Elective – III	3	0	0	3	3	6
4	PEC	Elective – IV	3	0	0	3	3	7
5	PEC	Elective – V	3	0	0	3	3	7
6	PEC	Elective – VI	3	0	0	3	3	8
		Total:	**18**	**0**	**0**	**18**	**18**	

OPEN ELECTIVE COURSES [OEC]

SI. No.	Code No.	Course Title	Hours per week				Total Credits	Semester
			L	T	P	Total		
1	OEC	Open Elective – I	3	0	0	3	3	6
2	OEC	Open Elective – II	3	0	0	3	3	7
3	OEC	Open Elective – III	3	0	0	3	3	8
4	OEC	Open Elective- IV	3	0	0	3	3	8
		Total:	**12**	**0**	**0**	**12**	**12**	

MANDATORY COURSES (MC)

SI. No.	Code No.	Course Title	Hours per week				Total Credits	Semester
			L	T	P	Total		
1	BM0005	Indian Constitution	3	0	0	3	0	1
2	HS2101	Essence of Indian Traditional Knowledge	2	0	0	2	0	3
3	MC_	Environmental Sciences	3	0	0	3	0	4
		Total:	**8**	**0**	**0**	**8**	**0**	

Branch / Course: Computer Science and Engineering
Total credits (4 years course): 160

I. **Induction Program**

Induction program(mandatory)	3 weeks duration
Induction program for students to be offered right at the start of the First year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

II.**Semester-wise structure of curriculum**

[L= Lecture, T = Tutorials, P = Practical& C = Credits]

Engineering I - Semester I [First Year-First Semester] Curriculum
Branch/Course: Computer Science Engineering

Sl. No	Course Type	Course Code	Course Title	Hours per week				Total Credits
				L	T	P	Total	
1	ESC	CS1101	Programming for Problem Solving	3	0	0	3	3
2	ESC	ME1102	Engineering Workshop	2	0	2	4	3
3	BSC	CY1101	Chemistry-I	4	0	0	4	4
4	BSC	MA1102	Calculus	2	0	0	2	2
5	BSC	MA1101	Linear Algebra	3	0	0	3	3
6	HSMC	HS1102	Communication Skills-I	2	0	0	2	0
7	MC	BM0005	Indian Constitution	3	0	0	3	0
8	ESC	CS1701	Programming for Problem Solving Lab	0	0	4	4	2
9	BSC	CY1701	Chemistry-I Lab	0	0	3	3	1.5
			Total:	**19**	**0**	**9**	**28**	**18.5**

Engineering I - Semester II [First Year-Second Semester] Curriculum
Branch/Course: Computer Science Engineering

Sl. No.	Course Type	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	PCC	CS1802	IT Workshop	0	0	3	3	1.5
2	ESC	EE1202	Basic Electrical Engineering	4	0	0	4	4
3	ESC	CE1801	Engineering Graphics	0	0	6	6	3
4	BSC	PH1201	Physics-I	4	0	0	4	4
5	BSC	MA1201	Differential Equations & Vector Calculus	4	0	0	4	4
6	HSMC	HS1201	English	2	0	0	2	2
7	HSMC	HS1202	Communication Skills-II	2	0	0	2	0
8	ESC	EE1802	Basic Electrical Engineering Lab	0	0	2	2	1

9	BSC	PH1801	Physics-I Lab	0	0	3	3	1.5
10	HSMC	HS1801	English Language Lab	0	0	2	2	1
			Total:	**16**	**0**	**16**	**32**	**22**

Engineering II - Semester I [Second Year-First Semester] Curriculum
Branch/Course: Computer Science Engineering

SI. No.	Course Type	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	PCC	CS2101	Data structure & Algorithms	3	0	0	3	3
2	PCC	CS2102	Discrete Mathematics	4	0	0	4	4
3	ESC	EC2105	Analog Electronic Circuits	4	0	0	4	3
4	ESC	EC2101	Digital Electronic Circuits	3	0	0	3	3
5	BSC	MA2102	Probability and Statistics	4	0	0	4	4
6	MC	HS2101	Essence of Indian Traditional Knowledge	2	0	0	2	0
7	PCC	CS2701	Data structure & Algorithms Lab	0	0	4	4	2
8	ESC	EC2703	Analog Electronics Circuits Lab	0	0	3	3	1.5
9	ESC	EC2701	Digital Electronic Circuits Lab	0	0	2	2	1
			Total:	**20**	**0**	**9**	**29**	**21.5**

Engineering II - Semester II [Second Year-Second Semester] Curriculum
Branch/Course: Computer Science Engineering

SI. No.	Course Type	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	PCC	CS2201	Computer Organization & Architecture	3	0	0	3	3
2	PCC	CS2202	Database Management Systems	3	0	0	3	3
3	PCC	CS2203	Design & Analysis of Algorithms	3	0	0	3	3
4	PCC	CS2204	Data Analytics	3	0	0	3	3
5	HSMC	BM0001	Managerial Economics	3	0	0	3	3
6	MC		Environmental Sciences	3	0	0	3	0
7	PCC	CS2801	Computer Organization & Architecture Lab	0	0	4	4	2
8	PCC	CS2802	Database Management Systems Lab	0	0	4	4	2
9	PCC	CS2803	Design & Analysis of Algorithms Lab	0	0	4	4	2

Total	**18**	**0**	**12**	**30**	**21**

Engineering III - Semester I [Third Year-First Semester] Curriculum
Branch/Course: Computer Science Engineering

SI. No.	Course Type	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	PCC	CS3101	Operating Systems	3	0	0	3	3
2	PCC	CS3102	Object Oriented Programming	3	0	0	3	3
3	PCC	CS3103	Formal Language & Automata Theory	3	0	0	3	3
4	PEC	CS_	Elective-I	3	0	0	3	3
5	ESC	EC3106	Signals & Systems	3	0	0	3	3
6	HSMC	BM0002	Humanities – II (Principles of Marketing)	3	0	0	3	3
7	HSMC	HS3101	Soft Skills	2	0	0	2	0
8	PCC	CS3701	Operating Systems Lab	0	0	4	4	2
9	PCC	CS3702	Object Oriented Programming Lab	0	0	4	4	2
Total:				**20**	**0**	**8**	**28**	**22**

Engineering III - Semester II [Third Year-Second Semester] Curriculum
Branch/Course: Computer Science Engineering

SI. No.	Course Type	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	PCC	CS3201	Compiler Design	3	0	0	3	3
2	PCC	CS3202	Computer Networks	3	0	0	3	3
3	PEC	CS_	Elective-II	3	0	0	3	3
4	PEC	CS_	Elective-III	3	0	0	3	3
5	PCC	CS3801	Complier Design Lab	0	0	4	4	2
6	PCC	CS3802	Computer Networks Lab	0	0	4	4	2
7	PROJ	PROJCS60	Project-I(SE&WT)	0	0	6	6	3
8	PEC	CS_	Elective-IV(Graph Theory & Combinatorics	3	0	0	3	3
9	HSMC	BM0004	Personality Development	2	0	0	2	0
Total:				**17**	**0**	**14**	**31**	**22**

Engineering IV - Semester I [Fourth Year-First Semester] Curriculum
Branch/Course: Computer Science Engineering

SI. No.	Course Type	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	PEC	CS_	Elective-V	3	0	0	3	3
2	PEC	CS_	Elective-VI	3	0	0	3	3
3	OEC	OEC_	Open Elective- I	3	0	0	3	3
4	BSC	BSC701	Bioinformatics	3	0	0	3	3
5	PROJ	CSP02	Project-II	0	0	12	12	6
			Total:	**12**	**0**	**12**	**24**	**18**

Engineering IV - Semester II [Fourth Year-Second Semester] Curriculum
Branch/Course: Computer Science Engineering

Sl. No.	Course Type	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	OEC		Open Elective-II	3	0	0	3	3
2	OEC	OEC_	Open Elective-III	3	0	0	3	3
3	OEC	OEC_	Open Elective-IV	3	0	0	3	3
4	PROJ	CSP03	Project-III	0	0	12	12	6
			Total:	**9**	**0**	**12**	**21**	**15**

PROFESSIONAL ELECTIVE COURSES

Electives will be introduced in 4 threads besides the Open Elective. There are 6 slots for Electives and 4 slots for Open Electives. The department may permit students to take 50% of these (electives + open electives) from other disciplines, based on the choices of the students and consent of course advisors.

A. **Theory** B. **Systems** C. **Data Science** D. **Applications** E. **Open Electives**

The students will have options of selecting the electives from the different threads depending on the specialization they wish to acquire. **There should be at least two electives from the open elective choices; the rest two can be taken from the other threads, if intended.**

Theory and Algorithms **Code: PEC-CS-T<number>**	**Systems** **Code: PEC-CS-S<number>**	**Data Science and Machine Intelligence** **Code: PEC-CS-D <number>**	**Applications** **Code: PEC-CS-A<number>**	**Open Electives** **OEC-CS<number>**
Theory of Computation	Advanced Computer Architecture	Artificial Intelligence	Image Processing	Soft Skills and Interpersonal Communication
Graph Theory	Software Engineering	Data Analytics	Cryptography and Network Security	Economic Policies in India
Advanced Algorithms	Distributed Systems	Machine Learning	Introduction to Block Chain Technology	Human Resource Development and Organizational Behavior
Parallel and Distributed Algorithms	Embedded Systems	Data Mining	Cloud Computing	Cyber Law and Ethics
Computational Complexity	Advanced Operating Systems	Soft Computing	Digital Signal Processing	
Computational Geometry	Low Power Circuits & Systems	Speech and Natural Language Processing	Electronic Design Automation	Comparative Study
Queuing Theory and Modeling	Fault Tolerant Computing		Computer Graphics	Indian Music System
Computational Number Theory	Real Time Systems	Information Retrieval	VLSI System Design	History of Science
Quantum Computing	Ad-Hoc & Sensor Networks	Neural Networks & Deep Learning	Optimization Techniques	Introduction to Art & Aesthetics

Information Theory & Coding	Signals & Networks	Multi-agent Intelligent Systems	Web & Internet Technology	
	Internet of Things			

Total Number of Credits Semester –wise report:

SEMESTER	CREDITS
E1S1	18.5
E1S2	22
E2S1	21.5
E2S2	21
E3S1	22
E3S2	22
E4S1	18
E4S2	15
	TOTAL: 160

B.TECH (CSE) I YEAR I-SEM

CS1101	**Programming for Problem Solving**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Objectives:

- To introduce the basic concepts of Computing environment, number systems and flowcharts
- To familiarize the basic constructs of C language – data types , operators and expressions
- To understand modular and structured programming constructs in C
- To learn the usage of structured data types and memory management using pointers
- To learn the concepts of data handling using pointers

Detailed Contents:

UNIT-I: Introduction to Programming & Arithmetic expressions and precedence(8 Lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - (1 lecture).

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 lecture)
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- (2 lectures) Arithmetic expressions and precedence (2 lectures).

UNIT-II: Conditional Branching , Loops & Arrays(12 Lectures)
Writing and evaluation of conditionals and consequent branching (3 lectures) Iteration and loops (3 lectures**)**
Arrays (1-D, 2-D), Character arrays and Strings(6 lectures)

UNIT-III: Function & Basic Algorithms(11 Lectures)
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference(5 lectures)
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)(6 lectures)

UNIT-IV: Recursion & Structure(9 lectures)
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.(5 Lectures) Structures, Defining structures and Array of Structures(4 lectures)

UNIT-V: Pointers & File handling(7 lectures)
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
File handling (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books
(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books
(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Course Outcomes:
- Formulate simple algorithms for arithmetic and logical problems.
- Translate the algorithms to programs (in c language).
- Test and execute the programs and correct syntax and logical errors.
- Implement conditional branching, iteration and recursion.
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- Use arrays, pointers and structures to formulate algorithms and programs.
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

- Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

ME1102	Engineering Workshop	2L: 0T: 2P	3 Credits

Pre-requisites	

Course Objectives:

- To understand the basic manufacturing process of producing a component by casting, forming plastic molding, joining processes, machining of a component either by conventional or by unconventional processes.
- To understand the advanced manufacturing process of additive manufacturing process.

Course Outcome:

- Students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Module – 1: ***Metal Casting*****:** Introduction, Tools, Types of Patterns, Pattern Materials, Types of casting – Sand, Die and other casting processes and Applications
Module – 2: ***Metal Forming*****:** Introduction, Classification, Types of Bulk and sheet metal forming and Applications.
Module – 3: ***Powder Metallurgy*****:** Introduction, Powder production methods, Compaction, Sintering, Secondary operations and Applications.
Module – 4: ***Joining:*** Types of Joining, Introduction to Welding, Brazing and soldering, Arc, Solid state welding processes.
Module – 5: ***Conventional Machining processes*****:** Introduction to machining operations; Lathe operations, Drilling, Milling and Grinding.
Module – 6: ***Unconventional Machining processes***.
Module – 7: ***CNC Machining and Additive manufacturing***
Text Books:
(i) 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.
(ii) Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Reference Books
(i)Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.

(ii) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

(iii) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

(ii) PRACTICALS

List of Experiments:

1. **Fitting –** Step and V Fit
2. **Carpentry** – Half lap joint and Dove tail joint
3. **House Wiring** – Series, Parallel, Staircase and Godown wiring
4. **Tin Smithy** – Tray and Cylinder
5. **Welding** – Bead formation, Butt and Lap joint welding
6. **Foundry** – Mold preparation with Single piece and Split piece pattern
7. **Machining –** Plain turning, Facing, Step and Taper turning
8. **Plastic molding** – Demo
9. **WIRE EDM, CNC, 3D Printer** – Demo

COURSE ASSESSMENT		
Assessment Method	**Description**	**Weight**
Mid Term	3 mid examinations will be conducted and best of 2 will be considered.	30%
Assignment	Seminar / Test / Practical	10%
End Sem Practical	Students will be evaluated based on the understanding of the principles and performance skills and practices of the course	60%

Course Outcomes: Upon completion of this laboratory course

- Students will be able to fabricate components with their own hands.

CY1101	**Chemistry - I**	**4L: 0T: 0P**	**4 Credits**

Pre-requisites	

Course Objectives:

- To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
- To impart the basic knowledge of kinetic modifications which make the student to understand the technology based on them.

- To acquire the knowledge of electrochemistry, corrosion and water treatment which are essential for the Engineers and in industry.
- To acquire the skills pertaining to spectroscopy and to apply them for medical field etc.
- To impart then knowledge of engineering materials especially focusing more into nanomaterials focusing more into computer sciences..

Syllabus:

Unit 1: Spectroscopy (8 classes)

Introduction to spectroscopy, electromagnetic radiations, different types of spectroscopy, principle of spectroscopy, spectrophotometer Microwave spectroscopy: principle, microwave spectra of diatomic molecules, selection rules for microwave spectra, applications of microwave spectroscopy: determination of bond length, dipole moment measurement, determination of isotopic mass of an element. Infrared spectroscopy: introduction and principles of IR, types of vibrations: bending and stretching, Hooke's law for stretching vibrations, characteristic frequencies of common functional groups, IR instrumentation, interpretation and applications of IR spectrum with examples.

Ultra-violet spectroscopy: Introduction and principle of UV spectroscopy, color interpretation with VBT and MOT, types of electronic transitions, selection rules, chromophores and auxochromes with examples, conjugation effect, absorption and intensity shifts, applications of UV spectroscopy.

Unit 2: Chemical kinetics (7 classes)

Complex reactions: definition and classification of complex reactions, definition of reversible reactions with examples, rate law derivation for reversible reactions.

Consecutive reactions: definition, rate law derivation and examples of consecutive reactions.

Parallel reactions: definition, rate law derivation and examples of parallel reactions.

Steady-state approximation: introduction, kinetic rate law derivation by applying steady state approximation in case of the oxidation of NO and pyrolysis of methane.

Chain reactions: introduction, types and mechanism of chain reactions, stationary and non-stationary chain reactions with examples, deriving the kinetic rate equation using a general chain reaction.

Photochemical reactions: introduction, Stark-Einstein law of photochemical equivalence, photophysical processes: IC, ISC, fluorescence and phosphorescence with examples, kinetic rate law derivation incase of photochemical decomposition of HI and photochemical combination of H_2 and Br_2.

Unit 3: Electrochemistry (10 classes)

Types of electrodes: introduction, metal-metal ion electrodes, metal-insoluble salt-anion electrodes, calomel electrode, gas-ion electrodes, hydrogen and chlorine electrodes, oxidation-reduction electrodes, amalgam electrodes.

Types of cells: classification into chemical and concentration cells, chemical cells with transference and without transference, classification of concentration cells into electrolyte and electrode concentration cells, electrolyte concentration cells with and without transference, amalgam and gas concentration cells, examples for these cells.

EMF and applications of EMF: determination of pH, determination of the valency of the ions, potentiometric titrations. pH: definition of pH and determination of pH by various methods, acid-base titrations.

Thermodynamic data: enthalpy and entropy of cell reactions, Gibbs-Helmholtz equation and applications.

Unit 4: Corrosion and its prevention (10 classes)

Mechanism of Dry and wet corrosion (rusting of iron),

Types of corrosion, galvanic corrosion, stress corrosion, pitting and crevice corrosion.

Factors affecting corrosion, preventive measures (proper design, Cathodic and Anodic protection, Electroplating , tinning, galvanizing.

Phase Rule: Terminology, One component system (H_2O system, S- system and CO_2 – system), two components system, Cooling curves, simple eutectic system (Pb – Ag), system with congruent melting point (Zn – Mg).

Unit 5: Engineering Materials: (12 classes)

Polymers: Types of Polymerization (Chain & Step growth).Plastics: Thermoplastic & Thermo setting resins; Preparation, properties,engineering applications of PVC, Teflon and Bakelite.

Cement: composition of Portland cement, setting & hardening of cement (reactions),

Lubricants: Classification with examples-Characterstics of a good lubricant & mechanism of lubrication (thick film , thin film and extreme pressure) –properties of lubricants: viscosity , Cloud point, flash and fire points.

Refractories: Classification, characteristics of a good refractory and applications.

Nanomaterials: Introduction, preparation by sol-gel & chemical vapour deposition methods. Applications of nanomaterials.

Introduction to current scenarios of nanotechnology and computer science

Carbon nanotube computers, quantum computers, computational nanotechnology, DNA computing, single electron transistor, NV RAM (Non volatile RAM)

Refer Books

1. **Engineering Chemistry, Jain & Jain**
2. **Engineering Chemistry, Shashi Chawla**

3. **Chemistry for Engineers, B. K. Ambasta**
4. **Engineering Chemistry, H. C. Srivastava**

MA1102	**Mathematics-I (Calculus)**	**2L: 0T: 0P**	**2 Credits**

Pre-requisites	

Course Objectives: To learn

- Concept of Sequence.
- Concept of nature of series.
- Geometrical approach to the mean values theorems and their application to the mathematical problems.
- Evaluation of surface areas and volumes of revolutions of curves.
- Evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative.
- Finding maxima and minima of function of two and three variables.

Syllabus:

UNIT-I
Sequences
Definition of a sequence, limit; Convergent, Divergent and Oscillatory sequences. Sandwich theorem,Tests for discussing the convergence and divergence of the sequence

Unit-II
Series
Definition of Series, Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert's ratio test; Raabe's test; Cauchy's Integral test; Cauchy's root test; Logarithmic test. Alternating series; Leibnitz test; Alternating Convergent series; Absolute and conditionally convergence of a series

UNIT-III
Mean Value Theorems and Taylor series
Mean value theorems: Roll's theorem, Lagrange's Mean value theorem, Cauchy's Mean value theorem; Taylor's and Maclaurin's series with remainders, Expansions;

UNIT-IV
Applications of Definite Integrals and Improper Integrals
Applications of definite integrals to evaluate surface area and volumes of revolutions of curves (Only in Cartesian coordinates)Definition of Improper Integrals and their convergence, Beta and Gamma functions and their applications.

UNIT-V

Multivariable Calculus (Partial Differentiation and applications):
Definitions of Limits and continuity. Partial Differentiation; Euler's theorem; Total Derivative; Jacobian; Functional dependence and independence; Maxima and minima of functions of several variables (two and three variables) using Lagrange Multipliers.

TEXTBOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition,
2. R.K.Jain and S.R.K.Iyengar Advanced Engineering Mathematics, Narosa Publications House.2008
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 2009.

REFERENCES:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint,2002.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
3. N.P. bail and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2008.

Course outcomes: After learning the concepts of this paper the student must be able to .

- Analyze the nature of sequence and series.
- Solve the applications on the mean value theorems.
- Evaluate the improper integrals using Beta and Gamma functions.
- Find the extreme values of functions of two variables with/without constraints.

MA1101	**Mathematics-II (Linear Algebra)**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives: To learn

- Concept of vector spaces and Linear Transformation
- Types of matrices and their properties.
- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of Eigen values and Eigen vectors and to reduce the quadratic form to canonical form.
- Concept of Singular value decomposition
- Matrix factorization (QR, LU,LDU).

Syllabus:

Unit-I
Vector spaces:
Vector Space, subspace, span of vectors ,linear dependence of vectors, basis, dimension; Linear transformations (maps),range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, Matrix associated with a linear map.

Unit-II
Algebra of matrices, four ways of multiplying matrices, Hermition and unitary matrices,Left inverse and right inverse of a matrix,Four subspaces associated with a matrix, Dimensions of four subspaces of matrix, Fundamental theorem of linear Algebra
Null space of a matrix, Row reduced echelon form of a matrix, rank of a matrix elementary matrices, permutation matrices,Solvability of system $AX = b\ AX = b$, consistency of solutions, Complete solution of $Ax = b\ Ax = b$,

Unit-III
Inner product on a vector space, norm of a vector, Angle between the vectors, Orthogonal vectors, Orthogonal subspaces, Fundamental theorem of Orthogonality, Orthogonal complement of a subspace, projection of a vector over a vector and subspace, Projection matrix and Least square fitting of data.

Unit-IV
Orthogonal bases of a vector space, Gram Schmidt method, QR factorization of a matrix.
Eigen values and Eigen vectors of a matrix, special case to Hermition and unitary matrices, Cayley -Hamilton Theorem (Without proof),finding inverse and power of a matrix by Cayley-Hamilton Theorem,Diagonalization of matrix.

Unit-V
Similar matrices, Jordon canonical form of a matrix, Quadratic forms and Nature of the Quadratic forms, Positive definite and semi positive definite forms, Reduction of quadratic form to canonical form by Orthogonal transformation.Singular value Decomposition of a matrix

Text Books:

- Introduction to Linear Algebra by Gilbert Strang
- Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition,

Reference Books:

- Linear algebra by Kenneth Hoffmann and Ray Kunze.
- R.K.Jain and S.R.K.Iyengar Advanced Engineering Mathematics, Narosa Publications House.2008

Course Outcomes:

- Write the matrix representation of set of linear equations and to analyze the solution of the system of equations.

- Find the Eigen values and Eigen vectors of a matrix
- Reduce the quadratic form to canonical form using orthogonal transformations.
- Write the Jordon canonical forms of a matrix
- Find the factorization of Matrices(LU,QR,LDU).

HS1102	Communication Skills - I	2L: 0T: 0P	0 Credits

Pre-requisites	

Course Objectives:

1. To make the students efficient communicators via experiential learning.
2. To enhance learners' analytical and creative skills, so that they will be capable to address a wide variety of challenges in their professional lives.
3. To help learners to improve the leadership qualities and professional etiquette.
4. To expose learners to an effective communicative environments.

Detailed Content:

Module 1:

Introduction to communication: Introduction – Importance of Communication Skills – Definition – Scope and Nature – Verbal and Nonverbal communication.

Module 2:

Reading Skills: Reading Comprehension of unseen passage – Prose – News Paper Reading and Analysis (Editorial)

Module 3:

Grammar:

1. Parts of Speech
2. Subject and predicate
3. Articles – Determiners
4. Conjunctions (Linkers; connectors; cohesive devices)
5. Verbs – Transitive and Intransitive - Finite and Infinite - Regular and Irregular - Modals
6. Tenses
7. Prepositions/ Prepositional verbs
8. Adverbs – types and their order in sentences
9. Adjectives
10. Including Degrees of Comparison and also Quantifiers

Module 4:

Enhancing Vocabulary: Developing Professional vocabulary – Using Dictionary: Spelling – Grammar and Usage

Module 5:

Composition: Paragraph – Essay - Expansion - Describing the Pictures – Giving Directions – Situational Dialogue writing – Social and Professional Etiquette – Telephone Etiquette

Suggested Reference Books:

1. Joseph Mylal Biswas book of English Grammar
2. R. Murphy -Cambridge Press
3. Wren and Martin
4. The Good Grammar book by OUP
5. Communication skills by M. Raman and Sangeeta Sharma
6. How to Win Friends and Influence people by Dale Carnigie
7. How to Read and Write Better by Norman Lewis
8. Better English by Norman Lewis
9. Use of English Collocations by OUP

Websites:

1. www.humptiesgrammar.com
2. www.bbcenglisgh.com
3. www.gingersoftware.com
4. www.pintest.com

Course Outcomes:

Students will be able to

1. Develop interpersonal communication, small group interactions and public speaking.
2. Exercise the writing assignments, precise writing for informational, persuasive and creative purposes.
3. Apply right form of structural usage of sentences in their written and oral communication.
4. Develop confidence and skills related reading comprehension.
5. Improve a logical framework for the critical analysis of spoken, written, visual and mediated messages upon diverse platforms.
6. Demonstrate the ability to apply vocabulary in practical situations.

BM0005	**Indian Constitution**	**3L: 0T: 0P**	**0 Credits**

Pre-requisites	

CONSTITUTION OF INDIA

Course objectives:

- To provide basic information about Indian constitution.
- To identify individual role and ethical responsibility towards society.
- To understand human rights and its implications

Unit 01: Introduction to Indian Constitution

- Meaning of the term Constitution
- History of Indian constitution
- Preamble of the Constitution
- Constituent Assembly
- The Salient Features of Indian Constitution

Unit 02: Fundamental Rights

- Fundamental Rights
- Importance and scope of fundamental rights

Unit-03: Fundamental Duties

- Fundamental Duties
- The Directive Principles of State Policy

Unit 04: Union Government

- Union Government
- Union Legislature (Parliament)
- Lok Sabha and Rajya Sabha (with Powers and Functions)
- Union Excecutive
- President of India (with Powers and Functions)
- Prime Minister of India (with Powers and Functions)
- Union Judiciary (Supreme Court)
- Jurisdiction of the Supreme Court

Unit 05: State Government

- State Government
- State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad)
- Powers and Functions of the State Legislature
- State Executive
- Governor of the State (with Powers and Functions)
- The Chief Minister of the State (with Powers and Functions)
- State Judiciary (High Courts)

Unit 06: Local Self Government (with Special Reference to Telangana State)

- Election Commission of India (with Powers and Functions)
- The Union Public Service Commission (with Powers and Functions)

Books Recommended:

1. ‘Indian Polity’ by Laxmikanth

2. ‘Indian Administration’ by Subhash Kashyap
3. ‘Indian Constitution’ by D.D. Basu
4. ‘Indian Administration’ by Avasti and Avasti

CS1701	Programming for Problem Solving Lab	0L: 0T: 4P	2 Credits

Pre-requisites	

Course Objectives

- Understand the fundamentals of programming in C Language.
- Write, compile and debug programs in C.
- Formulate solution to problems and implement in C.
- Effectively choose programming components to solve computing problems

Detailed Contents:

List of Tutorials/Experiments:

Week 1

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Week 2

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

1. Write a C program to find the area of a circle using the formula: Area = PI * r2
2. Write a C program to find the area and volume of sphere.
   (Formula are: Area =4*PI*R*R Volume = 4/3*PI*R*R*R.)
3. Write a C program to convert centigrade into Fahrenheit.
   (Formula: C= (F-32)/1.8.)
4. Write a C program to read in two integers and display one as a percentage of the other. Typically your output should look like 20 is 50.00% of 40 assuming that the input numbers where 20 and 40. Display the percentage correct to 2 decimal places.

Week 3

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

1. Write a C program to find the maximum from given three nos.
2. Write a C program to find that the accepted no is Negative, Positive or Zero.
3. Write a program which reads two integer values. If the first is lesser print the

message **"up"**. If the second is lesser, print the message **"down"** if they are equal, print the message **"equal"** if there is an error reading the data, print a message containing the word **"Error".**

4. Write a C program that prints the given three integers in ascending order using if – else.

5. Given as input three integers representing a date as day, month, year, print the number day, month and year for the next day's date. Typical input: "28 2 1992" Typical output: "Date following 28:02:1992 is 29:02:1992"

Week 4 & 5

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

1. Write a C program to find the sum of first 100 odd nos. and even nos.
2. Write a C program to display first 100 prime nos.
3. Write a C program to read in a three digit number produce following output
   (Assuming that the input is 347) 3 hundreds, 4 tens, 7 units
4. Write a C program to display Fibonacci series
5. Write a C program to calculate the following i.sum=1-x2/2! +x4/4!-x6/6!+x8/8!-x10/10!+… ,
   ii.sum=x-x3/3!+x5/5!. ,
   iii.sum=1+x/1!+x^2/2!+x^3/3!. ,
6. Write a C program to find the roots of a Quadratic equation.

Week 6

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

1. C program that reads N integer numbers and arrange them in ascending order using Bubble Sort
2. C program that reads N integer numbers and arrange them in ascending order using Merge Sort
3. C program that reads N integer numbers and arrange them in ascending order using Quick Sort
4. C program that reads N integer numbers and arrange them in ascending order using Insertion Sort

Week 7

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

1. Write a C program to perform the basic Matrix operations
   i) Addition ii) Subtraction iii) Multiplicationiv) Transpose.
2. Write a C program to determine if the given string is a palindrome or not
3. Write a C program to count the lines, words and characters in a given text
4. Write a C program to Search a word in a given Sentence

Week 8

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

1. Write a C Function for the following task
   i) Calculating Factorial
   ii) Find value of a given Fibonacci term
   iii) Swapping the values of two variable

2. Write a C program that uses functions to perform the following operations:
   i) To insert a sub-string in to a given main string from a given position.
   ii) To delete n Characters from a given position in a given string.

Week 9

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

1) Write the following recursive C Function
   i)Factorial of a given number
   ii)Nth Fibonacci number
   iii)Reverse of a given String
   iv)Reverse of a give Number

Week10

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

1. Write a C program to maintain a record of "n" student details using an array of structures with four fields (Roll number, Name, Marks, and Grade). Assume appropriate data type for each field. Print the marks of the student, given the student name as input.
2. Define structure called cricket that will describe the information player name, team name,batting aveg.Using cricket ,declare an array player with 10 elements and write program to read information about all 10 players and print team wise list containing names of the player with their batting avg
3. Write a program using pointers to compute the sum of all elements sorted in an array
4. Write a program to print the elements of a structure using pointers.

Week11

Tutorial 12: File handling

Lab 12: File operations

1. Write a C program that creates an Employee text file? Records Are empid, empname, designation, qualification, salary, experience, Research work, address, city phone?

2. Write a C program that manipulates the above text file. The program must implements the operation to modify a record, delete a record and append new records

Course Outcomes

- Choose appropriate data type for implementing programs in C language.
- Design and implement modular programs involving input output operations, decision making and looping constructs.
-
- Implement search and sort operations on arrays.
- Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
- Design and implement programs to store data in structures and files.

Suggested Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill Suggested Reference Books
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

CY1701	Chemistry – I Lab	0L: 0T: 3P	1.5 Credits

Pre-requisites	

Course Objectives:

1. To learn the preparation of organic compounds in the laboratory
2. To estimate the hardness and alkalinity of the given sample of water
3. To understand the Job's method for determining the composition
4. Learns how to use the pH meter and polarimeter
5. Synthesis of a pharmaceutically active drug

List of Experiments:

1. **Synthesis:** Synthesis of soap from cheap oil, Synthesis of Thiokol rubber.
2. **Volumetric analysis:** Estimation of alkalinity of water, Estimation of total hardness of water by EDTA method.
3. **Job's method:** Determination of composition of Ferric-Thiocyanate complex by Job's method
4. **pH meter:** Estimation of the strength of a weak acid by pH metry
5. **Polarimeter:** Determination of specific rotation of sucrose by polarimeter
6. **Synthesis of Aspirin Drug (NSAID)**

Suggested Reference Books:

1. College Practical Chemistry by V K Ahluwalia, Sunita Dhingra, Adarsh Gulati
2. Practical Engineering Chemistry by K Mukkanti
3. A Text Book of Engineering Chemistry: by Shashi Chawla
4. Essentials of Experimental Engineering Chemistry by Shashi Chawla
5. Comprehensive Practical Organic Chemistry – Preparation and Quantitative analysis by V K Ahluwalia, Renu Aggarwal

Course Outcomes: Minimum knowledge on basic synthesis, quantitative and qualitative analysis is being imparted.

B.TECH (CSE) I YEAR II-SEM

CS1802	IT Workshop	0L: 0T: 3P	1.5 Credits

Pre-requisites	

Week1

Basic introduction on System Hardware devices and its Peripherals
Introduction to Unix , UNIX architecture , Unix directory Structure locating commands ,Manual Pages On-Line (Man, info--)

Week2

General Purpose and Utilities(Commands) – pwd,cd,cal,date,echo,printf,bc,script,passwd.who whoami, uname,tty,stty

Week3
Files Permissions
File and Directory creation and removing
(cat,touch,mkdir,rm etc..)

Week4
ls command with options
Simple Filters –head ,tail,cut,paste,sort
User and Group Administration

Week5
Latex:Introduction, Document Structure,Essentials ,Troubleshooting Creating a Title, Sections ,Labelling,Table of Contents.

Typesetting Text: Font Effects, Coloured Text ,Font Sizes ,Lists ,Comments & Spacing,Special Characters.

Week6
Tables, Figures
Equations: Inserting EquationsMathematical Symbols,Practical

Week7
Inserting References: Introduction,The BibTeX file ,Inserting the bibliography,Citing references,Styles,Practical

Week-8:
Basic HTML Tags,Table Tags,List Tags,Image Tags, Forms .
Week-9:
Implement forms using HTML,FRAMES,CSS.

Week-10:
Install the following on local machine • Apache web server • Tomcat application server locally, • Install MySQL • PHP and configure it to work with Apache web server and MySQL

Week 11:

The NumPy array object

What are NumPy and NumPy arrays, Creating arrays, Basic data types, Basic visualization, Indexing and slicing, Copies and views, Fancy indexing

Numerical operations on arrays
Elementwise operations, Basic reductions, Broadcasting, Array shape manipulation, Sorting data

Week12:
Matplotlib: plotting
Introduction, Simple plot, Figures, Subplots, Axes and Ticks, different types of Plots: examples and exercises

EE1202	**Basic Electrical Engineering**	**4L: 0T: 0P**	**4 Credits**

Pre-requisites	

Course Objectives: This course introduces
1. DC and AC electrical circuit steady state analysis
2. Construction and working of DC and AC electrical machines
3. The components of low-voltage electrical installations

Detailed Contents:
Module 1:
Circuits Analysis:
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Module 2:

Transformers : Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 3:
Electrical Machines: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 4:
Power Converters: DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 5:
Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes: At the end of this course, students will demonstrate the ability

1. To understand and analyze basic electric and magnetic
2. To study the working principles of electrical machines and power converters.
3. To introduce the components of low-voltage electrical installations.

CE1801	Engineering Graphics	0L: 0T: 6P	3 Credits

Pre-requisites	

Course Objectives:

1. To introduce the students to the "Universal Language of Engineers" for effective communication through drawing.
2. To understand the basic concepts of drawing through modern techniques.
3. To impart knowledge about standard principles of projection of objects.

4. To provide the visual aspects of Engineering drawing using Auto-CAD.

Detailed Contents:

Module 1:

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, types of lines and Dimensioning.

Over view of Auto-CAD: Theory of CAD software (The Menu System, Tool Bars, Drawing area, Dialogue boxes, Shortcut Menu, the command lines, Select and erase objects, Introduction to layers etc.), Drawing simple figures- lines, planes, solids.

Module 2:

Geometrical constructions: Construction of regular polygons.

Conic sections: Construction of Ellipse, Parabola, Hyperbola (General method only), Cycloid, Epicycloid, Hypocycloid and Involutes.

Scales: Construction of Plain, Diagonal and Vernier scales.

Module 3:

Orthographic projections: Principles of Orthographic Projections

Projections of Points: Projections of Points placed in different quadrants,

Projection of lines: lines parallel and inclined to both the planes (Determination of true lengths and true inclinations and traces)

Projection of planes: Planes inclined to both the reference planes

Module 4:

Projection of Solids: Projection of solids whose axis is parallel to one of the reference planes and inclined to the other plane, axis inclined to both the planes,

Projection of sectioned solids: Sectioning of simple solids like prism, pyramid, cylinder and cone in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.

Module 5:

Development of surfaces: Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone.

Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views of planes and simple solids,

Perspective projections: Basic concepts of perspective views.

Suggested Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age publications
5. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
6. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers (Corresponding set of) CAD Software Theory and User Manuals

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Use Engineering principles and techniques to understand and interpret engineering drawings.
2. Understand the concepts of Auto-CAD.
3. Draw orthographic projections of lines, planes and solids using Auto-CAD.
4. Use the techniques, skills and modern engineering tools necessary for engineering practices.

PH1201	Physics - I	4L: 0T: 0P	4 Credits

Pre-requisites	

Detailed Contents:

Module 1:

Vectors and Mathematical Physics: Gradient, Divergence, Curl and its applications, Line, surface and volume integrals, Stokes and Gauss theorem, Curvilinear Coordinates: Polar, Cylindrical and spherical polar co-ordinates, Problems.

Module 2:

Electromagnetic Theory (18)

Electrostatics in linear medium: Physical Interpretation of Bound charges & Electric displacements, Boundary conditions of displacements and linear dielectrics, Potential at the center of a metal sphere surrounded by linear dielectrics.

Magneto statics in linear magnetic linear medium: Magnetization and associated bound currents, auxiliary magnetic fields, Boundary conditions on B and H.

Module 3:

Maxwell's Equations: Continuity equation for current density; modifying equation for curl of magnetic field to satisfy continuity equation, displace current and magnetic field arising from time dependent electric field, Maxwell's equation in vacuum and non- conducting medium; Energy in an electromagnetic fields. Flow of energy and Pointing vector & Qualitative discussion of momentum in electromagnetic fields.

Module 4:

Electromagnetic waves: The wave Equation; Plane electromagnetic waves in vacuum. Polarization, relation between electric and magnetic fields of electromagnetic waves, Energy carried by electromagnetic waves and examples, Momentum carried by electromagnetic waves and pressure. EM waves in vacuum: propagation in linear media, boundary conditions, Reflection and transmission co-efficient of electromagnetic waves from a non-conducting medium- vacuum interface for normal incidence, Problems.

Module 5:

Quantum Mechanics: Introduction to Quantum Mechanics, De-Brogile waves and uncertainty principle, Time dependant Schrodinger wave equation, Significance of Wave Function, Time

independent Schrodinger wave equation and solution of generalized potential, Particle in a box, Problems.

Module 6:
Electron Structure of solids: Introduction to Crystallography, Bravais Lattices, Miller Indices, Free electron Theory, Kronig Penny model (E vs K), Band theory of solids.

Module 7:
Semiconductor Physics: Intrinsic and extrinsic semiconductors, Fermi level and carrier-concentration, Effect of temperature on Fermi level. Mobility of charge carriers and effect of temperature on mobility, Hall Effect, Energy band gap determination of semiconductors by four probe method, Direct and Indirect Band gap semiconductors.

Suggested Reference Books:

1. **Arfken**, Mathematical Physics
2. **David Griffiths,** Introduction to Electrodynamics &W Saslow, Electricity, Magnetism and Light
3. **David Griffiths,** Quantum Mechanics
4. **Wahab,** Solid State Physics
5. **S M Sze**, Semiconductor Devices: Physics and Technology, Wiley (2008)

MA1201	Differential Equations & Vector Calculus	4L: 0T: 0P	4 Credits

Pre-requisites	

Course Objectives:
1. Methods of solving the differential equations of first and higher order.
2. To study the methods of solving improper integrals and the concepts of multiple integrals.
3. The basic properties of vector valued functions and their applications to line, surface a volume integral.
4. To study numerical methods to analyze an experimental data.

Detailed Contents:
Module 1:
Ordinary Differential Equations of first order: Exact first order differential equation, finding integrating factors, linear differential equations, Bernoulli's, Riccati, Clairaut's differential equations, finding orthogonal trajectory of family of curves, Newton's Law of Cooling, Law of Natural growth or decay.

Module 2:
Ordinary Differential Equations of higher order: Linear dependence and independence of functions, Wronskian of n- functions to determine Linear Independence and dependence of functions, Solutions of Second and higher order differential equations (homogeneous & non-homogeneous) with constant coefficients, Method of variation of parameters, Euler-Cauchy equation.

Module 3:
Integral Calculus: Convergence of improper integrals, tests of convergence, Beta and Gamma functions - elementary properties, differentiation under integral sign, differentiation of integrals with variable limits - Leibnitz rule. Rectification, double and triple integrals, computations of surface and volumes, change of variables in double integrals - Jacobians of transformations, integrals dependent on parameters – applications.

Module 4:
Vector Differentiation: Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

Module 5:
Vector Integration: Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications.
Numerical Methods: Introduction and motivation about numerical methods, True value, approximate value, error, error percentage, algebraic equations, transcendental equations, Newton-Raphson method, Bisection method.

Suggested Books:

1. Advanced Engineering Mathematics (3rd Edition) by R. K. Jain and S. R. K. Iyengar, Narosa Publishing House, New Delhi.
2. Advanced Engineering Mathematics (8th Edition) by Erwin Kreyszig, Wiley-India.
3. Dr. M.D. Raisinghania, Ordinary and Partial differential equations, S.CHAND, 17th Edition 2014.

Course Outcomes: At the end of the course student will be able to
1. Solve first order linear differential equations and special nonlinear first order equations like Bernouli, Riccati &Clairaut's equations.
2. Compute double integrals over rectangles and type I and II" regions in the plane.
3. Explain the concept of a vector field and make sketches of simple vector fields in the plane.
4. Explain concept of a conservative vector field, state and apply theorems that give necessary and sufficient conditions for when a vector field is conservative, and describe applications to physics.
5. Recognize the statements of Stokes' Theorem and the Divergence Theorem and understand how they are generalizations of the Fundamental Theorem of Calculus.
6. Able to solve the problems in diverse fields in engineering science using numerical methods.

HS1201	**English**	**2L: 0T: 0P**	**2 Credits**

Pre-requisites	

INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures.

Course Objectives: The course will help to

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus.
3. Develop study skills and communication skills in formal and informal situations.

Detailed Content:

Module 1:

'The Raman Effect' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.

Vocabulary Building: The Concept of Word Formation --The Use of Prefixes and Suffixes.

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Basic Writing Skills: Sentence Structures -Use of Phrases and Clauses in Sentences Importance of Proper Punctuation- Techniques for writing precisely - **Paragraph writing** - Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

Module 2:

'Ancient Architecture in India' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.

Vocabulary: Synonyms and Antonyms.

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Improving Comprehension Skills – Techniques for Good Comprehension.

Writing: Format of a Formal Letter-**Writing Formal Letters** E.g.., Letter of Complaint, Letter of Requisition, Job Application with Resume.

Module 3:

'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.

Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-skills of Reading- Skimming and Scanning.

Writing: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places and Events – **Classifying**- Providing Examples or Evidence.

Module 4:
'What Should You Be Eating' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Standard Abbreviations in English.
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension**-** Intensive Reading and Extensive Reading.
Writing: Writing Practices - Writing Introduction and Conclusion - Essay Writing-Précis Writing.

Module 5:
'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Technical Vocabulary and their usage.
Grammar: Common Errors in English.
Reading: Reading Comprehension-Exercises for Practice.
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Suggested Books:
1. **Sudarshana, N.P. and Savitha, C. (2018), English for Engineers, Cambridge University Press.**

Suggested Reference Books:
1. Swan, M. (2016). Practical English Usage. Oxford University Press.
2. Kumar, S and Lata, P(2018), Communication Skills. Oxford University Press.
3. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001), On Writing Well, Harper Resource Book.
5. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.
6. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

Course Outcomes: Students should be able to
1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

HS1202	**Communication Skills - II**	**2L: 0T: 0P**	**0 Credits**

Pre-requisites	

Course Objectives:
1. To develop the learners ability to read fluently and critically.
2. To make awareness of the common punctuation marks and the importance of it in writing
3. To build academic vocabulary of the learners
4. To offer the learners opportunity to practice creative writing
5. To make the learners apply the skills and strategies of a successful listener

Detailed Content:
Module 1:
Reading: Reading Skills – Importance - Definition –Types -Techniques and strategies

Module 2:
Punctuation and Capitalization: Punctuation - Use of Capital Letters

Module 3:
Vocabulary

1. Antonyms
2. Synonyms
3. Affixation
4. Vocabulary in context
5. Proverbs /Collocations
6. One word substitutes
7. Idioms and Phrasal verbs

Module 4:
Writing Skills: Creative writing – Story Writing – Precise - Letter writing

Module 5:
Listening: Listening Skills – Academic Listening – Listening to Talks and Presentations – Note Taking

Suggested Reference Books:

1. Meenakshi Raman and Sangeeta Sharma **"Communication skills"** Oxford University press, 2013
2. Wren and Martin, NDV Prasad Rao. "**High School English Grammar and Composition**" S. Chand& Compay Ltd, 2012
3. Michael Swan, **"Practical English Usage"** 3rd edition: guide to problems in English, Oxford University press, 2011
4. Edgar Thorpe and Showick Thorpe, **"Objective English"** 3rd Edition, Pearson, 2010

Course Outcomes:
The learners will be able to:

1. Make use of contextual clues to infer meanings of unfamiliar words from context and make inferences and predictions based on comprehension of a text
2. Punctuate simple sentences correctly
3. Produce appropriate vocabulary and correct word forms
4. Write creatively and accurately. They will also have a critical awareness of their writing in terms of unity, content, coherence and linguistic accuracy (grammatical structure and choice of vocabulary).
5. Comprehend the talks and presentations, take organized notes on lectures and listening passages

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EE1802	**Basic Electrical Engineering Lab**	**0L: 0T: 2P**	**1 Credits**

Pre-requisites	

Course Objectives: To provide practical exposure

1. Common electrical components and their ratings.
2. Common electrical measuring instruments.
3. Transformers, electrical machines and power electronic converters.

Detailed Contents:

List of Laboratory Experiments/Demonstrations (any 10 of the following):

1. **Introduction to Lab:**
   a) Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
   b) Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
   c) Demonstration of Components of LT switchgear.

2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
5. Torque Speed Characteristic of separately excited dc motor.
6. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.
7. Torque-Slip Characteristic of an induction motor.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Power electronics (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and Calibration of Energy Meter
10. 3-phase power measurement using two wattmeter method
11. Characteristic of the lamps (Tungsten, Fluorescent and Compact Fluorescent Lamps)

Course Outcomes: The students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of power electronic converters.

PH1802	Physics-I Lab	0L: 0T: 3P	1.5 Credits

Pre-requisites	

List of Experiments:

1. Four Probe Method
2. Hall Effect
3. Dielectric Constant
4. Frank Hertz Experiment
5. Diffraction Grating
6. Ultrasonic Interferometer
7. Energy Band gap of a semiconductor
8. Photoelectric Effect
9. Torsional Pendulum
10. Magnetic Hysteresis Curve

HS1801	English Language Lab	0L: 0T: 2P	1 Credits

Pre-requisites	

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

1. To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
2. To sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm.
3. To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking.
4. To improve the fluency of students in spoken English and neutralize their mother tongue influence.
5. To train students to use language appropriately for public speaking and interviews

Syllabus of English Language Lab (Computer Assisted Language Learning (CALL) Lab):

Listening Skills:

Course Objectives:

1. To enable students, develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation.
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions.

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:
Course Objectives:

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
    - Oral practice: Just A Minute (JAM) Sessions
    - Describing objects/situations/people
    - Role play – Individual/Group activities

The following course content is prescribed for the English Language and based on AICTE Model Curriculum 2018 for B.Tech First year. As the syllabus is very limited, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning and timesaving in the Lab.

Detailed Content:
Module 1:
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening -Communication at Work Place- Spoken vs. Written language.
Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants -Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Module 2:
Understand: Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context- Features of Good Conversation – Non-verbal Communication.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context-Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Module 3:
Understand: Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI)- How to make Formal Presentations.
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation- Formal Presentations.

Module 4:

Understand: Listening for General Details-Public Speaking – Exposure to Structured Talks.
Practice: Listening Comprehension Tests- Making a Short Speech – Extempore

Module 5:
Understand: Listening for Specific Details- Interview Skills.
Practice: Listening Comprehension Tests- Mock Interviews.

Suggested Reference Books:

1. Clarity English Success - Software
2. Connected Speech- Software
3. Issues in English 2- Software
4. http://www.clarityenglish.com/program/practicalwriting/
5. http://www.clarityenglish.com/program/roadtoielts/
6. http://www.clarityenglish.com/program/clearpronunciation1/
7. http://www.clarityenglish.com/program/resultsmanager/

Learning Outcomes: Students will be able to attain

1. Better understanding of nuances of English language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking skills with clarity and confidence which in turn enhances their employability skills

B.TECH (CSE) II YEAR I-SEM

CS2101	**Data Structure & Algorithms**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	**CS1101**

Course Objectives:

1. To impart the basic concepts of data structures and algorithms.

2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Detailed Contents:

Module 1:

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc. Analysis of an algorithm, Asymptotic Notations, Time-Space trade off.

Module 2:

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation - corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 3:

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Module 4:

Searching: Linear search and binary search techniques and their complexity analysis.

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Module 5:

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis, Applications of Binary Trees, B Tree, B+ Tree: definitions, algorithms and analysis, Red-Black Trees and their operations.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and Complexity analysis.

Suggested Books:

1. “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, computer science Press.

Suggested Reference Books:

1. “Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
2. “How to Solve it by Computer”, 2nd Impression by R.G. Dromey, Pearson Education.

Course Outcomes:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.

2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

CS2102	Discrete Mathematics	4L: 0T: 0P	4 Credits

Pre-requisites	

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Detailed Contents:

Module 1:
Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.
Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module 2:
Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination

Module 3:
Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Module 4:

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Module 5:

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Coloring, Coloring maps and Planar Graphs, Coloring Vertices, Coloring Edges, List Coloring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

Suggested Reference Books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
3. Discrete Mathematics, Tata McGraw - Hill

Course Outcomes:

1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference
3. For a given a mathematical problem, classify its algebraic structure
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
5. Develop the given problem as graph networks and solve with techniques of graph theory.

EC2105	**Analog Electronics Circuits**	**4L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives:

- To introduce the semiconductor devices like Diode, BJT, MOSFET and their applications
- To know the linear and non-linear applications of operational amplifiers.

UNIT I: Diode circuits (4 Hours)
P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clippingcircuits.

UNIT II: BJT circuits (8 Hours)
StructureandI-VcharacteristicsofaBJT;BJTasaswitch.BJTasanamplifier:small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collectoramplifiers;Smallsignalequivalentcircuits,high-frequencyequivalentcircuits

UNIT III: MOSFET circuits (8 Hours)
MOSFETstructureandI-Vcharacteristics.MOSFETasaswitch.MOSFETasanamplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans- conductance, high frequency equivalentcircuit.

UNIT IV: Operational amplifiers (6 Hours)
Idealop-amp,non-idealitiesinanop-amp(Outputoffset voltage,inputbiascurrent, inputoffsetcurrent,slewrate,gainbandwidthproduct)

UNIT V: Applications of op-amp (14 Hours)
Linear applications of op-amp: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, Adders,oscillators(Weinbridgeandphase shift).Analog to Digital Conversion.
Nonlinear applications of op-amp:
HystereticComparator,ZeroCrossingDetector,Square-waveandtriangular-wavegenerators. Precision rectifier, peak detector.Monoshot, 555 timer.

Text/References:

1. A.S.SedraandK.C.Smith,"MicroelectronicCircuits",NewYork,OxfordUniversity Press,1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S.,1992.
3. J. MillmanandA.Grabel,"Microelectronics",McGrawHillEducation,1988.
4. P.HorowitzandW. Hill,"TheArtofElectronics",CambridgeUniversityPress,1989.
5. P. R. Gray, R. G. Meyer and S. Lewis, " Analysis and Design of Analog Integrated Circuits", John Wiley & Sons,2001.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the characteristics oftransistors.
- Designandanalyzevariousrectifierandamplifiercircuits.
- Designsinusoidalandnon-sinusoidaloscillators.

- Understand the functioning of OP-AMP and design OP-AMP based circuits.

EC2101	Digital Electronic Circuits	3L: 0T: 0P	3 Credits

Pre-requisites	

Objectives:

1. To understand basic number systems codes and logical gates.
2. To understand the Boolean algebra and minimization logic.
3. To understand the design of combinational sequential circuits.
4. To understand the basic s of various memory.

Unit-I:

Introduction

Digital & analog signals, Number System, BCD & its arithmetic, Binary, Decimal, Octal, Hexadecimal, Negative numbers& its arithmetic, Number base conversions,

Unit II:

Logic Realization & Simplification : Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Quine mccluskey method, Binary codes,Code Conversion.

Unit-III

Logic Gates:Basic, Arithmetic, Universal Gates Realizations

Unit IV:

Combinational Logic Design: MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU, parity generator, checker

Logic Families: characteristics of digital circuit (Fan-in, Fan-out, power dissipation, propagation delay, noise margin, Figure of Merit etc., Saturated logic families: DCTL, RTL, DTL, HTL, TTL, I2L etc., non-saturated logic families: STTL, ECL. PMOS, NMOS, CMOS. Programmable logic Families: PAL, PLA.

Unit V:

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM,. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator

TEXTBOOKS:

1. Digital Fundamentals – Thomas L Floyd, Pearson 11th edition

2. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.
3. Switching & Finite Automata theory – Zvi Kohavi, TMH,2nd Edition.
4. Switching Theory and Logic Design-A.Anand kumar, 2008.

REFERENCES:

1. An Engineering Approach to Digital Design – Fletcher, PHI.

Course outcomes:

At the end of this course students will demonstrate the ability to

A basic understanding of Boolean algebra and theorems for optimization

Design and developing of combinational logic circuits, storage cells for sequential circuit realization

Students will be having knowledge on basic Logic Families

Dissemination of sequential circuits for high end applications and FSM realizations

A glimpse on various logic families and their impacts in circuit realizations

MA2102	Probability and Statistics	4L: 0T: 0P	4 Credits

Pre-requisites	

Objectives:

* To understand the basic concept of counting, probability and its properties.
* To understand the concept of random variables and expectation.
* To learn various distributions and their applications.
* To study the properties of convergence of random variables.
* To know the concepts of statistics applicable in estimation and testing.

UNIT-I

Principles of Counting (Review): Counting using Sum Rule and Product rule. Concepts of permutations, combinations and circular permutations. Pigeonhole Principle, Occupancy Problem.

Basic Probability (Review): Random experiment. Sample space. Mutually exclusive events. Empirical definition of probability. Problems based on probability. Axiomatic definition of probability. Properties based on axiomatic definition of probability. Conditional probability. Independent events.

Random Variables: Definition of random variables. Properties of discrete and continuous random variables. Definition and properties of probability mass function and probability density function. Definition of cumulative distribution function and its properties for discrete and continuous distributions.

UNIT-II

Multivariate Distributions: Definition and properties of multivariate distribution (Continuous and Discrete). Joint probability distributions. Marginal probability distributions. Conditional probability distributions.

Mathematical Expectation: Concept of mathematical expectation of functions of random variables and their significance.
Discrete Distributions: Properties of various discrete distributions: Binomial, Poisson, Negative Binomial, Geometric, Hypergeometric and Discrete uniform distributions.

UNIT-III

Continuous Distributions: Properties of various continuous distributions: Uniform, Exponential, Normal, Gamma distributions.
Functions of Random Variables: Evaluating probability distribution of functions of random variables using CDF technique. Determination of joint probability distribution of functions of random variables using transformations.
Moments and Moment Generating Functions: Moments about origin, Central moments. Moment generating functions of random variables and its properties.

UNIT-IV
Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves

UNIT-V
Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.Test for single mean, difference of means and correlation coefficients, test for ratio of variances -Chi-square test for goodness of fit and independence of attributes.

Text Books References:

1. Miller, I., Miller, M., John E. Freund's Mathematical Statistics with Applications (7^{th} Edition), Pearson Education, Inc., 2009.
2. Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists (4^{th} Edition), Academic Press, 2011.

Reference Books

1. Gupta, S.C., Kapoor V.K., Fundamentals of Mathematical Statistics (11^{th} Edition), Sultan Chand & Sons, 2002.
2. Gupta, A., Groundwork of Mathematical Probability and Statistics (5^{th} Edition), Academic Publishers, 2002.
3. Feller, W., An Introduction to Probability Theory and its Applications, Volume 1 (3^{rd} Edition), John Wiley & Sons, Inc., 1967.
4. Feller, W., An Introduction to Probability Theory and its Applications, Volume 2 (2^{nd} Edition), John Wiley & Sons, Inc., 1971.

Course Outcomes:

- After learning the contents of this paper the student must be able to
- Apply the concepts of probability and distributions to some case studies
- Correlate the material of one unit to the material in other units
- Resolve the potential misconceptions and hazards in each topic of study.

HS2101	Humanities-I(Essence of Indian Traditional Knowledge)	2L: 0T: 0P	0 Credits

Pre-requisites	

UNIT –I

BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM:

VEDA (AYURVEDA, DHANURVEDA, GANDHARVA VEDA, STHAPATYA AATI**(SHILPA VEDA**), ARTHA VEDA, VEEDANGA (SHIKSHA, KALPA, CHHANDA, NIRUKTHA, VYAKARANA, JYOTHISHYA) DARMA SHASTRA, MIMASHA, PURANA, TARKASHASTRA

UNIT – II

MODERN SCIENCE AND INDIAN KNOWLEDGE SYSTEM

YOGA HOLISTIC HEALTH CARE

UNIT – III

INDIAN PHILOSOPHICAL TRADITION:

A) ORTHODOX (HINDU) SCHOOL: SAMKYA, YOGA, NYAYA, VAISHESHIKA, PURVA MIMAMSA, VEDHANTA,

B) HETORODOX (NON-HINDU) SCHOOLS: CARVAKA, JAIN, BUDDHA

UNIT-IV

INDIAN LINGUISTIC TRADITION:

PHONOLOGY, MORPHOLOGY, SYNTAX AND SEMANTICS

UNIT –V

INDIAN ARTISTIC TRADITION:

CHITRA KALA, MANTRA KALA, VAASTU KALA, SANGEETHA KALA, NRUTHYU EVAM SAHITYAM

CS2701	Data Structures & Algorithms Lab	0L: 0T: 4P	2 Credits

Pre-requisites	

COURSE OBJECTIVE:

This lab course is intended to write and execute programs in C to solve problems using data structures such as linked lists, stacks, queues, trees, graphs, hash tables search trees, pattern matching techniques and implement various searching and sorting methods

SOFTWARE REQUIREMENTS:

Turbo C / Linux

SYLLABUS:

LIST OF PROGRAMS

1. Write a program that uses functions to perform the following operations on singly linked list.
   i) Creation ii) Insertion iii) Deletion iv) Traversal
2. Write a program that uses functions to perform the following operations on doubly linked list.
   i) Creation ii) Insertion iii) Deletion iv) Traversal
3. Write a program that uses functions to perform the following operations on circular linked list.
   i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Write a program that implement stack (its operations) using
   i) Arrays ii) Pointers
5. Write a program that implement Queue (its operations) using
   i) Arrays ii) Pointers
6. Write a program that implements the following sorting methods to sort a given list of integers in ascending order
   i) Bubble sort ii) Merge sort iii) Heap sort iv) Quick sort
7. Write a program that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
   i) Linear search ii) Binary search
8. Write a program to implement binary search tree
9. Write a program to implement the tree traversal methods
10. Write a program to implement AVL Tree
11. Write a program to implement the graph traversal methods
12. Write a program to implement pattern matching algorithms
13. Write a program to implement stack using queues
14. Write a program to implement queue using stacks
15. Write a program to implement tree traversal methods without using recursion

TEXT BOOKS:

1. Fundamentals of data structures in C, 2 nd edition, E.Horowitz, S.Sahni and Susan Anderson Freed, Universities Press.
2. Data structures using c – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/pearson education.

REFERENCE BOOKS:

1. Data structures: A Pseudocode Approach with C, 2 nd edition, R.F.Gilberg And B.A.Forouzan, Cengage Learning.
2. Introduction to data structures in c, 1/e Ashok Kamthane.

COURSE OUTCOMES:

Upon successful completion of this Lab, students will be able to:

CO 1: Identify the appropriate data structure for given problem
CO 2: Analyze the time and space complexity of algorithm or program
CO 3: Effectively use compilers including library functions, debuggers and trouble shooting
CO 4: Implement the various searching and sorting techniques
CO 5: Compare and contrast the abstract data types and pattern matching algorithms

EC2703	**Analog Electronics Circuits Lab**	**0L: 0T: 3P**	**1.5 Credits**

Pre-requisites	

Course Objective:

- To provide practical Exposure for the students of semiconductor devices, operation amplifiers and their application

LIST OF EXPERIMENTS:

1. Familiarization with electronic components and usage of multimeter (measurement of resistance, classification of capacitors, diode testing)
2. Familiarization with Oscilloscope, signal generator and further usage of multimeters
3. Frequency response and square wave resting of R-C, C-R and R-L networks
4. Half-wave and full-wave rectifiers, rectification with capacitive filters, zener diode and IC regulation
5. Studies on CE amplifiers
6. Studies on Analog Circuits using OP-AMP
7. Studies on logic gates Studies on 555 circuits, J-K flip-flop, counters and shift registers

Course Outcome: At the end of this course, students will be able to

- Understand the characteristics oftransistors.
- Designandanalysevariousrectifierandamplifiercircuits.

- Designsinusoidalandnon-sinusoidaloscillators.
- Design OP-AMP based circuits.

EC2701	Digital Electronic Circuits Lab	0L: 0T: 4P	2 Credits

Pre-requisites	

Course Objectives:

1. Familiarize with VLSI CAD tools like Xilinx14.4 and Mentor Graphics tool.
2. Gives Basic concepts of Verilog HDL code to write a code for digital circuits.
3. To have hands on experience to design digital circuits, simulate and synthesis the design with Xilinx 14.4 VLSI CAD tool with timing diagrams and RTL diagrams.
4. To have hands on experience for transistor level design and simulate it with transient and DC analysis using mentor Graphics tool.
5. FPGA implantation of the Verilog code written in the VLSI CAD tool.

Detailed Contents:

List of Experiments:

1. Familiarization with Xilinx14.4 tool.
2. Simulate and Synthesis of all basis gates.
3. Simulate and synthesis of multiplexers, decoders and code converters.
4. Simulate and synthesis of all flip-flops.
5. Simulate and synthesis of Universal shift registers.
6. Simulate and synthesis of the binary counter, MOD counters.
7.

Course Outcomes:

1. Able to write a Verilog HDL code for the digital systems.
2. Able to use the VLSI CAD tools to design digital systems and get synthesis the design to get RTL level diagram.
3. Able to simulate the digital system to check the functionality with the timing diagrams.
4. Able to do transient and dc analysis of the CMOS Inverter, Logic gates and analog circuits.
5. Able to do FPGA Implementation of the combinational and sequential circuits.

B.TECH (CSE) II YEAR II-SEM

CS2201	Computer Organization & Architecture	3L: 0T: 0P	3 Credits

Pre-requisites	EC2101

Course Objectives:

1. To understand how Computer Systems work & its basic principles
2. To learn how to analyze the system performance
3. To understand the concepts behind advanced pipelining technique
4. To learn the current state of artin memory system design
5. To understand how I/O devices are being accessed and its principles
6. To provide the knowledge on Instruction Level Parallelism

Detailed Contents:

Module 1:

Basic functional blocks of a computer, Basic Functional blocks – CPU, Memory, Input-output, Control unit, InstructionsandInstructionexecutioncycle,Instruction setarchitecture-Elementsof machine instructions, Instruction representation, Instruction types, classification based on number of addresses, Data types, Types of operations-Data transfer, Arithmetic, Logical, Conversion, Input-output, system, Control and transfer of control operations, Addressing modes, Casestudy of 8086 instructionset.

Module 2:

Datarepresentation and Arithmetic Data Representation: Signed number representation, fixed and floating point representations, character representation.Convertingbetween different bit lengths; **Integerarithmetic:** Negation, integer addition and subtraction, ripple carry adder,carry look ahead adder,etc.multiplication shift-and-add, and Booth multiplier. Division non-restoring and restoring techniques, **floatingpoint:** floating point representation and floating point arithmetic: Addition, Subtraction, Division, Multiplication.

Module 3:

CPU controlunit design Micro operations: fetch, indirect, interrupt, execute, Instruction cycle, **ControlSignals:** inputs and outputs, HardWired ControlUnit; **Microinstructions:** horizontal and vertical instruction formats, Microprogram, Micro programmed control unit, Advantages and Disadvantages of hard wired and Micro programmed control unit; **Pipelining:** Parallel processing, pipelining, Arithmetic pipelining, Instruction pipelining, RISC pipelining, throughput and speedup, pipeline hazards and solutions.

Module 4:

Input-output organization External devices, **Input-outputInterface:** I/O Bus and interface Modules, I/O Versus memory Bus, I/O Modules structure and their functions.

Modesof Transfer: Programmed I/O, Interrupt driven I/O, **Direct Memory Access:** DMA Controller and Transfer, DMA Configurations, Privileged and Non-privileged instructions, Software Interrupts and exceptions, **Processormodes:** User mode and kernel mode.

Module 5:

Semi-conductor main memory & Memory organization Memory Hierarchy; **MainMemory:** Semi-conductor main memory, Organization of memory cell, **RAM:** DRAM, SRAM and ROM Chips, Memory Connection to CPU. **Auxiliary memory:** Disks, Read and write mechanisms, Data organization and formatting, Physical Characteristics, Disk performance parameters, Overview of

optical discs, RAID Levels, **Memory Organization:** Memory Interleaving, Cache memory, Cache memory principles, **Mapping functions:** Direct mapping, Associative mapping function, Set Associative mapping function, Replacement Algorithms,Write policy.

Suggested Books:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, Mc Graw Hill, Higher Education.

Suggested Reference Books:

1. William Stallings, Computer Organization & Architecture, 6th edition, Pearson Education Asia.
2. M.Morris Mano, Computer System Architecture, 3rd edition, Pearson Education Asia.
3. V.Carl Hamacher, Z.G.Vranesic, S.G.Zaky, Computer organization, Mc Graw Hill.

Course Outcomes:

1. Draw the functional block diagram of single bus **architecture of a computer and describe the function of the** instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2. Write assembly language program for specified microprocessor for computing 16 bit multiplication, division and I/O device interface (ADC, Control Circuit, serial port communication).
3. Write a flowchart for Concurrent access to memory and cache coherency in **Parallel Processors** and describe the process.
4. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.
5. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

CS2202	Database Management Systems	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives:

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

UNIT 1

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

UNIT 2

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS – MYSQL, ORACLE, DB2, SQL server.
Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization.

UNIT 3
Relational database design and Schema Refinement: Domain and data dependency, Armstrong's axioms, Problems Caused by redundancy, Decompositions - Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms - FIRST, SECOND, THIRD Normal forms - BCNF - Properties of Decompositions - Loss less join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design - Multi valued Dependencies - FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.
Storage strategies: Indices, B-trees, hashing.

UNIT 4

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

UNIT 5

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.
Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Suggested Books:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Suggested Reference Books:

1. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
2. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education
3. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

Course Outcomes:

1. For a given query write relational algebra expressions for that query and optimize the developed expressions

2. For a given specification of the requirement design the databases using E R method and normalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

CS2203	**Design and Analysis of Algorithms**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	CS1101

OBJECTIVES:

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power.

Detailed Contents:

Module 1: Introduction

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis – Mathematical analysis for Recursive and Non-recursive algorithms – Visualization

Module 2: Brute Force And Divide-And-Conquer

Brute Force – Computing an – String Matching – Closest-Pair and Convex-Hull Problems – Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort – Multiplication of Large Integers – Closest-Pair and Convex – Hull Problems.

Module3: Dynamic Programming And Greedy Technique

Dynamic programming – Principle of optimality-Chain Matrix Multiplication, Computing a Binomial Coefficient – Floyd‘s algorithm – Multi stage graph – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique –Prim‘s algorithm and Kruskal’s Algorithm – Knapsack problem, Optimal Merge pattern – Huffman Trees.

Module 4: Iterative Improvement

The Simplex Method – The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.

Module 5: Coping With The Limitations Of Algorithm Power

Lower – Bound Arguments – P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search – Assignment problem – 0/1 Knapsack Problem – Travelling Salesman Problem – Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

TEXT BOOKS:

- Anany Levitin, ―Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.
- Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

REFERENCES:

- Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms‖, Third Edition, PHI Learning Private Limited, 2012.
- Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms‖, Pearson Education, Reprint 2006.
- Harsh Bhasin, ―Algorithms Design and Analysis‖, Oxford university press, 2016.
- S. Sridhar, ―Design and Analysis of Algorithms‖, Oxford university press, 2014.

OUTCOMES:

At the end of the course, the students should be able to:

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency.

CS2204	Data Analytics	3L: 0T: 0P	3 Credits

Pre-requisites	

Course objectives

1. To understand the fundamentals of statistics
2. To calculate the measures of central tendency, asymmetry and variability
3. To distinguish and work with different types of distributions
4. To estimate confidence intervals for population parameters
5. To understand z-test, t-test, chi-square test, ANOVA
6. To understand mechanics of regression analysis
7. To calculate correlation and covariance

Detailed contents

Unit-I

Introduction to Analytics: why analytics, types of analytics, framework for data driven decision making. Descriptive Analytics: types of data measurement scales, population, sample, measures of central tendency, measures of variation, shape, data visualization techniques. Probability distributions: Random variables, Probability Density Function, Cumulative Distribution Function, PMF, Discrete distributions- binomial, Poisson, geometric distributions, Continuous distributions- uniform, exponential, normal distribution and other distributions(chi-square, t, F)

Unit-II

Hypothesis testing-I: sampling & estimation- sampling, types of sampling, sampling distribution, central limit theorem, sample size estimation, estimation of population parameters, confidence intervals- Confidence intervals for population mean, population proportion. Introduction to hypothesis testing- basics, z-test, t-test, one tailed & two-tailed tests, type-I error, type-II error.

Unit-III

Hypothesis Testing-II: Comparing two populations –two sample z-test & t-test, hypothesis test for difference in population proportion, hypothesis test for equality of population variances, chi-square test, goodness of fit test, F-test, analysis of variance(ANOVA) –multiple t-tests for comparing several means, one way ANOVA.

Unit-IV

Correlation & Regression: Introduction to correlation, correlation coefficient, correlation Vs Causation, coefficient of determination. Simple linear regression –model building, estimation of parameters using ordinary least squares, validation of regression model, multiple linear regression-ordinary least square estimation of MLR, validation, logistic regression.

Unit-V

Case studies with python or R: problems related to data visualization, hypothesis testing, ANOVA, classification and regression.

Course outcomes:

Students will be able to

1. Plot different types of data
2. Perform hypothesis testing
3. Carry out regression analysis
4. Make data driven decisions

Suggested textbooks:

1. U Dinesh Kumar, Business Analytics-The science of Data driven decision making, Wiley publications

BM0001	Managerial Economics	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives: As Economics is the bedrock of business activities, understanding the fundamentals of economics and using its knowledge in managerial decisions is important for modern managers.

UNIT-I: Introduction to Managerial Economics: Definition, Nature and Scope, Relationship with other disciplines –business decision making process-The role of managerial economist-Basic economic principles –the concept of opportunity cost, Marginalism, Equi-marginalism, incremental concept, Time perspective, discounting principle, risk and uncertainty.

UNIT-II: Theory of Demand and Supply: Demand Analysis -demand function, law of demand, determinants of demand, types of demand. Elasticity of demand, types, Measurement and significance of Elasticity of Demand. Demand Forecasting, Need for Demand Forecasting, Methods of Demand Forecasting. Supply –Supply function, determinants of supply, law of supply, Elasticity of Supply.

UNIT-III: Production and Cost Analysis: Production function, Production function with one, two variables, Cobb-Douglas Production Function, Marginal Rate of Technical Substitution, Isoquants and Isocosts , Returns to Scale, Economies of scale -Innovations and global competitiveness. Cost concepts, determinants of cost, cost-output relationship in the short run and long run, short run vs. long run costs, average cost curves.

UNIT-IV:

Market Structure and Pricing Practices: Classification of Market Structures -Features -competitive situations -Price-Output determination under Perfect competition, Monopoly, Monopolistic competition and Oligopoly -both the long run and short run.Pricing Practices-Price Discrimination- Pricing Strategies-Pricing Over Product Life Cycle-Break Even Analysis.

Unit-V

Capital Budgeting: Introduction of Capital Budgeting, Methods of Capital Budgeting.

TEXTBOOKS:

1.H L Ahuja, BusinessEconomics, S.Chand& Co, 13e, 2016.
2.Chaturvedi, Business Economics, International Book House, 2012.
3.Craig H. Petersen,W. Cris Lewis and Sudhir K. Jain,Managerial Economics,Pearson, 14e, 2014.
4.Dominick Salvatore,Managerial Economics, Oxford Publications, 7e, 2012.
5.Justin Paul, Business Environment, Tata McGraw Hill, 2010.
6.Francis Cherunilam, Business Environment Text & Cases, Himalaya Publications, 2012.

Course Outcomes: Students will be able to understand (a) Economic Principles in Business (b) Forecast Demand and Supply (c) Production and Cost Estimates (d) Market Structure and Pricing Practices (e) Economic Policies.

MC_	Environmental Sciences	3L: 0T: 0P	0 Credits

Pre-requisites	

UNIT 1: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES
Definition, scope and importance, need for public awareness.

UNIT 2: NATURAL RESOURCES:
Renewable and non-renewable resources : Natural resources and associated problems.
a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.
f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- .Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

UNIT 3: ECOSYSTEMS & BIODIVERSITY
Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.
Introduction, types, characteristic features, structure and function of the following ecosystems:-

a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem, d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
b. Biodiversity- Definition : genetic, species and ecosystem diversity. Biogeographical classification of India Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
c. Biodiversity at global, National and local levels. Inida as a mega-diversity nation Hot-sports of biodiversity.
d. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 4: ENVIRONMENTAL POLLUTION
Definition, Cause, effects and control measures of :- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards

- Solid waste Management: Causes, effect s and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- Environment Protection Act., Air (Prevention and Control of Pollution) Act. Water Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act .

UNIT 5 : SOCIAL ISSUES & THE ENVIRONMENT

Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

Field work : Visit to a local area to document t environmental assets river/ forest/grassland/hill/mountain Visit to a local polluted site-Urban/Rural/Industrial/Agricultural . Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCES :

a). Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
b). Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad- 380 013, India, Email:mapin@icenet.net (R)
c). Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
d) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
e). Cunningham, W.P. Cooper, T.H. Gorhan i, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p

CS2801	Computer Organization & Architecture Lab	0L: 0T: 4P	2 Credits

Pre-requisites	

Course Objectives:

· Teach students basic principles about computer architecture, machine language, and low level programming.

· Teach students enough assembly language to enhance their knowledge on today's most widely used microcomputer family.

· Improving students systems programming skills through programming exercises carried out by students.

· Students are expected to implement solutions to problems using the concepts they will take through the course.

Week	Name of the Program
Week 1	1. Introduction to 8086 microprocessor, Architecture of 8086.
Week 2	1. Instruction set of 8086 microprocessor.

Week 3	1. Write an ALP program by using ADD, SUB, MUL, and DIV. 2. Write an ALP program to analyze AAA, AAS. 3. Write an ALP program to check the given input number is odd or even. 4. Write an ALP program to check the given input number is prime or not.
Week 4	1. Write an ALP program to analyze AAM, AAD. 2. Write an ALP program to check the given input number is Armstrong or not. 3. Program to check the given input number is Palindrome or not. 4. Program to check the given input number is positive or negative.
Week 5	1. Write an ALP program to analyze DAA, DAS. 2. Program to check the given input number is perfect or not. 3. Program to convert a given decimal number to binary number. 4. Given n and r, compute and display nCr.
Week 6	1. Program to find the LCM of two numbers by taking input from keyboard. 2. Program to find the GCD of two numbers by taking the input from keyboard 3. Program to find the factorial of a given number. 4. Program to print the Fibonacci series for given input number (EX: Input 5, print 0,1,1,2,3)
Week 7	1. Program to find the square root of given number. 2. Program to find the sum of digits in a given number. 3. Program to find the square and cube of a given number. 4. Write a program to display prime numbers between two given numbers
Week 8	1. Study of TSR.
Week 9	1. Variables of TSRs. 2. Functioning of the Keyboard. 3. How the Printer Works.
Week 10	1. TSR to write-Protect the Hard Disk. 2. Interrupt 0*21 – A Gateway to the DOS Kingdom.
Week 11	1. . A Pop-up calendar. 2. Copying Files Through a TSR.

Week 12	1. A TSR to Display Directory. 2. A Screen Saver TSR.

Course Outcomes: This course concentrates on the practical part of Computer Organization by using Assembly language. This course allows students to practice writing programs based on the concepts the will learn through the course by giving the students different types of problems to be solved using an emulator.

CS2802	**Database Management Systems Lab**	**0L: 0T: 4P**	**2 Credits**

Pre-requisites	

Course Objectives:

- This lab enables the students to practice the concepts learnt in the subject DBMS by developing a database.
- The student is expected to practice the designing, developing and querying a database.
- Students are expected to use "Mysql/Oracle" database.

Case Studies

1. university database
2. online ticket booking system
3. library management systems

Week 1: E-R Model

Analyze the problem carefully and Identify the entities, attributes etc. Identify the primary keys for all the entities. Identify the other keys like candidate keys, partial keys

Concept design with E-R Model

Relate the entities appropriately. Apply cardinalities for each relationship. Identify strong entities and weak entities (if any). Indicate the type of relationships (total / partial). Try to incorporate generalization, aggregation, specialization etc wherever required.

Weak 2**: DDL and DML commands**

In this week you are going to practice DDL commands, DML commands, Constraints and Data Query Language

Week 3: SQL Special operators

In this week you are going to practice Convert ER Diagrams into tables and SQL Special operators like, (in between, is null, not, exist, not Exists ANY, ALL, IN, set operators, Constraints etc.

Week 4: Aggregate functions

You are going to practice queries using Aggregate functions (COUNT, SUM, AVG, and MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.

Week 5: Functions

In this week you are going to practice queries on String/Character,Date/Time Functions,Numeric Functions,Math Functions.

Week 6: SQL Joins

In this week you are going to practice queries on different Joins in SQL

Week 7: Sub Queries

In this week you are going to practice queries on Nested Queries, Correlated Sub Queries.

Week 8: DCL and TCL commands

In this week you are going to practice queries on DCL Commands, TCL Commands

Week 9: Sequences and views

In this week you are going to practice queries onCreate sequences and views, Top N Analysis.

Week 10: Triggers

In this week you are going to work on Triggers. Creation of insert trigger, delete trigger, update trigger. Practice triggers using the above database.

Week 11: Procedures

In this session you are going to learn Creation of stored procedure, Execution of procedure and modification of procedure.

Week 12: Cursors

In this week you need to do the following: Declare a cursor that defines a result set. Open the cursor to establish the result set. Fetch the data into local variables as needed from the cursor, one row at a time. Close the cursor when done

Course Outcomes:

- Ability to design and implement a database schema for given problem.
- Apply the normalization techniques for development of application software to realistic problems.
- Ability to formulate queries using SQL DML/DDL/DCL commands.

Suggested References:

1. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education
2. Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

CS2803	Design and Analysis of Algorithms Lab	0L: 0T: 4P	2 Credits

Pre-requisites	

Detailed Contents:

All the problems have to be implemented either writing C programs or writing C++ programs.

Elementary Problems:

1. Using a stack of characters, convert an infix string to a postfix string.
2. implement polynomial addition using a single linked list
3. Implement insertion, deletion, searching of a BST, Also write a routine to draw the BST horizontally.
4. Implement binary search and linear search in a program
5. Implement heap sort using a max heap.
6. Implement DFS/ BFS routine in a connected graph

7. Implement Dijkstra's shortest path algorithm using BFS
8. Greedy Algorithm (Any Two)
    i. Given a set of weights, form a Huffman tree from the weight and also find oot the code corresponding to each weight.
    ii. Take a weighted graph as an input, find out one MST using Kruskal/ prim's algorithm
    iii. Given a set of weight and an upper bound M – Find out a solution to the Knapsack problem
9. Divide and Conquer Algorithm (any Two)
    i. Write a quick sort routine, run it for a different input sizes and calculate the time of running. Plot in graph paper input size verses time.
    ii. Implement two way merge sort and calculate the time of sorting
    iii. Implement Strasseem's matrix multiplication algorithm for matrices whose order is a power of two.
10. Dynamic programming
    i. Given two sequences of character, find out their longest common subsequence using dynamic programming

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CS3101	Operating Systems	3L:0T:0P	3 Credits

Pre-requisites	

Objectives:
To learn the fundamentals of Operating Systems.
1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management

Syllabus:

Unit 1: Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS – Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.

Unit 2: Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching
Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,
Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR

Unit 3: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\
Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing,
Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.
Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Unit 4: Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–
Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Unit 5: I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software,
Secondary-Storage Structure: Disk structure, Disk scheduling algorithms
File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation

(linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Suggested books:
1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Suggested reference books:
1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Outcomes:
1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
4. Design and implement file management system.
5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

CS3102	**Object Oriented Programming**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	CS2101

Objectives:

- The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.
- To understand Object oriented programming concepts, and apply them in Problem solving.
- To learn the basics of Java Console and GUI based programming

Detailed Contents:
UNIT-1:

Introduction to OOPS: Paradigms of Programming Languages, Basic concepts of Object Oriented Programming, Differences between Procedure Oriented Programming and Object Oriented Programming, Objects and Classes, Data abstraction and Encapsulation, Inheritance, Polymorphism, benefits of OOP , application of OOPs.
Java : History, Java features, Java Environment, JDK, API.
Introduction to Java : Types of java program, Creating and Executing a Java program, Java Tokens, Keywords, Character set, Identifiers, Literals, Separator, Java Virtual Machine (JVM), Command Line Arguments, Comments in Java program.

UNIT -2:
Elements: Constants, Variables, Data types, Scope of variables, Type casting, Operators: Arithmetic, Logical, Bit wise operator, Increment and Decrement, Relational, Assignment, Conditional, Special operator, Expressions – Evaluation of Expressions
Decision making and Branching: Simple if statement, if, else statement, Nesting if, else, else if Ladder, switch statement, Decision making and Looping: While loop, do-While loop, for loop, break, labelled loop, continue Statement, Simple programs
Arrays: One Dimensional Array, Creating an array, Array processing, Multidimensional Array, Vectors, Wrapper classes, Simple programs

UNIT-3:
Strings: Exploring String class, String Class Methods, String Buffer Class, Simple programs
Class and objects: Defining a class, Methods, Creating objects, Accessing class members, Constructors, Static members, Nesting of Methods, this keyword, Command line input.
Polymorphism – Static Polymorphism, Dynamic Polymorphism, Method overloading, Polymorphism with Static Methods, Private Methods and Final Methods.
Inheritance: Defining a sub class, Deriving a sub class, Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Overriding methods, Final variables and methods, Final classes, Finalizer methods, Abstract methods and classes, Visibility Control: Public access, Private access, default and protected. Abstract classes.
Interfaces - Interfaces vs Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interfaces. Inner classes **-** uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples.

UNIT- 4:
Packages: Java API Packages, System Packages, Naming Conventions, Creating & Accessing a Package, Adding Class to a Package, Hiding Classes, Programs
Exception Handling: Limitations of Error handling, Advantages of Exception Handling, Types of Errors, Basics of Exception Handling, try blocks, throwing an exception, catching an exception, finally statement
Multi threading: Creating Threads, Life of a Thread, Defining & Running Thread, Thread Methods, Thread Priority, Synchronization, Implementing runnable interface, Thread scheduling.
I/O Streams: File, Streams, Advantages, The stream classes, Byte streams, Character streams.
JDBC, ODBC Drivers, JDBC ODBC Bridges, Seven Steps to JDBC, Importing java SQL Packages, Loading & Registering the drivers, Establishing connection. Creating & Executing the statement.

UNIT-5:

AWT Components and Event Handlers: Abstract window tool kit, Event Handlers, Event Listeners, AWT Controls and Event Handling: Labels, TextComponent, ActionEvent, Buttons, CheckBoxes, ItemEvent, Choice, Scrollbars, Layout Managers- Input Events, Menus, Programs
Design patterns - Introduction to Creational design patterns, Structural design patterns and Behavioral design patterns.
GUI Programming with Java - Introduction to Swing, limitations of AWT, Swing vs AWT, MVC architecture, Hierarchy for Swing components, Containers - JFrame, JApplet, JDialog, Jpanel. Overview of some swing components Jbutton, JLabel, JTextField, JtextArea, simple swingapplications.

TEXT BOOKS:
1. Java the complete reference, 7 th edition, Herbert Schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.

REFERENCE BOOKS:
1. An Introduction to programming and OO Design using Java, J.Nino and F.A. Hosch, John wiley & Sons.
2. Introduction to Java Programming, Y. Daniel Liang, Pearson Education
3. An Introduction to Java programming and Object Oriented Application Development, R.A. Johnson-Thomson
4. Programming with Java - E. Balagurusamy
5. Object oriented Programming in Java - Dr. G.Thampi
6. Let us Java – Yashavant Kanetkar - BPB Publications, New Delhi - First Edition 2012
7. Core Java, An Integrated Approach, Dr. R. Nageswara Rao
8. An Introduction to Oops with Java - C Thomas WU - TataMc-Graw Hill, New Delhi - 4th Edition
9. Object oriented Programming through Java - ISRD Group - TataMc-Graw Hill, New Delhi - Eight Reprint 2011

Outcomes:
After taking the course, students will be able to:
- Specify simple abstract data types and design implementations, using abstraction functions to document them.
- Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
- Name and apply some common object-oriented design patterns and give examples of their use.
  Design applications with an event-driven graphical user interface.

CS3103	**Formal Language & Automata Theory**	**3L:0T:0P**	**3 Credits**

Pre-requisites	

Course Objectives:
1. Develop a formal notation for strings, languages and machines.

2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Push Down Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Detailed Contents:

Module 1:

Introduction: Alphabet, Languages and grammars, productions and derivations, Chomsky hierarchy of languages. Regular Languages and finite automaton: Regular Expressions and languages, deterministic finite automaton and Equivalence with regular expressions, Non deterministic finite automaton (NFA) and Equivalence with DFA.

Module 2:

Regular languages: regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.

Context free languages: Context free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, pumping lemma for context free languages, parse trees, ambiguity in CFG, closure properties of CFLs.

Module 3:

Pushdown automata: Deterministic Push down automata (PDA), non deterministic Push down automata (PDA) and equivalence with CFG. Context sensitive languages, Context sensitive grammars

Module 4:

Turing Machine: Basic model for TM, Turing recognizable (recursively enumerable) and Turing-decidable(recursive) languages and their closure properties, variants of **Turing Machines**, Non deterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with TMs, TMs as enumerators.

Module5:

Undicidability: Church-Turing thesis, universal turing machine, the universal and diagnolization languages, reduction between languages and rice's theorem, undecidable problems about languages.

Suggested Books:

1. John E Hopcroft and Jeffrey D Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson education Asia.

Suggested Reference Books:

1. Harry R Lewis and Christos H Papadimitriou, Elements of the Theory of Computation Pearson education Asia.
2. Dexter C Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser Introduction to the Theory of Computation, PWS publishing.
4. John Martin ,Introduction to Languages and The Theory of Computation, Tata McGraw Hill

Course Outcomes:

1. Write a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. For a given language determine whether the given language is regular or not.
4. Design context free grammars to generate strings of context free language.
5. Determine equivalence of languages accepted by Push down Automata and languages generated by context free grammars.
6. Write the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

CS	Artificial Intelligence(Elective-IV)	3L: 0T: 0P	3 Credits

Pre-requisites	

ARTIFICIAL INTELLIGENCE

Course Objectives

1. Student should be able to get the notion of Natural and Artificial Intelligence
2. Student should be able to get the idea of artificial intelligence problems
3. To introduce students to the basic concepts and techniques of Machine Learning.
4. Student should be able to understand the working of an artificial neural network

Syllabus

UNIT-I

Introduction - AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, Constraint Satisfaction Problems, problem solving agents, problem formulation. Searching - Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Greedy best first search, A* search

UNIT – II

Game Playing: Adversial search, Games, minmax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, cutting of search. Knowledge Representation & Reasons logical Agents, Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propositional logic, Resolution, Forward & Backward. Chaining, First order logic, Resolution

UNIT – III

Learning –Types of Machine Learning –Supervised Learning –The Brain and the Neuron –Design a Learning System –Perspectives and Issues in Machine Learning –Concept Learning Task –Concept Learning as Search –Finding a Maximally Specific Hypothesis –Version Spaces and the Candidate Elimination Algorithm –Linear Discriminants –Perceptron –Linear Separability –Linear Regression.

UNIT IV

Linear Models: Multi-layer Perceptron –Going Forwards –Going Backwards: Back Propagation Error –Multi-layer Perceptron in Practice –Examples of using the MLP –Overview –Deriving Back-Propagation –Radial Basis Functions and Splines –Concepts –RBF Network –Curse of Dimensionality –Interpolations and Basis Functions –Support Vector Machines

UNIT – V

Artificial Neural Networks: Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units.

TextBooks:

1 Artificial Intelligence – A Modern Approach. Third Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education.

2 Stephen Marsland, ―Machine Learning –An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

3 Artificial Neural Networks, B. YagnaNarayana

References

1. Simon Haykin- Neural Networks, Pearsons education asia (2001), II edition.

Course Outcomes

1. Student will be able to get the idea of natural and artificial intelligence
2. Student will be able to formulate and identify some solutions for artificial intelligence problems
3. Distinguish between, supervised, unsupervised and semi-supervised learning
4. Student will be able to understand how neural networks work to solve AI problems

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EC3106	**Signals and Systems**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives: This course introduces

- Concepts of signals and systems and their characteristics
- Various mathematical tools like Fourier, Laplace and z- transforms to analyze an LTI systems

Syllabus:

UNIT I: Introduction to Signals and Systems (6 hours):
Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals,continuousanddiscreteamplitudesignals.Systemproperties:linearity:additivityand homogeneity, shift-invariance, causality, stability, realizability.Examples.

UNIT II: Behavior of continuous and discrete-time LTI systems (8 hours)
Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTIsystems.Systemrepresentationthroughdifferentialequationsanddifferenceequations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notionofafrequencyresponseand itsrelationtothe impulseresponse.

UNIT III: Fourier Transforms(8 hours)
Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

UNIT IV: Laplace and z-Transforms (10 Hrs)
ReviewoftheLaplaceTransformforcontinuoustimesignalsandsystems,system functions,polesandzerosofsystemfunctionsandsignals,Laplacedomainanalysis,solution todifferentialequationsandsystembehavior.Thez-Transformfor discretetimesignalsand systems,systemfunctions,polesandzerosofsystemsandsequences,z-domainanalysis.

UNIT V: Sampling and Reconstruction (6 hours)
The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: idealinterpolator,zero-orderhold,first-orderhold.Aliasinganditseffects.Relationbetween continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback controlsystems.

Text/References:

1. A.V.Oppenheim,A.S. WillskyandS.H.Nawab,“Signalsand systems”,PrenticeHall India,1997.
2. J. G. Proakis and D. G. Manolakis, “ Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson,2006.
3. H. P. Hsu, “ Signalsand systems” , Schaum’sseries, McGraw Hill Education,2010.
4. S. Haykinand B. V. Veen, “ Signalsand Systems” , John Wiley and Sons,2007.
5. A. V. Oppenheim and R. W. Schafer, “ Discrete-Time Signal Processing” , Prentice Hall,2009.
6. M. J. Robert “ Fundamentalsof Signals and Systems”, McGraw Hill Education, 2007.

7. B. P. Lathi, " LinearSystems and Signals" , Oxford University Press,2009.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the concepts of continuous time and discrete time systems.
- Analyse systems in complex frequency domain.
- Understand sampling theorem and its implications.

BM0002	**Humanities-II (Principles of Marketing)**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objective: To understand the basic marketing concepts and its applications in markets.

1. **Marketing Introduction: (6)**
    a. Definition, concept of marketing
    b. Philosophies
    c. Market process
    d. Marketing environment- Micro and Macro
    e. Analyze the marketing opportunities
2. **Buying Behavior: (4)**
    a. Buyer Black box model,
    b. Factors affecting consumer buying behavior.
3. **Market Strategy (5)**
    a. Market Segmentation (Consumer markets)
    b. Targeting
    c. Positioning
4. **Product (5)**
    a. What is Product?
    b. Product classification
    c. Branding, labeling, and Packaging
    d. Product Mix
    e. NPD & PLC
5. **Pricing (4)**
    a. Pricing concepts
    b. General approaches to pricing
    c. Factors considering while setting price
6. **Place (4)**
    a. Distribution channels
    b. Channel behavior and conflict
    c. Channel design decisions
    d. Retailing and wholesaling
7. **Promotion (8)**
    a. Sales promotion
    b. Advertising
    c. Personal selling
    d. Public relations

Case studies are discussed wherever applicable.

Suggested Readings:

1. Philip Kotler, Gray Armstrong, Principles of Marketing, 15e, Pearson Education, 2016.
2. Lamb, Hair, Sharma, Mc Daniel, Principles of Marketing, A South Asian Perspective Cengag Learning, 2016.
3. Paul Baines, Chris Fill, Kelly Page, Piyush Sinha, Marketing, Asian Edition, Oxford University· Press, 2015.
4. Arun Kumar & N. Meenakshi, Marketing Management , Vikas, 2012
5. Rajan Saxena, Marketing Management, 3e, Tata Mc Graw Hill, 2012
6. Kenneth E Clow, Donald Baack, Cases in Marketing Management, Sage South Asia edition,· 2012.

HS3101	Soft Skills	2L: 0T: 0P	0 Credits

Pre-requisites	

Course Objectives:

1. To enable students speak effectively in formal and informal situations
2. To equip the students with necessary writing skills in order to face the corporate world
3. To strengthen the writing skills of the students and help them in documentation
4. To enable students sharpen their communication skills towards writing a persuasive resume and effective job application letters
5. To equip students with pre-presentation steps, to understand the structure of a good presentation, and devise various techniques for delivering a successful presentation
6. To make students understand the importance of team work and group presentations and group discussions

Detailed Contents:

Module 1:

Activities on Fundamentals of Inter-personal Communication: Starting a conversation-responding appropriately and relevantly - using the right body language-Role Play in different situations & Discourse Skills using visuals.

Module 2:

Activities on Reading Comprehension: General Vs Local comprehension- reading for facts-guessing meanings from context- scanning-skimming- inferring meaning-critical reading-effective goggling.

Module 3:

Activities on Writing Skills: Structure and presentation of different types of writing-Resume writing/e-correspondence/Technical report writing-planning for writing-improving one's writing.

Module 4:

Activities on Presentation Skills: Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations.

Module 5:

Activities on Group Discussion and Interview Skills: Dynamics of group discussion-intervention-summarizing-modulation of voice-body language-relevance-fluency and organization of ideas and rubrics for evaluation-Concept and process-pre-interview planning-opening strategies-answering strategies-interview through tele-conference & video-conferencing-Mock Interviews.

Suggested Reference Books:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication by Paul V. Anderson , 2007. Cengage Learning pvt. Ltd. New Delhi.
4. Business and Professional Communication: Keys for Workplace Excellence, Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications, 2011.
5. The Basics of Communication: A Relational Prespective, Stev Duck & David T. Mc Mahan. Sage South Asia Edition. Sage Publications, 2012.
6. English Vocabulary in Use series, Cambridge University Press 2008.
7. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley, 2012. Cengage Learning.
8. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
9. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.

Course Outcomes: Students will be able to

1. Communicate effectively in formal and informal situations
2. Understand the structure and mechanics of writing resumes, reports, documents and e-mails
3. Present effectively in academic and professional contexts
4. Develop communication in writing for a variety of purposes
5. Identify areas of evaluation in Group Discussions conducted by organizations as part of the selection procedure
6. Overcome stage fear and tackle questions

CS3701	**Operating Systems Lab**	**0L: 0T: 4P**	**2 Credits**

Pre-requisites	

OBJECTIVE:

1. To understand and implement basic services and functionalities of the operating system using system calls.
2. To use modern operating system calls and synchronization libraries in software/ hardware interfaces.
3. To understand the benefits of thread over process and implement synchronized programs using multithreading concepts.

4. To Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
5. To implement memory management schemes and page replacement schemes.
6. To simulate file allocation and organization techniques.
7. To understand the concepts of deadlock in operating systems and implement them in multiprogramming system

Week	Name of the Program
Week 1	**Execute the following UNIX command** PWD, CD, MKDIR, RMDIR, LS, CP, MV, RM, CHMOD, MAN, CAT, WHO, MORE Assignment: Explain each command with examples and option for all above mentioned commands.
Week 2	**Execute the following UNIX command** TEE, PIPE, HEAD, TAIL, CUT, PASTE, DIFF, COMM, GREP, ECHO, ETC… Assignment: Explain each command with examples and option for all the week 2 commands.
Week 3	Write a C program to simulate the following non-preemptive CPU Scheduling algorithms to find turnaround time, waiting time, average turnaround time and average waiting time. a) FCFS b) SJF Assignment: Write a C program to simulate the following preemptive CPU Scheduling algorithms to find turnaround time, waiting time, average turnaround time and average waiting time. a) FCFS b) SRTF
Week 4	Write a C program to simulate the following non-preemptive CPU Scheduling algorithms to find turnaround time and waiting time, average turnaround time and average waiting time. c) Round Robin (pre-emptive) d) Priority Assignment: Write a C program to implement round robin CPU scheduling algorithm for the following given scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Consider the time quantum size for the system processes and user processes to be 5 msec and 2 msec respectively
Week 5	Write a C program to simulate multi level queue scheduling algorithm.

	Assignment: Write a C program to simulate MFT memory management Scheme with unequal sized partitions
Week 6	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit Assignment: Write a C program to implement compaction technique
Week 7	Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) Optimal
Week 8	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical Assignment: Write a C program to simulate a two-level index scheme for file allocation?
Week 9	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance. Assignment: Write a C program to simulate readers-writers problem using monitors.
Week 10	Write a C program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN
Week 11	Write a C program to implement Dining philosophers problem

OUTCOMES:

- Upon the completion of Operating Systems practical course, the student will be able to gain practical experience with designing and implementing concepts of operating systems such as system calls, CPU scheduling, process management, memory management, file systems and deadlock handling, using C language in Linux environment.

CS3702	**Object Oriented Programming Lab**	**0L: 0T: 4P**	**2 Credits**

Pre-requisites	

OBJECTIVES:

- To model a object oriented programming using abstract data types, encapsulation, inheritance and polymorphism
- Practical exposure in Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
- How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.
- How to test, document and prepare a professional looking package for each business project using javadoc.

Detailed Contents:

Week-I

1. Write a Java program print "Hello World"
2. Write a Java program that prints all real and imaginary solutions to the quadratic equation ax2 + bx + c = 0. Read in a, b, c and use the quadratic formula
3. Write a Java program to implement calculator operations
4. Write a java program to find prime factors of given number
5. Write a java program to find whether given number is Palindrome or not
6. Write an application that declares 5 integers, determines and prints the largest and smallest in the group.

Week-II

1. Write a Java program to sort given list of numbers.
2. Write a Java program to implement linear search.
3. Write a Java program to implement binary search.
4. Write a java program to add two given matrices.
5. Write a java program to multiply two given matrices.
6. Write a java program for sorting a given list of names.
7. Write a Java program to give an example for command line arguments.

Week-III

1. Write a program to display details of the required employee based on his Id. The details of employee includes, Emp_name, Emp_age, Emp_gender, Emp_designation, Emp_salary, Emp_Address etc.,
2. A mail-order house sells five products whose retail prices are as follows : Product 1 : Rs. 99.90 , Product 2 : Rs. 20.20 , Product 3 : Rs. 6.87 , Product 4 : Rs. 45.50 and Product 5 : Rs. 40.49 . Each product has Prdouct_Id, Product_Name, Product_Quantity, Product_Price. Write an application that reads a series of pairs of numbers as follows :

a) product Id

b) quantity sold your program use a switch statement to determine the retail price for each product. it should calculate and display the total retail value of all products sold.

3. Write java program that inputs 5 numbers, each between 10 and 100 inclusive. As each number is read display it only if it's not a duplicate of any number already read display the complete set of unique values input after the user enters each new value
4. Write a java program : rolling a pair of dices 10 times [each attempt should be delayed by 10000 ms] and count number Successful attempts. successful attempt : If the pair of Dice results in same values.
5. Implement the following case study using OOP concepts in Java. E-Book stall : Every book has Properties which includes : Book _Name, Book_Author, Book_Count ; Every Customer is having properties as : Customer_Id, Customer_Name, Customer_Address and he can buy

Books from E-Book stall. Write a Program which will display the text book name and the remaining count of text books when a customer buys a text book.

Week-IV

1. Write an application that uses String method compareTo to compare two strings defined by the user.
2. Write an application that uses String method equals and equalsIgnoreCase to tests any two string objects for equality.
3. Write an application that uses String method indexOf to determine the total number of occurrences of any given alphabet in a defined text.
4. Write an application that uses String method concat to concatenate two defined strings.
5. Write a Java program to print all vowels in given string and count number of vowels and consonants present in given string
6. Write an application that finds the length of a given string.
7. Write an application that uses String method charAt to reverse the string.
8. Write an application that finds the substring from any given string using substring method and startsWith & endsWith methods.
9. Write an application that changes any given string with uppercase letters, displays it, changes it back to lowercase letters and displays it.

Week-V

1. Write a Java Program to implement Wrapper classes and their methods.
2. Write an application that prompts the user for the radius of a circle and uses a method called circleArea to calculate the area of the circle and uses a method circlePerimeter to calculate the perimeter of the circle.
3. Write a JAVA program for the following a. Call by value b. Call by object
4. Create a class Account with an instance variable balance (double). It should contain a constructor that initializes the balance, ensure that the initial balance is greater than 0.0. Acct details: Acct_Name, Acct_acctno, Acct_Bal, Acct_Address.

Create two methods namely credit and debit, getBalance. The Credit adds the amount (passed as parameter) to balance and does not return any data. Debit method withdraws money from an Account. GetBalance displays the amount. Ensure that the debit amount does not exceed the Account's balance. In that case the balance should be left unchanged and the method should print a message indicating "Debit amount exceeded account balance".

5. Write Java program for the following

a. Example for this operator and the use of this keyword.
b. Example for super keyword.
c. Example for static variables and methods.

Week-VI

1. Write a Java program to find Area and Circle of different shapes using polymorphism concept
2. Write a Java program which can give example of Method overloading and overriding
3. Write an application to create a super class Employee with information first name & last name and methods getFirstName(), getLastName() derive the sub-classes ContractEmployee and RegularEmployee with the information about department, designation & method displayFullName() , getDepartment(), getDesig() to print the salary and to set department name & designation of the corresponding sub-class objects respectively.
4. Derive sub-classes of ContractEmployee namely HourlyEmployee & WeeklyEmployee with information number of hours & wages per hour, number of weeks & wages per week respectively & method calculateWages() to calculate their monthly salary. Also override getDesig () method depending on the type of contract employee.
5. Write an application to create a super class Vehicle with information vehicle number,insurance number,color and methods getConsumption() displayConsumption(). Derive the sub-classes

TwoWheeler and FourWheeler with method maintenance() and average() to print the maintenance And average of vehicle.

6. Extend the above TwoWheeler class with methods getType() and getName() which gives the information about the type and the name of the company.Create sub-classes Geared and NonGeared with method average() to print the average of a geared and non-geared two wheeler.

Week-VII

1. Create an abstract class Shape which calculate the area and volume of 2-d and 3-d shapes with methods getArea() and getVolume(). Reuse this class to calculate the area and volume of square ,circle ,cube and sphere.

2. Create an abstract class Employee with methods getAmount() which displays the amount paid to employee. Reuse this class to calculate the amount to be paid to WeeklyEmployeed and HourlyEmployee according to no. of hours and total hours for HourlyEmployee and no. of weeks and total weeks for WeeklyEmployee.

3. Create an Interface payable with method getAmount ().Calculate the amount to be paid to Invoice and Employee by implementing Interface.

4. Create an Interface Vehicle with method getColor(),getNumber(), getConsumption() calculate the fuel consumed, name and color for TwoWheeler and Four Wheeler By implementing interface Vehicle.

5. Create an Interface Fare with method getAmount() to get the amount paid for fare of travelling. Calculate the fare paid by bus and train implementing interface Fare.

6. Create an Interface StudentFee with method getAmount(),getFirstName(),getLastName(), getAddress(), getContact(). Calculate the amount paid by the Hostler and NonHostler student by implementing interface Student Fee

Week-VIII

1. Write a Program to create your own package. Package should have more than two classes. write a Program that uses the classes from the package.

2. Create a package named org.shapes. Create some classes in the package representing some common geometric shapes like Square, Triangle, Circle and so on. write a Program that uses the classes from the package.

3. Write a Java program to create package called dept. Create four classes as CSE, ECE, ME and CE add methods in each class which can display subject names of your respect year. access this package classes from main class

4. Write a Calculator program : Include all calculator operations in as classes in a Package “Calculator” and import in to main class.

5. Write a program for the following

a. Example to use interfaces in Packages. b. Example to create sub package in a package.

Week-IX

1. Program for demonstrating the use of throw, throws & finally - Create a class with a main( ) that throws an object of class Exception inside a try block. Give the constructor for Exception a String argument. Catch the exception inside a catch clause and print the String argument. Add a finally clause and print a message to prove you were there.

2. Write a program that shows that the order of the catch blocks is important. If you try to catch a superclass exception type before a subclass type, the compiler should generate errors.

3. Write a program to rethrow an exception – Define methods one() & two(). Method two() should initially throw an exception. Method one() should call two(), catch the exception and rethrow it Call one() from main() and catch the rethrown

4. Exception Handling program for ClassNotFoundException--thrown if a program can not find a class it depends at runtime (i.e., the class's ".class" file cannot be found or was removed from the CLASSPATH).

5. Exception Handling program for NumberFormatException--thrown if a program is attempting to convert a string to a numerical datatype, and the string contains inappropriate characters (i.e. 'z' or 'Q').
6. Create your own exception class using the extends keyword. Write a constructor for this class that takes a String argument and stores it inside the object with a String reference. Write a method that prints out the stored String. Create a try- catch clause to exercise your new exception.

Week-IX

1. Write a program to create MyThread class with run() method and then attach a thread to this MyThread class object.
2. Write a program where the consumr thread checks the data production status [is over or not] for every 10 ms.
3. Write a Program using Threads to simulate a traffic light. The Signal lights should glow after each 10 second, one by one. For example: Firstly Red, then after 10 seconds, red will be put to off and yellow will start glowing and then accordingly green.
4. Write a Program using Threads for the following case study: Movie Theatre To watch a movie the following process is to be followed, at first get the ticket then show the ticket. Assume that N persons are trying to enter the Theatre hall all at once, display their seuence of entry into theater. Note: The person should enter only after getting a ticket and showing it to the boy.
5. Write a Program using Threads for the following case study: Train Reservation system To reserve a berth the following process need to be followed, at first check the number of available berths with the requested berths, if the number of requested berths are less than or equal to availabe berths then allot berth and print ticket or else display no berths are available. Assume that N persons are trying to reserve the berth, display their sequence of reservation status along with the number of available berths. Note : The person can print ticket only if berth is confirmed.

Week-X

1. Write a program for the following a. display a frame with title MyFrame b. draw a horizontal line. c. Draw one line perpendicular to other. One line parallel to other.
2. Create an application to display a circle within rectangle and fill different colors in the circle & rectangle
3. Write an application that displays any string. Choose color from combo box to change the color of this displayed string and choose its size & type respectively from another two combo boxes.
4. Write a small application with a default date 01/01/2000 and three combo boxes displaying valid days, months & year (1990 – 2050). Change the displayed date with the one chosen by user from these combo boxes.
5. Create a GUI with title STUDENT which has labels roll no., name, course, gender, class, address with textboxes for taking input from the user(without any functionality) and checkboxes for selecting the course, radio buttons for selecting gender with appropriate background color.
6. Create a GUI application to display a calculator using grid Layout (You do not have to provide functionality).

Week-XI

1. Write a program to create a frame by creating an object to Jframe class and include close button to terminate the application of the frame.
2. Write program for the following.

a. Display text in the frame by overriding PaintComponent() method of Jpanel class.
b. Display some text in the frame with the help of a Label.

3. Write a program to create a push button , when the button is clicked an image is displayed in the frame.
4. Write a program to create a menu with several menu items.
5. Create an application Form for University Enroll ment with the following Fields.

a. Check box b. Text area c. List box d. Display text e. Push buttons f. Combo box. g. Radio buttons. h. Back ground color

Week-XII

1. Write a program to insert data into Student Table.
2. Write a program to retrieve the data from the table Student.
3. Create a Form to insert and retrieve the data from Database as user prefer.
4. Write a program to store an Image and retrieve an image from Database
5. Write a program to Store and retrieve file content from the Data base.

OUTCOMES:

CO 1: Be able to analyze and design a computer program to solve real world problems based on object-oriented principles.

CO 2: Be able to write simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles.

CO 3: A competence to design, write, compile, test and execute straightforward programs using a high level language.

CO 4: Demonstrate the ability to employ various types of selection constructs in a Java program. Be able to employ a hierarchy of Java classes to provide a solution to a given set of requirements.

CO 5: Become familiar with the fundamentals and to acquire programming skills in the Java language.

B.TECH (CSE) III YEAR II-SEM

CS3201	**Compiler Design**	**3L:0T:0P**	**3 Credits**

Pre-requisites	CS3103

Course Objectives:

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis.
3. Design top-down and bottom-up parsers.
4. Identify synthesized and inherited attributes.
5. Develop syntax directed translation schemes.
6. Develop algorithms to generate code for a target machine

Detailed Contents:

UNIT-I:

Introduction – Language Processors, Structure of a compiler- phases of compiler design and overview. Applications of compiler Technology, Lexical analysis: The role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical errors, error recovery in lexical analysis phase, The Lexical-Analyzer Generator Lex.

UNIT-II:

Syntax Analysis – Introduction, Context Free Grammars, Top-Down parsing: Brute Forcing, Recursive Descent parsing, LL (1) parsing, Bottom-Up parsing : Shift reduce parsing, conflicts during shift reduce parsing, Introduction to LR Parsing: LR(0), simple LR, powerful LR parsers: CLR, LALR, conflicts, Parser Generators – Yacc. Error Recovery: Introduction, Error detecting and Reporting, Syntax Errors handling.

UNIT-III:

Semantic Analysis – Introduction, semantic errors, attribute grammars
Syntax Directed Translation – Syntax Directed Definitions, Evaluation Orders for SDDs. Applications of Syntax Directed Translation. Symbol Table Organization - Structure of Symbol table, Symbol Table organization, Data Structures of symbol Table, representation of scope.

UNIT-IV:

Intermediate code generation – Variants of syntax trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Back patching.
Run time Environment – storage organization, Stack allocation of space, activation records, and Access to non local data.

UNIT-V:

Code Generation – Issues in the Design of a Code Generator, the Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks. Peephole Optimization, Register Allocation and Assignment, Instruction Scheduling. Machine Independent Optimizations – The Principal Sources of Optimizations, Introduction to data flow analysis.

Suggested books:

1. Compilers: Principles, Techniques, and Tools , by A.V. Aho, Monica Lam, Ravi Sethi, and J.D. Ullman, (2nd ed.), Addison-Wesley, 2007 (main text book, referred to as ALSU in lab assignments).
2. K.D. Cooper, and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2004.

Suggested reference books:

1. K.C. Louden, Compiler Construction: Principles and Practice, Cengage Learning, 1997.
2. D. Brown, J. Levine, and T. Mason, LEX and YACC, O ‟Reilly Media, 1992.

Course Outcomes:

1. For a given grammar specifications develop the lexical analyzer.
2. For a given parser specification design top-down and bottom-up parsers.
3. Develop syntax directed translation schemes.
4. Develop algorithms to generate code for a target machine.

CS3202	Computer Networks	3L:0T:0P	3 Credits

Pre-requisites	CS2201, CS3101

Objectives:

1. To Introduce The Fundamental Various Types Of Computer Networks.
2. To Demonstrate The TCP/IP And OSI Models With Merits And Demerits.
3. To Introduce UDP And TCP Models.

Detailed Contents:

UNIT - I:

Introduction- Hardware And Software, Data Communication, Networking, Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet History Standards And Administration; Comparioson Of The OSI And TCP/IP Reference Model, Digital And Analog Data And Signals.

Physical Layer: Guided Transmission Media, Wireless Transmission Media.

Data Link Layer: Design Issues, CRC Codes, Elementary Data Link Layer Protocols, Sliding Window Protocol, Flow Control. Error Detection And Error Control. HDLC And other Data Link Protocols.

UNIT - II:

Band Width Utilization: Multiplexing – Frequency-Division, Synchronous Time-Division, And Statistical Time-Division Multiplexing.

Multi Access Protocols: ALOHA, CSMA, Collision Free Protocols, Ethernet- Physical Layer, Ethernet Mac Sub Layer, Data Link Layer Switching & Use Of Bridges, Learning Bridges, Spanning Tree Bridges, Repeaters, Hubs, Bridges, Switches, Routers And Gateways.

UNIT-III:

Network Layer: Network Layer Design Issues, Store And Forward Packet Switching Connection Less And Connection Oriented Networks-Routing Algorithms-Optimality Principle, Shortest Path, Flooding, Distance Vector Routing, Control To Infinity Problem, Hierarchical Routing, Congestion Control Algorithms, Admission Control.

UNIT-IV:

Internetworking: Tunneling, Internetwork Routing, Packet Fragmentation, Ipv4, Ipv6 Protocol, IP Addresses, CIDR, IMCP, BOOTP, ARP, RARP, DHCP, Network Address Translation(NAT) Internetworking

Transport Layer: TCP Introduction, Reliable/Un- Reliable Transport ,Connection Establishment, Connection Release, Crash Recovery, Intra-Domain Routing: Distance-Vector, Intra-Domain Routing: Link- State, Wireless Networks: 802.11 MAC, Efficiency Considerations

UNIT-V:

The Internet Transport Protocols: UDP-RPC, Real Time Transport Protocols, The Internet Transport Protocols- Introduction To TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The Future Of TCP.

Application Layer: Introduction, Providing Services, Applications Layer Paradigms, Client Server Model, Standard Client-Server Application-HTTP, FTP, Electronic Mail, TELNET, DNS, SSH,SNMP,WWW.

Text Books:

1.Computer Networks, by Andrew s Tanenbaum,PHI(2010)

2.Data and Computer Communications,by William Stallings,PHI(2002)

References Books:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
3. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Edication.
4. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
5. Introduction to Computer Networks and Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press.
6. Computer Networks, L. L. Peterson and B. S. Davie, 4th edition, ELSEVIER.

7. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

Course Outcomes:

- Students should understand and explore the basics of Computer Networks and Various Protocols. He/She will be in a position to understand the World Wide Web concepts.
- Students will be in a position to administrate a network and flow of information further he/she can understand easily the concepts of network security, Mobile and ad hoc networks.

CS	**Data Mining**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

COURSE OBJECTIVE:

The course aims at providing the student with the concepts related to data warehousing, on-line analytical processing (OLAP) and various techniques used for the functionalities of data mining

SYLLABUS:

UNIT-I
DATA MINING
Data-Types of Data-, Data Mining Functionalities- Interestingness Patterns-Classification of Data Mining systems- Data mining Task primitives -Integration of Data mining system with a Data warehouse-Major issues in Data Mining-Data Preprocessing.

UNIT-II
DATA WAREHOUSE AND BUSINESS ANALYSIS
Data Warehouse-Data Warehouse Architecture- Multidimensional Data Model-Data cube and OLAP Technology-Data Warehouse Implementation -DBMS schemas for Decision support -Efficient methods for Data cube computation.

UNIT-III
ASSOCIATION RULE MINING AND CLASSIFICATION
Mining Frequent Patterns-Associations and correlations- Mining Methods- Mining Various kinds of Association Rules- Correlation Analysis- Constraint based Association mining.- Classification and Prediction- Basic concepts-Decision tree induction-Bayesian classification, Rule-based classification - classification by Back propagation,-Support vector machines-.Associative Classification, Lazy learners-Other classification methods – Prediction.

UNIT-IV
CLUSTERING AND APPLICATIONS

Cluster analysis-Types of Data in Cluster Analysis-Categorization of Major Clustering Methods- Partitioning Methods,-Hierarchical Methods- Density-Based Methods,-Grid-Based Methods,-Model-Based Clustering Methods- Clustering high dimensional data-Constraint-Based cluster analysis-Outlier Analysis

UNIT-V

MINING DATA STREAMS, TIME-SERIES AND SEQUENCE DATA

Basic concepts- Mining data streams-Mining Time-series data--Mining sequence patterns in Transactional databases-.Mining Object- Spatial- Multimedia-Text and Web data- Spatial Data mining- Multimedia Data mining--Text Mining- Mining the World Wide Web.

TEXT BOOKS:

1. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Elsevier.
2. Data Warehousing, Data Mining &OLAP- Alex Berson and Stephen J. Smith-Tata McGraw-Hill Edition, Tenth reprint 2007

REFERENCE BOOKS:

1. Building the DataWarehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd..
2. Data Mining Introductory and Advanced topics –Margaret H Dunham, Pea.

COURSE OUTCOMES:

By the end of the course, students will be able to:

CO1: Define the types of the data to be mined and present a general classification of tasks and Primitives to integrate a data mining system

CO2: Discuss preprocessing statistical methods for any given raw data

CO3: Produce interesting patterns from large amounts of data that can be used for further analysis

CO4: Evaluate the accuracy of supervised and unsupervised models and algorithms

CSA	Machine Learning & Deep Learning	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	Artificial Intelligence

Objectives

1. To study the various probability based learning techniques
2. To understand graphical models of machine learning algorithms

3. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Learning Outcomes

1. Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
2. Design systems that uses the appropriate graph models of machine learning
3. Modify existing machine learning algorithms to improve classification efficiency
4. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.

Syllabus

UNIT I
TREE AND PROBABILISTIC MODELS
Learning with Trees –Decision Trees –Constructing Decision Trees –Classification and Regression Trees –Ensemble Learning –Boosting –Bagging –Different ways to Combine Classifiers –Probability and Learning –Data into Probabilities –Basic Statistics –Gaussian Mixture Models –Nearest Neighbor Methods –Unsupervised Learning –K means Algorithms –Vector Quantization –Self Organizing Feature Map

UNIT II
DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS Dimensionality Reduction –Linear Discriminant Analysis –Principal Component Analysis –Factor Analysis –Independent Component Analysis –Locally Linear Embedding –Isomap –Least Squares Optimization –Evolutionary Learning –Genetic algorithms –Genetic Offspring: -Genetic Operators –Using Genetic Algorithms –Reinforcement Learning –Overview –Getting Lost Example –Markov Decision Process

UNIT III
GRAPHICAL MODELS Markov Chain Monte Carlo Methods –Sampling –Proposal Distribution –Markov Chain Monte Carlo –Graphical Models –Bayesian Networks –Markov Random Fields –Hidden Markov Models –Tracking Methods

UNIT IV
IMPROVING DEEP NEURAL NETS
Regularizing nural networks: Regularization, Dropout Regularization, normalizing inputs, vanishing/ exploding gradients. **Optimization Algorithms:** Mini Batch Gradient Descent, understanding Mini Batch Gradient Descent, RMSprop, adam optimization algorithm, Hyper papameter tuning, Batch Normalization, Introduction to Programming frameworks

UNIT V
DEEP LEARNING MODELS
Convolutional Neural Networks: Architectures of Convolutional Neural Networks, convolution / pooling layers, CNN Example **Unit IV Recurrent Neural Networks:** Why sequence models, Recurrent Neural Networks, different types of RNN,Long Short Term Memory(LSTM), Gated Recurrent Unit(GRU), Encoder Decoder architectures

Text books:

1. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013
2. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press

REFERENCES:

1.Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
2.Jason Bell, ―Machine learning –Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
3.Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014

CS	Graph Theory & Combinatorics	3L: 0T: 0P	3 Credits

Pre-requisites	

Objectives:

- To develop an understanding the most fundamentals of Graphs, Subgraphs and Trees
- To be familiar with the concept of Spanning trees, Cut sets, Isomorphism, Network flows and Planar graphs.
- To determine chromatic number and partitioning, understand matching & Covering concepts.
- To learn about Directed graphs & its types, Euler graphs.
- To understand the fundamental principle of counting and to determine permutation & combination of objects.
- To state and prove Binomial Theorem
- To understand the principle of inclusion & exclusion & derangements
- To learn about generating functions & its methods and solving homogeneous ad non-homogeneous recurrence relations.

Detailed Contents:

UNIT I INTRODUCTION

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits – Connectedness –Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

UNIT II TREES, CONNECTIVITY & PLANARITY

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planar graphs – Different representation of a planer graph.

UNIT III MATRICES, COLOURING AND DIRECTED GRAPH

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

UNIT IV PERMUTATIONS & COMBINATIONS 9

Fundamental principles of counting – Permutations and combinations – Binomial theorem – combinations with repetition – Combinatorial numbers – Principle of inclusion and exclusion – Derangements – Arrangements with forbidden positions.

UNIT V GENERATING FUNCTIONS 10

Generating functions – Partitions of integers – Exponential generating function – Summation operator – Recurrence relations – First order and second order – Non-homogeneous recurrence relations – Method of generating functions.

TEXT BOOKS:

T1. Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", Prentice Hall of India, 2003.
T2. Grimaldi R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley, 1994.

REFERENCES:

R1. Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, 1995.
R2. Mott J.L., Kandel A. and Baker T.P. "Discrete Mathematics for Computer Scientists and Mathematicians" , Prentice Hall of India, 1996.
R3. Liu C.L., "Elements of Discrete Mathematics", Mc Graw Hill, 1985.
R4. Rosen K.H., "Discrete Mathematics and Its Applications", Mc Graw Hill, 2007.

Outcomes

- Write precise and accurate mathematical definitions of objects in graph theory.
- Use mathematical definitions to identify and construct examples and to distinguish examples from non-examples.
- Validate and critically assess a mathematical proof.
- Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.
- Reason from definitions to construct mathematical proofs.

CS3801	Compiler Design Lab	0L:0T:4P	2 Credits

Pre-requisites	

Detailed Contents:

Module 1:

Familiarization with LEX by writing simple specifications for tokens such as, identifiers, numbers, comments in C/C++, etc. All LEX specifications must be compiled and executed with appropriate inputs.

1. LEX Program to count the number of vowels and consonants in a given string.
2. LEX Program to count the number of lines, words, and characters in the input.

3. LEX Program to count the number of integers and floating point numbers appearing in the input.
4. LEX Program to list out all words of length three, starting with "A" to uppercase.
5. LEX Program to list out all C-like comments (both single line and multi line comments) from a text file.

Module 2: LEX specification for tokens of the small language in ALSU's book (appendix A).

Module 3: Complete the specifications in (5) above to make a complete lexical analyzer.

Module 4&5:
Familiarization with YACC by writing simple specifications for desk calculator, variable declarations in C (only numbers and array). All YACC specifications must be compiled and executed with appropriate inputs. Note that this exercise also requires LEX specifications & the tokens involved.
Module 6: YACC specifications for the syntax of the small language in ALSU's book (appendix A)
Module 7: Adding error recovery to (8) above to make a complete parser.
Module 8: S-attributed specification of the semantics of the small language in ALSU's (appendix A) to be incorporated into YACC specifications produced in (9) above.
Module 9:

1. Write a C program to find FIRST and FOLLOW.
2. Write a C program for constructing of LL (1) parsing.

Module 10:

1. Write a C program to implement Shift Reduce Parsing.
2. Write a C program to implement LALR parsing.
3. Write a program to generate machine code.

CS3802	**Computer Networks Lab**	**0L: 0T: 4P**	**2 Credits**

Pre-requisites	

Course Objectives

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes

Detailed Contents:
Week-1

1. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in Detail.

Week-2

3. Study of network IP.
4. Connect the computers in Local Area Network.

Week-3

5. Study of basic network command and Network configuration commands.
6. Socket Program for Echo/Talk commands.

Week-4

7. Configure a Network topology using packet tracer software.

Week-5

8. Configure Network using Link State Vector Routing protocol.
9. Configure a Network using Distance Vector Routing protocol.

Week-6

10. Write a program to implement RPC (Remote Procedure Call)
11. Write a code simulating PING and TRACEROUTE commands

Week-7

12. Implementation of STOP & WAIT protocol and sliding window protocol
13. Write a program to implement sub netting and find the subnet masks.

Week-8

14. Create a socket for HTTP for web page upload and download.
15. Create a socket (UDP)

Week-9

16. Using TCP/IP sockets, write a client server program to make client sending the file name and the server to send back the contents of the requested file if present.

Week-10

17. Simulation of ARP/RARP

Week-11

18. TCP Module Implementation

Week-12

19. Applications using TCP and UDP Sockets like d. DNS and SNMP

Course Outcomes

- Identify and use various networking components Understand different transmission media and design cables for establishing a network
- Implement any topology using network devices
- Analyze performance of various communication protocols.
- Compare routing algorithms
- Understand the TCP/IP configuration for Windows and Linux
- Implement device sharing on network
- Learn the major software and hardware technologies used on computer networks

B.TECH (CSE) IV YEAR I-SEM-II

CS	**Information Security (** Elective-V)	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives:

1. To be able to understand the basic concepts and goals of Information security such as Confidentiality, Integrity, Authentication, Non-Repudiation, Authorization, and Availability and their relevance in various Contexts.
2. To be able to understand the classical cryptosystems and techniques used to break them.
3. To be able to understand the ideas of public key cryptosystems and digital signature schemes.

Detailed Contents:

Module 1:

Symmetric Ciphers - Overview: Services, Mechanisms and Attacks, The OSI Security Architecture, A Model of Network Security. **Classical Encryption Techniques:** Symmetric Cipher Model, Substitution Techniques, Transposition Techniques. **Block Cipher and the Data Encryption Standard:** Simplified DES, Block Cipher Principles, The DES, The Strength of DES, Differential and Linear Cryptanalysis. **Symmetric Ciphers:** Triple DES, Blowfish. **Confidentiality using Conventional Encryption:** Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation.

Module 2:

Public Key Encryption, Digital Signatures-Number Theory, Prime Numbers Format's and Euler's Theorems. **Public Key Cryptography and RSA:** Principles of Public Key Cryptosystems, the RSA Algorithms, Key Management and Diffie Hellman Key Exchange.

Module 3:

Authentication Protocols - Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, MD5 Message Digest Algorithms, **Digital Signatures and Authentication Protocols:** Digital Signatures, Authentication Protocols and Digital Signature Standards.

Module 4:

Network Security - Authentication Applications: Kerberos, X.509 Directory Authentication Service. **Electronic Mail Security:** Pretty Good Privacy. **IP Security:** Overview, IP Security Architecture, Authentication Header, Encapsulation Security Payload. **Web Security:** Web Security Requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

Module 5:
System Security-Intruders, Malicious Software, Viruses and Related Threats, Counter Measures, Firewalls and its Design Principles.

Suggested Books:

1. William Stallings, Cryptography and Network Security, 4th Edition, Pearson Education/PHI. 2006.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education**.**

Suggested Reference Books:

1. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: Private Communication in Public World, 2nd Edition, 2011, Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W.Manzuik and Ryan Permeh, wiley Dreamtech.

Course Outcomes:

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

CSA	Speech and Natural Language Processing	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives:

- To understand the basic concepts of Natural Language Processing (NLP). The student must be able to apply the various concepts of NLP in other application areas.

Module 1:
Introduction: Origin of Natural Language Processing (NLP), Challenges of NLP, NLP Applications, Processing Indian Languages.
Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Named Entities.
Module 2:
Phrase structure and constituency models: phrase structure grammar; dependency grammar; formal language theory.
Parsing: Definite clause grammars; shift-reduce parsing; chart parsing' Shallow Parsing,

Statistical Parsing, Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution, Approaches to discourse, generation.
Language Modeling and Part of Speech Tagging: Markov models, N-grams, estimating the probability of a word, and smoothing, Parts-of-speech, examples and its usage.
Module 3:
Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation.
Meaning: Lexical Knowledge Networks, WorldNet Theory; Indian Language Word Nets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors.
Module 5:
Other Applications: Sentiment Analysis; Text Entailment; Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR. Text-classification.

Text Books:
1. Jurafsky D. and Martin H. J, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Prentice Hall (2014), 2nded.
2. Manning D. C. and Schütze H., Foundations of Statistical Natural Language Processing MIT Press (1999) 1sted.
Reference Books:
1. Dale R., Moisl H. and Somers H., Handbook of Natural Language Processing, CRC Press (2010), 2nded.
2. Bird S., Klein E. and Loper E., Natural Language Processing with Python, Oreilly Publication (2009), 2nd ed.

Course Outcomes:
After the completion of the course, the student will be able to:
1. Comprehend the concept of natural language processing, its challenges and applications.
2. Comprehend the concepts of words form using morphology analysis.
3. Acquire the knowledge of syntax and semantics related to natural languages.
4. Ability to design and analyze various NLP algorithms.
5. Acquire knowledge of machine learning techniques used in NLP.

BSC__	**BioInformatics**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives: The main objective of the course is to stress the need for algorithm and data processing technologies for analysis and decoding the information processing of biological systems. The course will enable the students

- To cognize the existing methodologies adopted in computational analysis of biological data
- To apply the concepts of computational science for analysis of biological data
- To work on big data analytics of biological world

Syllabus :

Unit-1

Biomolecules and Information processing

Molecules of life, monomeric units (biomolecules) and polymeric structures (biopolymers), four classes of biopolymers – Carbohydrates, Lipids, Proteins and Nucleic acids, Central Dogma of Life (Biological information processing) – information transfer from nucleic acids to proteins, the concept of genetic code and understanding relationship of sequence to structure and structure to function

Unit-2
Biological Databases
Introduction to bioinformatics – using computer science for biology, Need for bioinformatics (organizing biological information and analysis to decipher genetic code manifestation), Introduction to single letter code of amino acids, symbols used in nucleotides, Nucleotide databases and Protein databases, Protein Family databases; Genome and Metabolic Pathway database; Structure database. Difference between primary, secondary and composite databases, Information retrieval from biological databases.

Unit-3
Sequence Analysis
Analysis of protein and nucleic acid sequences, Sequence search and Pair wise Sequence Alignment (Methods, Scoring Matrices and Statistical significance); Database similarity searching - Dynamic Programming, Heuristic approach (BLAST & FASTA); Multiple Sequence Alignment; Methods in multiple sequence alignment.

Unit-4
Phylogeny & Structure Prediction
Phylogenetic Analysis - Methods of Construction of Phylogenetic trees & Phylogenetic tree evaluation; Protein structure visualization, comparision and classifications; Methods for Prediction of Secondary and Tertiary structures of Proteins; Model validation and evaluation. Software for sequence analysis and structure prediction (publicly available and commercial packages)

Unit-5
Applications of Bioinformatics
Applications of Bioinformatics in biotechnology, proteomics, genomics, medicine and other related fields; Disease genes, Drug Discovery & Drug designing; Computer aided drug design, ADME.

Learning Outcomes: Upon completion of the course, the students are expected to

- Develop the intellectual acumen required for handling and analyzing large data sets
- Integrate information to solve problems
- Develop algorithms and data processing technologies for analyzing biological information
- Capitalize on the opportunities of developing tools for big data analytics in the biological domain

References:

1. David W. Mount, *"Bioinformatics: Sequence and Genome Analysis*" Cold Spring Harbor Laboratory Press.
2. Lesk. A. M.,"Introduction to Bioinformatics" , Oxford University Press.
3. Andreas D. Baxevanis & Francis Ouelette.B.F, "*Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins"*, John Wiley & Sons, 2004
4. Xiong, J. (2006). *Essential bioinformatics*. New York: Cambridge University Press.

PROFESSIONAL ELECTIVE COURSES

Theory and Algorithms:

Code : PEC-CST

CST	**Theory Of Computation**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives:

The learning objectives of this course are to:

1. Introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
2. Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Detailed Contents:

UNIT – I: Regular Languages –Finite Automata, Formal definition of finite automaton, Examples of finite automata, Formal definition of computation, Designing finite automata, The regular operations, Non determinism, formal definition of nondeterministic finite automaton, equivalence of NFAs and DFAs, closure under the regular operations, Regular Expressions, formal definition of a regular expression, equivalence with finite automata, Nonregular languages, The pumping lemma for regular languages.

UNIT – II : Context-Free languages, Context-free grammars, formal definition of a Context-free grammar, Examples of context-free grammars, Designing context-free grammars, Ambiguity, Chomsky normal form, Pushdown Automata, Examples of pushdown Automata, Equivalence with context-free grammars, Non-context-free languages, The pumping lemma for context-free languages.

UNIT – III : The Church-Turing Thesis – Turing machines, Formal definition of turing machine, Examples of turing machines, Variants of turing machines, Multitape turing machines,

Nondeterministic turing machine, Enumerators, Equivalence with other models, The definition of algorithm, Hilbert's problem Terminology of describing turing machines.

UNIT – IV: Decidability –Decidable languages, Decidable problems concerning regular languages, Decidable problems concerning context-free languages, The halting problem, The diagonalization method, The halting method is undecidable, A turing –unrecognizable language, Reducibility – Undecidable problems for language theory, Reductions via computations histories, A simple undecidable problem, Mapping reducibility, computable functions, Formal definition of mapping reducibility.

UNIT – V: Time Complexity –Measuring complexity, Big – O and small-o notation, Analyzing algorithms, Complexity relationships among models, The class P, Polynomial time, examples of problems in P, The class NP, Examples of problems in NP, The P versus NP question, NP-Completeness, polynomial time reducibility, Definition of NP-Completeness, The Cook-Levin Theorem, Additional NP Complete problems, The vertex cover problem, The Hamiltonian path problem, The subset sum problem.

TEXTBOOKS:

- Introduction to the theory of computation, Micheal Sipser, Third Edition, Cengage Learning.

REFERENCES:

- Introduction to Languages and The Theory of Computation, John C Martin, TMH.
- Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
- A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
- Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.
- Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI.

Course Outcomes:

- Able to understand the concept of abstract machines and their power to recognize the languages.
- Able to employ finite state machines for modeling and solving computing problems.
- Able to design context free grammars for formal languages.
- Able to distinguish between decidability and undecidability.
- Able to gain proficiency with mathematical tools and formal methods.

CST	**Graph Theory**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Objectives:

- To develop an understanding the most fundamentals of Graphs, Subgraphs and Trees
- To be familiar with the concept of Spanning trees, Cut sets, Isomorphism, Network flows and Planar graphs.
- To determine chromatic number and partitioning, understand matching & Covering concepts.
- To learn about Directed graphs & its types, Euler graphs.
- To understand the fundamental principle of counting and to determine permutation & combination of objects.
- To state and prove Binomial Theorem
- To understand the principle of inclusion & exclusion & derangements
- To learn about generating functions & its methods and solving homogeneous ad non-homogeneous recurrence relations.

Detailed Contents:

UNIT I INTRODUCTION

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits – Connectedness –Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

UNIT II TREES, CONNECTIVITY & PLANARITY

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planar graphs – Different representation of a planer graph.

UNIT III MATRICES, COLOURING AND DIRECTED GRAPH

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

UNIT IV PERMUTATIONS & COMBINATIONS 9

Fundamental principles of counting – Permutations and combinations – Binomial theorem – combinations with repetition – Combinatorial numbers – Principle of inclusion and exclusion – Derangements – Arrangements with forbidden positions.

UNIT V GENERATING FUNCTIONS 10

Generating functions – Partitions of integers – Exponential generating function – Summation operator – Recurrence relations – First order and second order – Non-homogeneous recurrence relations – Method of generating functions.

TEXT BOOKS:

T1. Narsingh Deo, “Graph Theory: With Application to Engineering and Computer Science”, Prentice Hall of India, 2003.
T2. Grimaldi R.P. “Discrete and Combinatorial Mathematics: An Applied Introduction”, Addison Wesley, 1994.

REFERENCES:

R1. Clark J. and Holton D.A, “A First Look at Graph Theory”, Allied Publishers, 1995.
R2. Mott J.L., Kandel A. and Baker T.P. “Discrete Mathematics for Computer Scientists and Mathematicians” , Prentice Hall of India, 1996.
R3. Liu C.L., “Elements of Discrete Mathematics”, Mc Graw Hill, 1985.

R4. Rosen K.H., “Discrete Mathematics and Its Applications”, Mc Graw Hill, 2007.

Outcomes

- Write precise and accurate mathematical definitions of objects in graph theory.
- Use mathematical definitions to identify and construct examples and to distinguish examples from non-examples.
- Validate and critically assess a mathematical proof.
- Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.
- Reason from definitions to construct mathematical proofs.

CST	Advanced Algorithms	3L: 0T: 0P	3 Credits

Pre-requisites	

Objectives:

- Develop 'students' algorithmic thinking and their ability to analyse the efficiency of algorithms;
- Enable students to find different approaches for dealing with challenging computational problems;
- Provide insight into cutting-edge research-led teaching in modern subfields of algorithms theory.

UNIT-I
Design Paradigms: Overview :
Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.

UNIT-II
Max Flow Problem
String Matching
Introduction to string-matching problem, Naïve algorithm, Rabin Karp, Knuth Morris Pratt, Boyer-Moore algorithms and complexity analysis.

UNIT-III
Theory of NP- Hard and NP-Complete Problems.
P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes.

UNIT-IV

Approximation Algorithms
Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms.
Parallel Algorithms
Introduction, Models, speedup and efficiency, Some basic techniques of Parallel algorithms: Computing with a CBT, Pointer Doubling, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity.

UNIT-V
Probabilistic Algorithms & Randomized Algorithms
Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretictechniques, Applications on graph problems

Text Books :
1. Introduction to Algorithms : T.H. Cormen, C.E.Leiserson and R.L. Rivest
2. Fundamentals of Algorithmics : G.Brassard and P.Bratley
3. Approximation Algorithms: Vijay V.Vazirani
4. Randomized Algorithms: R. Motwani and P.Raghavan
5. Reference book: Algorithmics :The spirit of computing: D.Harel

Outcomes: By the end of the course, a candidate will be able to:

- Appreciate what constitutes an efficient and an inefficient solution to a computational problem.
- Analyse the efficiency of advanced algorithms.
- Evaluate and choose appropriate ways of dealing with challenging computational problems .
- Identify and apply design principles for the design of advanced efficient algorithms.
- Describe efficient algorithms for a range of computational problems, along with their computational complexity .

CST	Parallel And Distributed Algorithms	3L: 0T: 0P	3 Credits

Pre-requisites	

Objectives:

- To learn parallel and distributed algorithms development techniques for shared memory and message passing models.

- To study the main classes of parallel algorithms.
- To study the complexity and correctness models for parallel algorithms.

UNIT-I

Basic Techniques To, Parallel Computers for increase Computation speed, Parallel & Cluster Computing

UNIT-II

Message Passing Technique- Evaluating Parallel programs and debugging, Portioning and Divide and Conquer strategies examples

UNIT-III

Pipelining- Techniques computing platform, pipeline programs examples.

UNIT-IV

Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor constructs for specifying parallelist sharing data parallel programming languages and constructs, open MPx

UNIT-V

Distributed shared memory systems and programming achieving constant memory distributed shared memory programming primitives, algorithms – sorting and numerical algorithms.

TEXT BOOK:

1. Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.
2. Introduction to Parallel algorithms by Jaja from Pearson, 1992

Course outcomes:

- To reason about ways to parallelize a problem and be able to evaluate a parallel platform for a given problem.
- To understand and explore the concepts with programming with MPI and MapReduce/Hadoop
- To demonstrate the general concepts on Cloud computing, grid computing, and peer-to-peer systems To become familiar with evaluation of online social networks and their potential

CST	Computational Geometry	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives

1. Student should be able to get the notion of Visibility problems that arise during computation
2. Student should be able to get idea about Computational geometry algorithms and applications
3. Students should identify some geometrical solutions for computational problems

Detailed Contents:

UNIT-I Introduction
Visibility Problems, 2D Maxima, Line Sweep Method, Segment Intersection Problem, Line Sweep: Rectangle Union, Convex Hull, Quick Hull, More Convex Hull Algorithms

UNIT – II
Intersection of Half Planes and Duality, Lower Bounds, Planar Point Location, Triangulation, Triangulation of Arbitrary Polygon,

UNIT-III
Voronoi Diagram : Properties, Voronoi Diagram Construction, Delaunay Triangulation, Quick sort and Backward Analysis, Generalized RIC, Arrangements, Zone Theorem and Application, Levels,

UNIT-IV
Range Searching : Introduction, Orthogonal Range searching, Priority Search Trees, Non - Orthogonal Range Searching, Half - Plane Range Query, Well Separated Partitioning, Quadtrees

UNIT-V
Epsilon -WSPD, Construction of Epsilon – WSPD, Epsilon - WSPD to Geometric Spanner, Epsilon-Nets & VC Dimension, Geometric Set Cover, Bounded VC Dimension, Shape Representation, Shape Comparison

Textbook:
Computational Geometry: Algorithms and Applications by Mark de Berg, Otfried Chiong, Mark van Kreveld, Mark Overmars, 3rd edition

Course Outcomes
1. Student will understand the notion of visibility problems in computation complexity
2. Student will get knowledge about Computational geometry algorithms and applications
3. Students will identify some geometric solutions for computational problems

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CST	**Computational Complexity**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives:
1. The student should be able to get the notion of the computational complexity
2. The student should be able to get the parameters based on which computational complexities are analyzed.

UNIT-I The computational model – Introduction
Encodings and Languages, Modeling computation and efficiency, The Turing Machine, Robustness of our definition, The expressive power of Turing machines, Machines as strings and the universal Turing machines, The Universal Turing Machine, Uncomputable functions, The Halting Problem, Deterministic time and the classP, On the philosophical importance ofP, Criticisms ofPand some efforts to address them, Edmonds' quote

UNIT – II: NP and NP-Completeness
The class NP, Reducability and NP Completeness, Cook-Levin theorem, web of reductions, Decision vs Search, coNP,EXP and NEXP. Diagnolization- Time Hierarchy theorem, Space hierarchy theorem, Non-Deterministic time hierarchy theorem, Ladner's theorem, Oracle machines, Limits of Diagnolization.

UNIT-III: Space Complexity
Configuration graphs, space complexity classes, Pspace completeness, NL completeness, Polynomial hierarchy and alternatives: The classes Σp2 and Πp2, The polynomial hierarchy, alternating turing machines, Time vs alternations, Defining the hierarchy via oracle machines

UNIT – IV: Circuits
Boolean circuits, Karp-Lipton theorem, circuit lower bounds, non-uniform hierarchy theorem, finer gradations among circuit classes, circuits of exponential size, circuit satisfyability.

UNIT- V: Randomized computation-
Probabilistic turing machines, one sided and zero sided error, robustness, randomness, BPP, Interactive Proofs- deterministiv verifier, IP class, public coins and AM, the power of the prover, Program checking
Textbook: Computational Complexity: A modern Approach, Sanjeev Aurora and Boaz Barak, Princeton University, 2007 edition.
Course Outcomes:
1. Student will be able to define and describe the idea of computational complexity
2. Student will be able to list out the mathematical models laid down as metrics for computational complexity.
3. Student will be able to mathematically describe the performance of computation

CST	**Queuing Theory and Modeling**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives:
1. The students should be able to gain knowledge in the system performance metrics
2. The students should be able to understand the significance and applications of queueing theory and modeling
3. The students should be able to solve simple problems of measuring system performance using queueing theory
Syllabus

UNIT–I
Introduction, Measures of System Performance, Characteristics of Queueing Systems, The Experience of Waiting, Little's Law, General Results, Simple Bookkeeping for Queues

UNIT-II
Introduction to the QtsPlus Software, Review of Stochastic Processes, The Exponential Distribution, The Poisson Process, Discrete-Time Markov Chains, Continuous-Time Markov Chains, Problems

UNIT-III
Simple Markovian Queueing Models, BirthDeath Processes, Single-Server Queues, Multiserver Queues, Choosing the Number of Servers, Queues with Truncation, Erlang's Loss Formula (M/M/c/c), Queues with Unlimited Service (M/M/∞), Finite-Source Queues, State-Dependent Service, Queues with Impatience, Transient Behavior, Busy-Period Analysis

UNIT-IV
Advanced Markovian Queueing Models, Bulk Input (M[X]/M/1), Bulk Service (M/M[Y]/1), Erlang Models, Priority Queue Disciplines, Retrial Queues, Networks, Series, and Cyclic Queues, Series Queues, Open Jackson Networks, Closed Jackson Networks, Cyclic Queues, Extensions of Jackson Networks, Non-Jackson Networks

UNIT-V
General Arrival or Service Patterns-General Service, Single Server (M/G/1), General Service-Multiserver (M/G/c/·,M/G/∞), General Input (G/M/1,G/M/c), General Models and Theoretical Topics, applications in manufacturing, computer and communication networks.

Texts:

- D. Gross and C. Harris, Fundamentals of Queueing Theory, 3rd Edition, Wiley, 1998. (WSE Edition, 2004).
- L. Kleinrock, Queueing Systems, Vol. 1: Theory, Wiley, 1975.
- J. Medhi, Stochastic Models in Queueing Theory, 2nd Edition, Academic Press, 2003. (Elsevier India Edition, 2006).

References:

- J.A. Buzacott and J.G. Shanthikumar, Stochastic Models of Manufacturing Systems, Prentice Hall, 1992.
- R.B. Cooper, Introduction to Queueing Theory, 2nd Edition, North-Holland, 1981.
- L. Kleinrock, Queueing Systems, Vol. 2: Computer Applications, Wiley, 1976.
- R. Nelson, Probability, Stochastic Processes, and Queueing Theory: The Mathematics of Computer Performance Modelling, Springer, 1995.
- E. Gelenbe and G. Pujolle, Introduction to Queueing Networks, 2nd Edition, Wiley, 1998.

- **Course Outcomes**
- 1. The students will gain knowledge about system performance metrics
- 2. The students will get a notion about the queueing theory applications in measuring system performance
- 3. The students will be able to solve basic problems on queueing theory and modeling

CST	**Computational Number Theory**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives:
The students should be able to
1. Understand the mathematical models of computation
2. Formulate computation problems using number theory
2. Solve basic problems of computation using the number theory

Syllabus
UNIT-I
Algorithms for integer arithmetic: Divisibility, gcd, modular arithmetic, modular exponentiation, Montgomery arithmetic, congruence, Chinese remainder theorem, Hensel lifting, orders and primitive roots, quadratic residues, integer and modular square roots, prime number theorem, continued fractions and rational approximations.

UNIT-II
Representation of finite fields: Prime and extension fields, representation of extension fields, polynomial basis, primitive elements, normal basis, optimal normal basis, irreducible polynomials.
Algorithms for polynomials: Root-finding and factorization, Lenstra-Lenstra-Lovasz algorithm, polynomials over finite fields.

UNIT-III
Elliptic curves: The elliptic curve group, elliptic curves over finite fields, Schoof's point counting algorithm.
Primality testing algorithms: Fermat test, Miller-Rabin test, Solovay-Strassen test, AKS test.

UNIT-IV
Integer factoring algorithms: Trial division, Pollard rho method, p-1 method, CFRAC method, quadratic sieve method, elliptic curve method.
Computing discrete logarithms over finite fields: Baby-step-giant-step method, Pollard rho method, Pohlig-Hellman method, index calculus methods, linear sieve method, Coppersmith's algorithm.

UNIT-V
Applications: Algebraic coding theory, cryptography, Exercises and Problems

Textbook
V. Shoup, A computational introduction to number theory and algebra, Cambridge University Press.

References

M. Mignotte, Mathematics for computer algebra, Springer-Verlag.
I. Niven, H. S. Zuckerman and H. L. Montgomery, An introduction to the theory of numbers, John Wiley.
J. von zur Gathen and J. Gerhard, Modern computer algebra, Cambridge University Press.
R. Lidl and H. Niederreiter, Introduction to finite fields and their applications, Cambridge University Press.
A. J. Menezes, editor, Applications of finite fields, Kluwer Academic Publishers.

J. H. Silverman and J. Tate, Rational points on elliptic curves, Springer International Edition.
D. R. Hankerson, A. J. Menezes and S. A. Vanstone, Guide to elliptic curve cryptography, Springer-Verlag.
A. Das and C. E. Veni Madhavan, Public-key cryptography: Theory and practice, Pearson Education Asia.
H. Cohen, A course in computational algebraic number theory, Springer-Verlag.

Course outcomes:
The students will be able to
1. Gain knowledge about the mathematical models of computation namely number theory
2. Describe computational problems using number theory
3. Solve basic problems in computational number theory

CST	Quantum Computing	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objective
The objective of this course is to provide the students an introduction to quantum computation. Much of the background material related to the algebra of complex vector spaces and quantum mechanics is covered within the course. The quantum algorithms and error control techniques are covered to throw light on efficient computing using quantum principles
Syllabus

UNIT-I
Introduction to Quantum Computation: Quantum bits, Bloch sphere representation of a qubit, multiple qubits.

UNIT-II
Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

UNIT-III
Quantum Circuits:single qubit gates, multiple qubit gates, design of quantum circuits. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.

UNIT-IV
Quantum Algorithms:Classical computation on quantum computers. Relationship between quantum and classical complexity classes.Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

UNIT-V
Noise and error correction:Graph states and codes, Quantum error correction, fault-tolerant computation.

Course Outcomes:
Students will be able to
1. Gain knowledge about the fundamentals of quantum computing and quantum information
2. Know the background maths and physics related to quantum mechanics
3. Appreciate the efficiency and effectiveness of quantum algorithms and quantum error control techniques

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CST	Information Theory&Coding	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives
The students should be able to
1. acquire knowledge about information and entropy, Hamming weight, minimum distance decoding and different types of codes. They also learn about syndrome calculation and design of an encoder and decoder.

2. Learn convolution coding, sequential search and Viterbi algorithm, text compression techniques. They also learn about speech and audio coding., multimedia compressions

Syllabus

UNIT-I
INFORMATION THEORY
Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit.

UNIT-II
ERROR CONTROL CODING: BLOCK CODES
Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder - CRC

UNIT-III
ERROR CONTROL CODING: CONVOLUTIONAL CODES
Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding

UNIT-IV
SOURCE CODING: TEXT, AUDIO AND SPEECH
Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding
UNIT-V
SOURCE CODING: IMAGE AND VIDEO

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard

Text Books:

1.R Bose, "Information Theory, Coding and Cryptography", TMH 2007

2.Fred Halsall, "Multidedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia, 2002

References:

3.K Sayood, "Introduction to Data Compression" 3/e, Elsevier 2006

4.S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007

5.Amitabha Bhattacharya, "Digital Communication", TMH 2006

Course outcomes:

1. Students will gain knowledge about various aspects of information storage, encoding, decoding and compression

2. They explore information handling techniques using coding techniques

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Systems:

Code: PEC-CSS

CSS	**Advanced Computer Architecture**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

OBJECTIVES: The student should be made to:

- Understand the micro-architectural design of processors
- Learn about the various techniques used to obtain performance improvement and power savings in current processors

UNIT -I: Fundamentals of Computer Design: Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, Measuring and reporting performance, Quantitative principles of computer design, Amdahl's law. Instruction set principles and examples- Introduction, Classifying instruction set- MEmory addressing- type and size of operands, Operations in the instruction set.

UNIT –II: Pipelines: Introduction, Basic RISC instruction set, Simple implementation of RISC instruction set, Classic five stage pipe lined RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties.

Memory Hierarchy Design: Introduction, Review of ABC of cache, Cache performance, Reducing cache
miss penalty, Virtual memory.

UNIT -III: Instruction Level Parallelism the Hardware Approach: Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo's approach, Branch prediction, high performance instruction delivery- hardware based speculation.

UNIT-IV : ILP Software Approach Basic compiler level techniques, Static branch prediction, VLIW approach, Exploiting ILP, Parallelism at compile time, Cross cutting issues -Hardware verses Software.

UNIT –V: Multi Processors and Thread Level Parallelism: Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – memory architecture, Synchronization.

UNIT –VI: Inter Connection and Networks: Introduction, Interconnection network media, Practical issues in interconnecting networks, Examples of inter connection, Cluster, Designing of clusters.
Intel Architecture: Intel IA-64 ILP in embedded and mobile markets Fallacies and pit falls.

OUTCOMES: At the end of the course, the student should be able to:

- Evaluate performance of different architectures with respect to various parameters
- Analyze performance of different ILP techniques
- Identify cache and memory related issues in multi-processors

TEXT BOOKS

- John L. Hennessy, David A. Patterson – Computer Architecture: A Quantitative Approach, 3rd Edition, An Imprint of Elsevier.

REFERENCES

- John P. Shen and Miikko H. Lipasti – Modern Processor Design : Fundamentals of Super Scalar Processors
- Computer Architecture and Parallel Processing – Kai Hwang, Faye A.Brigs., MC Graw Hill.
- Advanced Computer Architecture – A Design Space Approach – Dezso Sima, Terence Fountain, Peter Kacsuk , Pearson Ed.

CSS	**Software Engineering**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Objectives:

- To understanding of software process models such as waterfall and evolutionary models.

- To understanding of software requirements and SRS document.
- To understanding of different software architectural styles.
- To understanding of software testing approaches such as unit testing and integration testing.
- To understanding on quality control and how to ensure good quality software.

Course Outcomes:

- Ability to identify the minimum requirements for the development of application.
- Ability to develop, maintain, efficient, reliable and cost effective software solutions
- Ability to critically thinking and evaluate assumptions and arguments.

UNIT- I: Introduction to Software Engineering:

The evolving role of software, Changing Nature of Software, legacy software, Software myths. A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models. Process models: The waterfall model, Incremental process models, Evolutionary process models, specialized process models, The Unified process.

UNIT- II : Software Requirements:

Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis,
Requirements validation, Requirements management. System models: Context Models, Behavioral models, Data models, Object models, structured methods.

UNIT- III: Design Engineering:

Design process and Design quality, Design concepts, the design model, pattern based software design. Creating an architectural design: software architecture, Data design, Architectural styles and patterns, Architectural Design, assessing alternative architectural designs, mapping data flow into a software architecture. Modeling component-level design: Designing class-based components, conducting component-level design, object constraint language, designing conventional components. Performing User interface design: Golden rules, User interface analysis, and design, interface analysis, interface design steps, Design evaluation.

UNIT- IV: Testing Strategies:

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

UNIT- V: Risk management:

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

TEXT BOOKS:

- Software engineering A practitioner's Approach, Roger S Pressman, sixth edition McGraw Hill International Edition.
- Software Engineering, Ian Sommerville, seventh edition, Pearson education.

REFERENCE BOOKS:

- Software Engineering, A Precise Approach, PankajJalote, Wiley India, 2010.
- Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
- Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
- Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
- Software Engineering2: Specification of systems and languages, Diner Bjorner, Springer International edition 2006.
- Software Engineering Foundations, Yingxu Wang, Auerbach Publications, 2008.
- Software Engineering Principles and Practice, Hans Van Vliet, 3rd edition, John Wiley &Sons Ltd.
- Software Engineering 3: Domains, Requirements, and Software Design, D. Bjorner, Springer International Edition.
- Introduction to Software Engineering, R. J. Leach, CRC Press.

CSS	Distributed Systems	3L: 0T: 0P	3 Credits

Pre-requisites	1. A course on "Database Management Systems"

COURSE OBJECTIVE:

This course is intended to introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems

SYLLABUS:

UNIT – I

INTRODUCTION

Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE

Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

UNIT – II

DISTRIBUTED DATABASE DESIGN

Alternative design strategies; Distributed design issues; Fragmentation; Data Allocation.

SEMANTICS DATA CONTROL

View management; Data security; Semantic Integrity Control.

QUERY PROCESSING ISSUES

Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

UNIT – III

DISTRIBUTED QUERY OPTIMIZATION

Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms.

TRANSACTION MANAGEMENT

The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models.

CONCURRENCY CONTROL

Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT – IV

RELIABILITY

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

UNIT – V

PARALLEL DATABASE SYSTEMS

Parallel architectures; parallel query processing and optimization; load balancing.

ADVANCED TOPICS

Mobile Databases, Distributed Object Management, Multi-databases.

TEXT BOOK:

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.

REFERENCE BOOK:

1. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

COURSE OUTCOMES:

By the end of the course, students will be able to:

CO 1: Analyze remote method invocation and objects

CO 2: Apply network virtualization

CO 3: Design trends in distributed systems

CSS	**Embedded Systems**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Objectives:

1. To provide an overview of Design Principles of Embedded System.

2. To provide clear understanding about the role of firmware , operating systems in correlation with hardware systems.

Course Outcomes:

1. Expected to understand the selection procedure of Processors in the Embedded domain.
2. Design Procedure for Embedded Firmware.
3. Expected to visualize the role of Real time Operating Systems in Embedded Systems
4. Expected to evaluate the Correlation between task synchronization and latency issues

UNIT -I:

Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II:

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III:

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV:

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT -V:

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

REFERENCE BOOKS:

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.

CSS	Advanced Operating Systems	3L: 0T: 0P	3 Credits

Pre-requisites	

Course objectives:

To understand the main components of distributed systems and their working
To study the operations performed by OS as a resource manager
To understand the scheduling policies of distributed OS
To implement the working principles of OS
To study different OS and compare their features

Detailed Contents:

UNIT-I

Architecture of Distributed Systems. : Types, Distributed OS, Issues in Distributed Operating Systems, Theoretical Foundations : Global Clock, Lamport's Logical Clock, Vector Clocks, Global State, Termination Detection.

UNTT-II

Distributed Mutual Exclusion : Classification, requirement, performance, non-token based
algorithms, Lamport's algorithm, the Richart-Agarwala algorithm, token-based algorithm-Suzuki liasamil's broadcast algorithm, Singhals heuristic algorithm.

Deadlock Detection : Resource Vs Communication deadlock, A graph - theoretic model,
prevention, avoidance, detection, control organization, centralized deadlock-detection algorithm,

the completely centralized algorithm, the HO-Ramamoorthy algorithm. Distributed deadlock detection algorithm - path - pushing, edge-chasing, hierarchical deadlock detection algorithm, menace-muntz and Ho-Ramamoorthy algorithm. Agreement Protocols : The system model, the Byzantine agreement, the consensus problem.

UNIT-III

Distributed File System : Mechanisms, Design Issues.

Case Studies : Sun NFS, Sprite File System, DOMAIN, Coda File System.

Distributed shared memory : Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues.

Case Studies : IVY, Mirage, Clouds.

Distributed Scheduling : Issues in Load Distribution, Components of Algorithm, Stability Load Distributing Algorithm, Performance.

UNIT IV

Failure Recovery : Backward, Forward Error Recovery in Concurrent Systems, Consistent Set of Check Points, Synchronous and Asychronous Check Pointing and Recovery.

Fault Tolerance : Commit protocols, Non-Blocking Commit Protocols, Voting Protocols.

Protection and Security: Access Matrix, Private Key, Public key, Kerberos System.

UNIT -V

Multiprocessor Operating Systems : Motivation, Basic Multiprocessor System Architecture, Interconnection Networks for Multiprocessor Systems, Caching, Hypercube Architecture. Threads, Process Synchronization, Processor scheduling, memory management.

Database Operating System : Concurrence Control, Distributed Databases,
Concurrency
Control Algorithms.

Suggested Reading:

1. Singhal M, Shivaratri N.G. "Advanced concepts in operating systems"Mc-Graw-Hill Intl., 1994.
2. Pradeep K Sinha, : "Distributed Operating Systems Concepts and Design", PHI, 2002.
3 Andrew S. Tanenbaum, "Distributed Operating Systems", Pearson Education India, 2011

Course Outcomes :

Students will be able

To know the architecture and issues in Distributed Operating systems

To know the different algorithms for resource allocation

To know the different algorithms and protocols used to avoid deadlocks and load distribution in distributed OS

To get familiar with different file systems architectures , algorithms to access distributed shared memory

Explain the methods for fault tolerance, failure recovery ,protection and security

Mechanisms to control access to distributed databases.

To know the architecture of multi processor operating system

CSS	**Fault Tolerant Computing**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

OBJECTIVES:

1. To understand the reliability engineering in a system perspective.
2.To determine the type of redundancy either in the form of hardware or software module and the optimum number of redundant units.
3.To understand the fault detection and activation technique of the necessary standby units in the repairable system in a quantitative manner.

Syllabus:

Unit 1: Hardware Fault TolerancePreliminaries - Fault classification- Types of Redundancy; Basic measures of FaultTolerance - Hardware Fault Tolerance - The rate of hardware failures - Failure rate, Reliability, and Mean Time To Failure - Canonical and Resilient Structures - Other Reliability Evaluation Techniques - Fault-Tolerance – Processor-Level techniques –Byzantine Failures.

Unit 2: Information Redundancy and Fault-Tolerant Networks Coding –Resilient Disk Systems; Data Replication-Algorithm-Based FaultTolerance -Measures of Resilience - Common Network Topologies and TheirResilience - Fault-Tolerant Routing.

Unit 3: Software Fault ToleranceAcceptance Tests - Single-Version Fault Tolerance - N-VersionProgramming - RecoveryBlock Approach - Preconditions, Postconditions and Assertions - Exception Handling -Software Reliability Models - Fault-Tolerant Remote Procedure Calls

Unit 4: Checkpointing Checkpointing - Checkpoint Level - Optimal Checkpointing – AnAnalytical Model -Cache-Aided Rollback Error Recovery - Checkpointing in Distributed Systems -Checkpointing in Shared Memory Systems - Checkpointing in Real-Time Systems - Other uses of Checkpointing.

Unit 5: Fault Detection in Cryptographic Systems Overview of Ciphers - Security Attacks through Fault Injection -Countermeasures - Case Studies: Non-Stop Systems - Stratus Systems - Cassini Command and Data Sub-System; IBM G5 - IBM Sysplex –n Itanium.

REFERENCE BOOKS:

1. Israel Koren, C. Mani Krishna: Fault-Tolerant Systems, Elsevier, 2007.2
2. Parag K. Lala,: Fault Tolerant and Fault Testable Hardware Design, BS Publications, 2011.3
3. D. K. Pradhan (Ed): fault Tolerant Computer Systems Design, Prentice Hall, 1996.4
4. K. S. Trivedi: Probability, Statistics with Reliability, Queuing and Computer Science Applications, John Wiley, 2002.

COURSE OUTCOMES:

On successful completion of this course, students should be able to
1. Explain the fundamental concepts of fault-tolerance
2. Explain the appropriate (hardware, software) detection and recovery techniques for a given environment
3. Develop skills in modeling and evaluating fault-tolerant architectures in terms of reliability, availability and safety
4. Explain the merits and limitations of fault-tolerant design [K

CSS	**Real Time Systems**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Objectives:

1. Real-time scheduling and schedulability analysis.
2. Formal specification and verification of timing constraints and properties.
3. Design methods for real-time systems.
4. Development and implementation of new techniques to advance the state-of-the-art real-time systems research.

UNIT -I
INTRODUCTION

Introduction-Issues in Real Time Computing, Structure of a Real Time System. Task Classes, Performance Measures for Real Time Systems, Estimating Program Run
times. Task Assignment and Scheduling-Classical uniprocessor scheduling algorithms, Uniprocessor scheduling of IRIS Tasks, Task Assignment, Mode Changes and Fault Tolerant Scheduling.

UNIT -II
PROGRAMMING LANGUAGES AND TOOLS

Programming Language and Tools–Desired Language
characteristics, Data Typing, Control structures, Facilitating Hierarchical Decomposition, Packages, Run-time(Exception) Error handling, Overloading and Generics, Multitasking, Low Level programming, Task scheduling, Timing Specifications, Programming Environments, Run-time Support.

UNIT -III
REAL TIME DATABASES

Real time Databases-Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency Control Issues, Disk Scheduling Algorithms, Two-phase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time systems.

UNIT -IV
COMMUNICATION
Real-Time Communication-Communications Media, Network Topologies Protocols,
Fault tolerant Routing. Fault Tolerance Techniques-Fault Types, Fault Detection. Fault Error containment Redundancy, Data Diversity, Reversal Checks, Integrated Failure handling.

UNIT- V
EVALUATION TECHNIQUES
Reliability evaluation Techniques-Obtaining Parameter Values, Reliability Models for Hardware Redundancy, Software Error models. Clock Synchronization-Clock, A Nonfault-Tolerant Synchronization Algorithm, Impact of Faults, Fault Tolerant Synchronization in Hardware, Fault Tolerant Synchronization in Software.

Course outcomes:

1. An ability to understand advanced concepts in theory of computer science;
2. An ability to understand advanced concepts in applications of computer science;
3. An ability to apply knowledge of advanced computer science to formulate the analyze problems in computing and solve them;
4. An ability to learn emerging concepts in theory and applications of computer science;
5. An ability to design and conduct experiments as well as to analyze and interpret data; and
6. An ability to function in teams and to communicate effectively.

CSS	Ad-Hoc & Sensor Networks	3L: 0T: 0P	3 Credits

Pre-requisites	

OBJECTIVES:

- The student should be made to:
- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols
- Be familiar with different types of adhoc routing protocols.
- Be expose to the TCP issues in adhoc networks.
- Learn the architecture and protocols of wireless sensor networks.

Detailed Contents:

UNIT I: INTRODUCTION

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum– Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc
and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

UNIT II:MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

UNIT III : ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

UNIT IV : WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS

Single node architecture: hardware and software components of a sensor node – WSN
Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

UNIT V :WSN ROUTING, LOCALIZATION & QOS

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient
Design-Synchronization-Transport Layer issues.

TEXT BOOK:

1. C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols “, Prentice Hall Professional Technical Reference, 2008.
REFERENCES:
1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, “Wireless Sensor Networks”, Elsevier Publication – 2002.
3. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor

Networks-Technology, Protocols, and Applications", John Wiley, 2007.
5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

OUTCOMES:

- Upon completion of the course, the student should be able to:
- Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
- Analyze the protocol design issues of ad hoc and sensor networks.
- Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues.
- Evaluate the QoS related performance measurements of ad hoc and sensor networks

Data Science and Machine Intelligence

CSA	Artificial Intelligence	3L: 0T: 0P	3 Credits

Pre-requisites	

ARTIFICIAL INTELLIGENCE

Course Objectives

1. Student should be able to get the notion of Natural and Artificial Intelligence
2. Student should be able to get the idea of artificial intelligence problems
3. To introduce students to the basic concepts and techniques of Machine Learning.
4. Student should be able to understand the working of an artificial neural network

Syllabus

UNIT-I
Introduction - AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, Constraint Satisfaction Problems, problem solving agents, problem formulation. Searching - Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Greedy best first search, A* search

UNIT – II
Game Playing: Adversial search, Games, minmax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, cutting of search. Knowledge Representation & Reasons logical Agents, Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propositional logic, Resolution, Forward & Backward. Chaining, First order logic, Resolution

UNIT – III
Learning –Types of Machine Learning –Supervised Learning –The Brain and the Neuron –Design a Learning System –Perspectives and Issues in Machine Learning –Concept Learning Task –Concept Learning as Search –Finding a Maximally Specific Hypothesis –Version Spaces and the Candidate Elimination Algorithm –Linear Discriminants –Perceptron –Linear Separability –Linear Regression.

UNIT IV
Linear Models: Multi-layer Perceptron –Going Forwards –Going Backwards: Back Propagation Error –Multi-layer Perceptron in Practice –Examples of using the MLP –Overview –Deriving Back-Propagation –Radial Basis Functions and Splines –Concepts –RBF Network –Curse of Dimensionality –Interpolations and Basis Functions –Support Vector Machines

UNIT – V
Artificial Neural Networks: Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic

Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units.

TextBooks:

1 Artificial Intelligence – A Modern Approach. Third Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education.

2 Stephen Marsland, ―Machine Learning –An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

3 Artificial Neural Networks, B. YagnaNarayana

References

1. Simon Haykin- Neural Networks, Pearsons education asia (2001), II edition.

Course Outcomes

1. Student will be able to get the idea of natural and artificial intelligence
2. Student will be able to formulate and identify some solutions for artificial intelligence problems
3. Distinguish between, supervised, unsupervised and semi-supervised learning
4. Student will be able to understand how neural networks work to solve AI problems

CSA	Machine Learning & Deep Learning	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	Artificial Intelligence

Objectives

4. To study the various probability based learning techniques
5. To understand graphical models of machine learning algorithms
6. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Learning Outcomes

5. Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
6. Design systems that uses the appropriate graph models of machine learning
7. Modify existing machine learning algorithms to improve classification efficiency
8. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.

Syllabus

UNIT I

TREE AND PROBABILISTIC MODELS

Learning with Trees –Decision Trees –Constructing Decision Trees –Classification and Regression Trees –Ensemble Learning –Boosting –Bagging –Different ways to Combine Classifiers –Probability and Learning –Data into Probabilities –Basic Statistics –Gaussian Mixture Models –Nearest Neighbor Methods –Unsupervised Learning –K means Algorithms –Vector Quantization –Self Organizing Feature Map

UNIT II

DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS Dimensionality Reduction –Linear Discriminant Analysis –Principal Component Analysis –Factor Analysis –Independent Component Analysis –Locally Linear Embedding –Isomap –Least Squares Optimization –Evolutionary Learning –Genetic algorithms –Genetic Offspring: -Genetic Operators –Using Genetic Algorithms –Reinforcement Learning –Overview –Getting Lost Example –Markov Decision Process

UNIT III

GRAPHICAL MODELS Markov Chain Monte Carlo Methods –Sampling –Proposal Distribution –Markov Chain Monte Carlo –Graphical Models –Bayesian Networks –Markov Random Fields –Hidden Markov Models –Tracking Methods

UNIT IV

IMPROVING DEEP NEURAL NETS

Regularizing nural networks: Regularization, Dropout Regularization, normalizing inputs, vanishing/ exploding gradients. **Optimization Algorithms:** Mini Batch Gradient Descent, understanding Mini Batch Gradient Descent, RMSprop, adam optimization algorithm, Hyper papameter tuning, Batch Normalization, Introduction to Programming frameworks

UNIT V

DEEP LEARNING MODELS

Convolutional Neural Networks: Architectures of Convolutional Neural Networks, convolution / pooling layers, CNN Example **Unit IV Recurrent Neural Networks:** Why sequence models, Recurrent Neural Networks, different types of RNN,Long Short Term Memory(LSTM), Gated Recurrent Unit(GRU), Encoder Decoder architectures

Text books:

1. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013
2. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press

REFERENCES:

1.Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
2.Jason Bell, ―Machine learning –Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
3.Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014

CSA	Data Mining	3L: 0T: 0P	3 Credits

Pre-requisites	

COURSE OBJECTIVE:

The course aims at providing the student with the concepts related to data warehousing, on-line analytical processing (OLAP) and various techniques used for the functionalities of data mining

SYLLABUS:

UNIT-I
DATA MINING
Data-Types of Data-, Data Mining Functionalities- Interestingness Patterns-Classification of Data Mining systems- Data mining Task primitives -Integration of Data mining system with a Data warehouse-Major issues in Data Mining-Data Preprocessing.

UNIT-II
DATA WAREHOUSE AND BUSINESS ANALYSIS
Data Warehouse-Data Warehouse Architecture- Multidimensional Data Model-Data cube and OLAP Technology-Data Warehouse Implementation -DBMS schemas for Decision support -Efficient methods for Data cube computation.

UNIT-III
ASSOCIATION RULE MINING AND CLASSIFICATION
Mining Frequent Patterns-Associations and correlations- Mining Methods- Mining Various kinds of Association Rules- Correlation Analysis- Constraint based Association mining.- Classification and Prediction- Basic concepts-Decision tree induction-Bayesian classification, Rule-based classification - classification by Back propagation,-Support vector machines-.Associative Classification, Lazy learners-Other classification methods – Prediction.

UNIT-IV
CLUSTERING AND APPLICATIONS
Cluster analysis-Types of Data in Cluster Analysis-Categorization of Major Clustering Methods-Partitioning Methods,-Hierarchical Methods- Density-Based Methods,-Grid-Based Methods,-Model-Based Clustering Methods- Clustering high dimensional data-Constraint- Based cluster analysis-Outlier Analysis

UNIT-V
MINING DATA STREAMS, TIME-SERIES AND SEQUENCE DATA
Basic concepts- Mining data streams-Mining Time-series data--Mining sequence patterns in Transactional databases-.Mining Object- Spatial- Multimedia-Text and Web data- Spatial Data mining- Multimedia Data mining--Text Mining- Mining the World Wide Web.

TEXT BOOKS:

3. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Elsevier.
4. Data Warehousing, Data Mining &OLAP- Alex Berson and Stephen J. Smith- Tata McGraw-Hill Edition, Tenth reprint 2007

REFERENCE BOOKS:

3. Building the DataWarehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd..
4. Data Mining Introductory and Advanced topics –Margaret H Dunham, Pea.

COURSE OUTCOMES:

By the end of the course, students will be able to:

CO1: Define the types of the data to be mined and present a general classification of tasks and Primitives to integrate a data mining system

CO2: Discuss preprocessing statistical methods for any given raw data

CO3: Produce interesting patterns from large amounts of data that can be used for further analysis

CO4: Evaluate the accuracy of supervised and unsupervised models and algorithms

CSA	Soft Computing	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

OBJECTIVES:

- Learn the various soft computing frame works
- Be familiar with design of various neural networks
- Be exposed to fuzzy logic
- Learn genetic programming.

Module 1: INTRODUCTION

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models – important technologies – applications. Fuzzy logic: Introduction – crisp sets- fuzzy sets – crisp relations and fuzzy relations: cartesian product of relation – classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction – biological background – traditional optimization and search techniques – Genetic basic concepts.

Module 2: NEURAL NETWORKS

McCulloch-Pitts neuron – linear separability – hebb network – supervised learning network: perceptron networks – adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network –unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

Module 3: FUZZY LOGIC
Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic – extension principle – fuzzy measures – measures of fuzziness -fuzzy integrals – fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

Module 4: GENETIC ALGORITHM
Genetic algorithm and search space – general genetic algorithm – operators – Generational cycle – stopping condition – constraints – classification – genetic programming – multilevel optimization – real life problem- advances in GA

Module 5: HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS
Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.
TOTAL : 45 PERIODS

TEXT BOOKS:

- J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
- S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCES:

- S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
- George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.
- David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
- James A. Freeman, David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
- Simon Haykin, "Neural Networks Comprehensive Foundation" Second Edition, Pearson Education, 2005.

OUTCOMES: Upon completion of the course, the student should be able to:
- Apply various soft computing frame works.
- Design of various neural networks.
- Use fuzzy logic.
- Apply genetic programming.
- Discuss hybrid soft computing.

CSA	Speech and Natural Language Processing	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives:

- To understand the basic concepts of Natural Language Processing (NLP). The student must be able to apply the various concepts of NLP in other application areas.

Module 1:

Introduction: Origin of Natural Language Processing (NLP), Challenges of NLP, NLP Applications, Processing Indian Languages.

Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Named Entities.

Module 2:

Phrase structure and constituency models: phrase structure grammar; dependency grammar; formal language theory.

Parsing: Definite clause grammars; shift-reduce parsing; chart parsing' Shallow Parsing, Statistical Parsing, Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution, Approaches to discourse, generation.

Language Modeling and Part of Speech Tagging: Markov models, N-grams, estimating the probability of a word, and smoothing, Parts-of-speech, examples and its usage.

Module 3:

Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation.

Meaning: Lexical Knowledge Networks, WorldNet Theory; Indian Language Word Nets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors.

Module 5:

Other Applications: Sentiment Analysis; Text Entailment; Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR. Text-classification.

Text Books:

1. Jurafsky D. and Martin H. J, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Prentice Hall (2014), 2nded.
2. Manning D. C. and Schütze H., Foundations of Statistical Natural Language Processing MIT Press (1999) 1sted.

Reference Books:

1. Dale R., Moisl H. and Somers H., Handbook of Natural Language Processing, CRC Press (2010), 2nded.
2. Bird S., Klein E. and Loper E., Natural Language Processing with Python, Oreilly Publication (2009), 2nd ed.

Course Outcomes:

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

1. Comprehend the concept of natural language processing, its challenges and applications.

2. Comprehend the concepts of words form using morphology analysis.
3. Acquire the knowledge of syntax and semantics related to natural languages.
4. Ability to design and analyze various NLP algorithms.
5. Acquire knowledge of machine learning techniques used in NLP.

CSA	Information Retrieval	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Objectives

- To learn the different models for information storage and retrieval
- To learn about the various retrieval utilities
- To understand indexing and querying in information retrieval systems
- To expose the students to the notions of structured and semi structured data
- To learn about web search

Detailed Contents:

UNIT-I

Introduction, Retrieval Strategies:Vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language Models.

UNIT-II

Retrieval Utilities:Relevance feedback, Clustering, N-grams, Regression analysis, Thesauri.

UNIT-III

Retrieval Utilities:Semantic networks, Parsing Cross-Language Information Retrieval: Introduction, Crossing the language barrier.

UNIT-IV

Efficiency:Inverted index, Query processing, Signature files, Duplicate document detection.

UNIT-V

Integrating Structured Data and Text: A Historical progression, Information retrieval as a relational application, Semi-structured search using a relational schema

Distributed information Retrieval: A Theoretical model of distributed retrieval Web search.

TEXT BOOK

- David A. Grossman, Ophir Frieder, information Retrieval —Algorithms and Heuristics, Springer, 2 Edition (Distributed by Universities Press), 2004.

REFERENCE BOOKS

- Gerald J Kowaiski, Mark T Maybury. Information Storage and Retrieval Systems, Springer, 2000
- Soumen Chakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan-Kaufrnann Publishers, 2002
- Christopher D. Manning, Prabhakar Raghavan, HinñchSchütze, An Introduction to Information Retrieval, Cambridge University Press, Cambridge, England, 2009

Outcomes

- Possess the ability to store and retrieve textual documents using appropriate models
- Possess the ability to use the various retrieval utilities for improving search
- Possess an understanding of indexing and compressing documents to improve space and time efficiency
- Possess the skill to formulate SQL like queries for unstructured data
- Understand issues in web search.

CSA	Neural Networks & Deep Learning	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Objectives

- Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Learning Outcomes

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.

Unit I

Neural networks: Artificial Neural Network, activation function**,** Types of neurons, Learning rules for binary, linear and logistic neurons,FeedForward Neural Networks (FFNN) Backpropagation (BP), BP with weight constraints.Recurrent Neural Networks (RNN)

Unit II

Improving Deep Nural Nets: Regularizing nural networks: Regularization, Dropout Regularization, normalizing inputs, vanishing/ exploding gradients.

Optimization Algorithms: Mini Batch Gradient Descent, understanding Mini Batch Gradient Descent, RMSprop, adam optimization algorithm, Hyper papameter tuning, Batch Normalization,

Introduction to Programming frameworks

Unit III

Convolutional Neural Networks: Architectures of Convolutional Neural Networks, convolution / pooling layers, CNN Example

Unit IV

Recurrent Neural Networks: Why sequence models, Recurrent Neural Networks, different types of RNN,Long Short Term Memory(LSTM), Gated Recurrent Unit(GRU), Encoder Decoder architectures

Unit V

Deep Unsupervised Learning: Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, Adversarial Generative Networks, Autoencoder and DBM
Deep Boltzmann Machines (DBM), Restricted Boltzmann Machines (RBM), Deep neural nets with generative pre- trining.

References:

Coursera courses:
Machine Learning by Andrew Ng https://www.coursera.org/course/ml
Neural networks for Machine Learning by Geoff Hinton https://www.coursera.org/course/neuralnets

Reference Books

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press
2. OReilly.Hands-On.Machine.Learning.with.Scikit-Learn.and.TensorFlow

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CSA	Multi-Agent Intelligent Systems	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objective:

- To introduce the student to the concept of an agent and multi-agent systems, and the main applications for which they are appropriate;
- To introduce the main issues surrounding the design of intelligent agents;
- To introduce the main issues surrounding the design of a multi-agent society.
- To introduce a contemporary platform for implementing agents and multi-agent systems

Module 1:

•Introduction: what is an agent?: agents and objects; agents and expert systems; agents and distributed systems; typical application areas for agent systems.

Module 2:

•Intelligent Agents: the design of intelligent agents - reasoning agents (egAgentO), agents as reactive systems (egsubsumption architecture); hybrid agents (eg PRS); layered agents (egInterrap) a

contemporary (Java-based) framework for programming agents (eg the Jack language, the JAM! system).

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Module 3:
•Multi-Agent Systems: Classifying multi-agent interactions - cooperative versus non-cooperative; zero-sum and other interactions; what is cooperation? how cooperation occurs - the Prisoner's dilemma and Axelrod's experiments; Interactions between self-interested agents: auctions & voting systems: negotiation;

Module 4:
Interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination; Interaction languages and protocols: speech acts, KQML/KIF, the FIPA framework.

Module 5:
•Advanced topics: One issue selected from the contemporary research literature.

Recommended Texts

- An Introduction to MultiAgent Systems - Second Edition. Michael Wooldridge (Wiley, 2009)
- Programming Multi-agent Systems in AgentSpeak Using Jason. Rafael H. Bordini, Jomi Fred Hubner and Michael Wooldridge (Wiley, 2007)

Course Outcomes:

At the end of the module, the student will be able to demonstrate:

- Understand the notion of an agent, how agents are distinct from other software paradigms (eg objects) and understand the characteristics of applications that lend themselves to an agent-oriented solution;
- Understand the key issues associated with constructing agents capable of intelligent autonomous action, and the main approaches taken to developing such agents;
- Understand the key issues in designing societies of agents that can effectively cooperate in order to solve problems, including an understanding of the key types of multi-agent interactions possible in such systems
- Understand the main application areas of agent-based solutions, and be able to develop a meaningful agent-based system using a contemporary agent development platform.

CSA	Data Analytics	3L: 0T: 0P	3 Credits

Pre-requisites	

Course objectives

8. To understand the fundamentals of statistics
9. To calculate the measures of central tendency, asymmetry and variability
10. To distinguish and work with different types of distributions
11. To estimate confidence intervals for population parameters
12. To understand z-test, t-test, chi-square test, ANOVA
13. To understand mechanics of regression analysis
14. To calculate correlation and covariance

Detailed contents

Unit-I

Introduction to Analytics: why analytics, types of analytics, framework for data driven decision making. Descriptive Analytics: types of data measurement scales, population, sample, measures of central tendency, measures of variation, shape, data visualization techniques. Probability distributions: Random variables, Probability Density Function, Cumulative Distribution Function, PMF, Discrete distributions- binomial, Poisson, geometric distributions, Continuous distributions- uniform, exponential, normal distribution and other distributions(chi-square, t, F)

Unit-II

Hypothesis testing-I: sampling & estimation- sampling, types of sampling, sampling distribution, central limit theorem, sample size estimation, estimation of population parameters, confidence intervals- Confidence intervals for population mean, population proportion. Introduction to hypothesis testing- basics, z-test, t-test, one tailed & two-tailed tests, type-I error, type-II error.

Unit-III

Hypothesis Testing-II: Comparing two populations –two sample z-test & t-test, hypothesis test for difference in population proportion, hypothesis test for equality of population variances, chi-square test, goodness of fit test, F-test, analysis of variance(ANOVA) –multiple t-tests for comparing several means, one way ANOVA.

Unit-IV

Correlation & Regression: Introduction to correlation, correlation coefficient, correlation Vs Causation, coefficient of determination. Simple linear regression –model building, estimation of parameters using ordinary least squares, validation of regression model, multiple linear regression-ordinary least square estimation of MLR, validation, logistic regression.

Unit-V

Case studies with python or R: problems related to data visualization, hypothesis testing, ANOVA, classification and regression.

Course outcomes:

Students will be able to

5. Plot different types of data
6. Perform hypothesis testing
7. Carry out regression analysis
8. Make data driven decisions

Suggested textbooks:

2. U Dinesh Kumar, Business Analytics-The science of Data driven decision making, Wiley publications

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Applications:

CSA	Image Processing	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives :

Learn and understand the representation of Two Dimensional Linear shift invariant Systems using Matrices
To underatand the acquisition of digital images
Learn and implement the algorithms for basic image processing applications such as image enhancement.
Formulate and solve the optimization problems to achieve image restoration from degraded images
To implement ,analyze ,and asses the performance of the image processing algorithms.

Course Outcomes :

To introduce the applications of the Digital image processing in different research fields, and learn the Mathematical preliminaries required for analyzing two dimensional systems .
To underatand the acquisition of digital images
Demonstrated understanding of Image transforms such as Discrete Fourier Transform, Cosine Transform ,Hadamard Transform , and KLT.
Demonstrated understanding of image enhancement techniques
Understanding of formulation and solution of image restoration techniques.

Unit – I

Introduction to Digital Image Processing, Origins and Applications of Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Digital Image Processing System, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization.

Unit – II

Filtering in the Frequency Domain: Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform (DFT) of one Variable, Extension to Function Two Variables, Some Properties of the 2-D Discrete Fourier Transform, Image Smoothing and Sharpening using Frequency Domain Filters.

Unit – III

Intensity Transformations and Spatial Filtering: Histogram Processing, Fundamental of Spatial Filtering, Smoothing and Sharpening Spatial Filters
Image Segmentation: Point, Line and Edge Detection, Thresholding, Region-Based Segmentation.

Unit – IV

Image Compression: Fidelity Criteria, Image Compression Models, Image Formats, Containers and Compression Standards, Compression Methods: Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding.

Unit – V

Restoration: Noise Models, Inverse filtering, Least squares Filtering.
Introduction to Color Image Processing and Video Processing.

Suggested Reading:

1.Gonzalez R.C., Woods R.E: Digital Image Processing, Pearson Education, Third Edition 2008.
2.William K. Pratt, "Digital Image Processing", John Wiley & sons Inc. 3rd Edition, 2001.
3.McAndrew, Introduction to Digital Image Processing, Cengage Learning 2004.
4. Sonka, H;avac, Boyle, Digital Image Processing and Computer Vision, Cengage learning, 2008. 5.Rosenfeld A. Kak AC., Digital Picture Processing Vol. I & II Acad, Press, 2 nd Edition, 1982

CSA	Digital Signal Processing	3L: 0T: 0P	3 Credits

Pre-requisites	

Objectives:

To make students familiar with the most important methods in DSP, including **digital** filter design, transform-domain **processing** and importance of **Signal Processors**.

To make students aware about the meaning and implications of the properties of systems and **signals**.

UNIT I

Discrete time signals ans Systems:

Introduction to DSP, Applications of DSP, Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals;

Discrete systems attributes, Representaion of system with Difference equations and Impulse response calculation, LSI systems, Cirular Convolution with examples

UNIT II

Frequency domain analysis

Review of DTFT, Discrete Fourier Transform (DFT) with Properties, Computation of Linear and circular convolution using DFT, Fast Fourier Transform Algorithm,

Z transform, ROC, Properties, System description in the frequency domain.

UNIT III

Digital filters and finite word length effects

Linear Phase filters, Analysis of simple digital filters,Comb filters, all-pass functions, Procedure for stability criteria of discrete systems

Effect of finite register length in FIR filter design.

Unit IV

Digital Filter Structures:

Direct,parallel, cascade, ladder and lattice for Infinite Impulse Response (IIR) filters

Possible realizations for FIR or Finite Impulse Response filters, including poly phase.

UNIT V

Design of Digital filters:

Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters, invariant and bilinear transformations

Designof FIR Digital filters: Windowmethod, and frequency response sampling techniques

Text/Reference Books:

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, AlgorithmsAnd Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, PrenticeHall, 1992.

Course Outcomes:

At the end of this course students will demonstrate the ability to

Represent signals mathematically in continuous and discrete time and frequency domain
Get the response of an LSI system to different signals
Design of different types of digital filters for various applications

CSA	Cloud Computing	3L: 0T: 0P	3 Credits

Pre-requisites	

COURSE OBJECTIVE:

This course is introduced to be familiar with how to apply trust-based security model to real-world security problems through cloud infrastructures

SYLLABUS:

UNIT – I

Introduction to Cloud Computing: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

UNIT – II

Cloud Computing Architecture: Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model **Cloud Deployment Models**: Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.

UNIT – III

Security Issues in Cloud Computing: Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security.

Identity and Access Management: Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

UNIT – IV

Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS.

Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations.

UNIT – V

Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud.
Advanced Topics: Recent developments in hybrid cloud and cloud security.

TEXT BOOK:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton Publication.

REFERENCE BOOK:

1. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, O'Reilly Media, 2009

COURSE OUTCOMES:

By the end of the course, students will be able to:

CO 1: Describe the basic cloud types and delivery models

CO 2: Identify the security aspects of each cloud model

CO 3: Develop a risk-management strategy for moving to the Cloud

CO 4: Implement a public cloud instance using a public cloud service provider

CO 5: Apply trust-based security model to different layer

CSA	Human Computer Interaction	3L: 0T: 0P	3 Credits

Pre-requisites	

The detailed syllabus for Human Computer Interaction is as follows

OBJECTIVES: The student should be made to:

- Learn the foundations of Human Computer Interaction
- Be familiar with the design technologies for individuals and persons with disabilities
- Be aware of mobile HCI
- Learn the guidelines for user interface.

UNIT I : FOUNDATIONS OF HCI

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT II : DESIGN & SOFTWARE PROCESS [9 hours]

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III : MODELS AND THEORIES [9 hours]

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV : MOBILE HCI [9 hours]

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V : WEB INTERFACE DESIGN [9 hours]

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

TOTAL: 45 PERIODS

OUTCOMES: Upon completion of the course, the student should be able to:

- Design effective dialog for HCI.
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- Develop meaningful user interface.

TEXT BOOKS:

- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)

- Brian Fling, “Mobile Design and Development”, First Edition , O‟Reilly Media Inc., 2009 (UNIT –IV)

Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O‟Reilly, 2009.(UNIT-V)

CSA	Computer Graphics	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives:

- To make students understand about fundamentals of Graphics to enable them to design animated scenes for virtual object creations.
- To make the student present the content graphically.

UNIT – I Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices Output primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood fill algorithms.

UNIT – II 2-D Geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to viewport coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

UNIT – III 3-D Object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B-spline surfaces, sweep representations, octrees BSP Trees, 3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT – IV Visible surface detection methods: Classification, back-face detection, depth-buffer, scanline, depth sorting, BSP-tree methods, area sub-division and octree methods Illumination Models and Surface rendering Methods: Basic illumination models, polygon rendering methods

UNIT- V Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications

TEXT BOOKS:

- "Computer Graphics C version", Donald Hearn and M. Pauline Baker, Pearson education.
- "Computer Graphics Second edition", Zhigand xiang, Roy Plastock, Schaum's outlines, Tata Mc Graw hill edition.

REFERENCE BOOKS:

1. "Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
2. "Procedural elements for Computer Graphics", David F Rogers, Tata Mc Graw hill, 2nd edition.
3. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
4. "Principles of Computer Graphics", Shalini, Govil-Pai, Springer.
5. "Computer Graphics", Steven Harrington, TMH
6. Computer Graphics, F. S. Hill, S. M. Kelley, PHI.
7. Computer Graphics, P. Shirley, Steve Marschner & Others, Cengage Learning.
8. Computer Graphics & Animation, M. C. Trivedi, Jaico Publishing House.
9. An Integrated Introduction to Computer Graphics and Geometric Modelling, R. Goldman, CRC Press, Taylor&Francis Group.
10. Computer Graphics, Rajesh K.Maurya, Wiley India.

Course Outcomes:

- Students can animate scenes entertainment.
- Will be able work in computer aided design for content presentation..
- Better analogy data with pictorial representation.
- Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
- Use of geometric transformations on graphics objects and their application in composite form.

CSA	VLSI System Design	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives:

To study the MOS transistors with their characteristics succeeded by the fabrication process. Making aware of VLSI design flow and gaining knowledge on its basic micron constraints for a panoramic view of transistors

Understanding various subsystem design concepts and its internal schematics.
Comparison of various programmable logic devices in terms of applications
To understand the need for testing a VLSI chip by applying the Engineering skills to meet the challenges in semiconductor industries.

UNIT I: INTRODUCTION

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies-
Oxidation, Lithography, Diffusion, Ion implantation, Metallization,. Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit o; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT II: VLSI CIRCUIT DESIGN PROCESSES

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 m CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT III: GATE LEVEL DESIGN

Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance RS and its concept to MOS, Area Capacitance Units, Calculations- Delays, driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layersSUBSYSTEM DESIGN: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

UNIT IV: SEMICONDUCTOR INTEGRATED CIRCUIT DESIGN

PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach.
Conceptof Programmable logic devices like FPGA. Logic implementation using ProgrammableDevices.

UNIT V: CMOS TESTING

CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level
Test Techniques, System-level Test Techniques, Layout Design for improved Testability.

TEXTBOOKS :

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, EshraghianDougles and A. Pucknell, PHI, 2005 Edition.
2. Principles of CMOS VLSI Design – Weste and Eshraghian, Pearson Education, 1999.

REFERENCES::

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, – John P. Uyemura, Thomson Learning.
2. Introduction to VLSI Circuits and Systems – John .P. Uyemura, JohnWiley, 2003.
3. Digital Integrated Circuits – John M. Rabaey, PHI, EEE, 1997.
4. Modern VLSI Design – Wayne Wolf, Pearson Education, 3rd Edition, 1997.
5. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

Course Outcomes:

Students will be Analyzed with various processing steps involved in IC on monolithic devices followed by understanding MOSFETS electrical properties.

Applying the knowledge of layout, stick diagrams, static and switching characteristics of inverters by CMOS technology for designing a sequential circuit.
Students will be good at Realizing CMOS as a switch and its technology for designing a combinational circuit by implementing it using transmission gate/PLD's.
Students will be knowing the ability to identify, formulate, and analyze by creating an ability to use the techniques, skills and modern EDA tools necessary for design and test of VLSI circuits by keeping aware of contemporary issues.
Students will be good at designing VLSI systems by keeping a view on the design for testability concepts.

CSA	Optimization Techniques	3L: 0T: 0P	3 Credits

Pre-requisites	

Course Objectives:

- To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
- Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project implementation.

UNIT – I Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.
UNIT – II Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm. Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.
UNIT – III Unconstrained Nonlinear Programming: One dimensional minimization methods, Classification, Fibonacci method and Quadratic interpolation method Unconstrained Optimization

Techniques: Univariant method, Powell's method and steepest descent method.
UNIT – IV Constrained Nonlinear Programming: Characteristics of a constrained problem – classification – Basic approach of Penalty Function method – Basic approach of Penalty Function method – Basic approaches of Interior and Exterior penalty function methods – Introduction to convex programming problem.
UNIT – V Dynamic Programming: Dynamic programming multistage decision processes – types –concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution – examples illustrating the tabular method of solution.
Course Outcomes:
After completion of this course, the student will be able to

- explain the need of optimization of engineering systems
- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
- apply unconstrained optimization and constrained non-linear programming and dynamic programming
- Formulate optimization problems.

TEXT BOOKS:

- Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
- H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

REFERENCE BOOKS:

- George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
- H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
- Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

CSA	**Cryptography and Network Security**	**3L: 0T: 0P**	**3 Credits**

Pre-requisites	

Course Objectives:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks
- Describe public-key cryptosystem.
- Describe the enhancements made to IPv4 by IPSec
- Understand Intrusions and intrusion detection
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.
- Discuss Web security and Firewalls

Course Outcomes:

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

UNIT – I: Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security, Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.
UNIT – II: Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.
UNIT – III: Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure
UNIT – IV:Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security
UNIT – V: E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.
TEXT BOOKS:

- Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition
- Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

REFERENCE BOOKS:

- Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
- Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
- Information Security, Principles, and Practice: Mark Stamp, Wiley India.
- Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
- Introduction to Network Security: Neal Krawetz, CENGAGE Learning
- Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

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