

Academic Regulations, Curriculum and Syllabi 2023

B. Tech. Computer Science and Engineering (Duration of Study: 4 years)



Department of Computer Science and Engineering
GMR Institute of Technology
Rajam, Andhra Pradesh
(An Autonomous Institute, Affiliated to JNTUGV, Vizianagaram, AP)
NBA Accredited and NAAC Accredited



Academic Rules and Regulations

2023

Undergraduate Programs



GMR Institute of Technology
Rajam 532 127, Andhra Pradesh
(An Autonomous Institute, Affiliated to JNTUGV, Vizianagaram, AP)
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The Vision of GMRIT

- ❖ To be among the most preferred institutions for engineering and technological education in the country
- ❖ An institution that will bring out the best from its students, faculty and staff – to learn, to achieve, to compete and to grow – among the very best
- ❖ An institution where ethics, excellence and excitement will be the work religion, while research, innovation and impact, the work culture

The Mission of GMRIT

- ❖ To turnout disciplined and competent engineers with sound work and life ethics
- ❖ To implement outcome based education in an IT-enabled environment
- ❖ To encourage all-round rigor and instill a spirit of enquiry and critical thinking among students, faculty and staff
- ❖ To develop teaching, research and consulting environment in collaboration with industry and other institutions

Department Vision

To be a preferred department of learning for students and teachers alike, with a commitment towards Academics & Research, serving the students in an atmosphere of innovation, critical thinking and making them Industry ready.

Department Mission

M1: To provide adaptable education in a collaborative and innovative environment in skilling the graduates to solve real world problems in the field of Computer Science and Engineering

M2: To prepare the students as critical thinking professionals with multidisciplinary research orientation and Innovation

M3: To instil ethical values and nurture the graduates who will be able to contribute to society

Program Educational Objectives

PEO 1: Employ logical and analytical skills in solving complex real-world engineering problems in the areas of computer Science and allied fields..

PEO 2: Adaptable to emerging technologies with enhanced professional skills and ability towards continuous learning, facilitating higher studies and research.

PEO 3: Demonstrate professional ethics, leadership qualities and promote inclusive and collaborative growth with human values towards societal interest.

Program Outcomes

Engineering graduate will be able to

PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. ([Engineering knowledge](#))

PO 2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. ([Problem analysis](#))

PO 3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. ([Design/development of solutions](#))

PO 4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. ([Conduct investigations of complex problems](#))

PO 5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. ([Modern tool usage](#))

PO 6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. ([The engineer and society](#))

PO 7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. ([Environment and sustainability](#))

PO 8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. ([Ethics](#))

PO 9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. ([Individual and team work](#))

PO 10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. [\(Communication\)](#)

PO 11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. [\(Project management and finance\)](#)

PO 12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. [\(Life-long learning\)](#)

PSO1: Ability to apply the software engineering principles to meet automation of the process and service industries apart from the community utilities.

[\(Program Specific\)](#)

PSO2: Ability to design, develop and implement management systems, E-Commerce tools and Web Apps for product development. [\(Program Specific\)](#)

Department of Computer Science and Engineering

Minimum Credits to be earned: 160 (for Regular Students) 120 (for Lateral Entry Students)

First Semester (Pattern-I/Pattern-II)							
No.	Course Code	Course	POs	L	T	P	Credits
1	23PYX01/ 23CYX01	Engineering Physics/Chemistry	1,2,7,10,12/1, 2,6,7,12	3/3	0	0	3/3
2	23MAX01/ 23MAX02	Linear Algebra& Calculus/Differential Equations and Vector calculus	1,2,3,4,12/1,2, 3,4,12	3/3	0	0	3/3
3	23BEX01/ 23BEX02	Basic Electrical and Electronics Engineering/ Basic Civil & Mechanical Engineering	1,3,6,7,9,12/1, 2,3,6,7,8,12	3/3	0	0	3/3
4	23BEX03	Introduction to Programming	1,2,3,12	3	0	0	3
5	23BEX04/ 23HSX01	Engineering Graphics/Communicative English	1,5,10,12/1,9, 10,11,12	2/2	0	2/0	3/2
6	23PYX02/ 23CYX03	Engineering Physics Lab/Chemistry Lab	4,6,9,11,12/1, 6,7,9,12	0	0	2/2	1/1
7	23BEX05/ 23BEX06	Electrical & Electronics Engineering workshop/Engineering Workshop	4,5,6,9,12/1,9, 12	0	0	3/3	1.5/1.5
8	23BEX07	Computer Programming Lab	2,3,4,12	0	0	3	1.5
9	23HSX11	-/ECA (Yoga / Sports)	-	-	-	-/1	-/0.5
10	23HSX12	-/CCA (NSS/NCC/Community Service)	-	-	-	-/1	-/0.5
11	23BEX08	IT Workshop/-	1,2,3,4,9,12	0	0	2/-	1/-
12	23HSX02	- /Communicative English Lab	1,9,10,11,12	0	0	-/2	-/1
Total				14/14	0	12/12	20/20
Second Semester(Pattern-I/Pattern-II)							
1	23HSX01/ 23BEX04	Communicative English/ Engineering Graphics	10,12/1,5,10	2/2	0	0/2	2/3
2	23MAX02/ 23MAX01	Differential Equations and Vector calculus/Linear Algebra & Calculus	1,2,3,4,12/1,2, 3,4,12/	3/3	0	0	3/3
3	23CYX01/ 23PYX01	Chemistry /Engineering Physics	1,2,6,7,12/1,2, 7,10,12	3/3	0	0	3/3
4	23BEX02/ 23BEX01	Basic Civil & Mechanical Engineering/ Basic Electrical and Electronics Engineering	1,2,3,6,7,8,12/ 1,3,6,7,9,12	3/3	0	0	3/3
5	23CS201	Data Structures (CSE, CSE-AI&DS, CSE-AI&ML, IT)	1,2,3,12,PS01	3/3	0	0	3/3
6	23CYX03/ 23PYX02	Chemistry Lab / Engineering Physics Lab	1,6,7,9,12/4,6, 9,11,12	0	0	2/2	1/1
7	23BEX06/ 23BEX05	Engineering Workshop/Electrical & Electronics Engineering workshop	1,9,12/1,4,5	0	0	3/3	1.5/1.5
8	23BEX08	IT Workshop/-	1,2,3,4,9,12	0	0	2/-	1/-
9	23HSX02	Communicative English Lab/-	1,9,10,11,12	0	0	2/-	1/-
10	23CS202	Data Structures Lab (CSE, CSE-AI&DS, CSE-AI&ML, IT)	2,3,4,12,PS01	0	0	3/3	1.5/1.5
11	23HSX11	-/ECA (Yoga/ Sports)	-	-	-	-/1	-/0.5
12	23HSX12	-/CCA (NSS/NCC/Community Service)	-	-	-	-/1	-/0.5
Total				14/14	0	12/12	20/20

Third Semester							
No.	Course Code	Course	POs	L	T	P	Credits
1	23CS301	Problem solving using Python	1,2,3,5,12	3	-	2	4
2	23HSX10	Engineering Economics and Project Management	1,2,10,11,PS02	3	-	-	3
3	23CS303	Design and Analysis of Algorithms	1,2,3,PO12,PS01	3	-	-	3
4	23CS304	Digital Logic Design	1,2,3,4,5,PS01	3	-	2	4
5	23CS305	Discrete Mathematical Structures	1,2,3,12,PS01	3	-	-	3
6	23CS306	Object Oriented Programming with JAVA	1,2,3,PO12,PS02	3	-	-	3
7	23CS307	Design and Analysis of Algorithms Lab	1,2,3,4,10,12,PS01	-	-	3	1.5
8	23CS308	JAVA Lab	1,2,3,4,10,12,PS02	-	-	3	1.5
9	23ESX01	Employability Skills I	1,2,3,4,5,9,10,11,12	0	-	2	-
Total				18	-	12	23
Fourth Semester							
1	23IT304	Database Management Systems	1,2,3,10,12,PS02	3	-	-	3
2	23IT403	Operating Systems	1,2,12,PS01,PS02	3	-	-	3
3	23CS403	Computer Organization and Architecture	1,2,3,12,PS01	3	-	-	3
4	23MA404	Probability and Statistics using Python	1,2,4,10,12	3	-	2	4
5	23CS405	Web Coding and Development	1,2, 3, 5, 8, PS02	3	-	-	3
6	23IT308	Database Management Systems Lab	1,2,3,8,10,12,PS02	-	-	3	1.5
7	23CS407	Web Coding and Development Lab	1,2,3,4,5,8,10,PS02	-	-	3	1.5
8	23ESX01	Employability Skills I	1,2,3,4,5,9,10,11,12	0	-	2	2
Total				15	-	10	21
Fifth Semester							
1	23EC502	Microprocessors and Microcontrollers (Integrated)	1,2,3,4,5,PS01	3	-	2	4
2	23CS502	Artificial Intelligence and Machine Learning	1,2,3,4,PS01,PS02	3	-	-	3
3	23CS503	Computer Networks (Integrated)	1,2,4,5,PS01	3	-	2	4
4	23CS504	Theory of Computation	1, 2,3,PS01	3	-	-	3
5		Elective I (Professional Elective)		3	-	-	3
6		Elective II (Open Elective I)		3	-	-	3
7	23CS507	Artificial Intelligence and Machine Learning Lab	1,4,5,12,PS01,PS02	-	-	3	1.5
8	23TPX01	Term Paper	1,4,10,12	-	-	3	1.5
9	23ESX02	Employability Skills II	1,2,3,5,8,10,12	0	-	2	-
10	23SIX01	Summer Internship I	1,2,8,10,12	-	-	-	1
Total				18	-	12	24
Sixth Semester							
1	23CS601	Compiler Design	1, 2,12,PS01	3	-	-	3
2	23CS602	Cryptography and Network Security	3, 6,8,12	3	-	-	3
3	23CS603	Software Engineering	1,2,3,5,11,PS01	3	-	-	3
4		Elective III (Professional Elective)		3	-	2	4
5		Elective IV (Open Elective II)		3	-	-	3
6	23CS606	Case Tools Lab	3,4,5,11,PS01	-	-	3	1.5
7	23MPX01	Mini Project	All POs & PSOs	-	-	3	1.5
8	23ESX02	Employability Skills II	1,2,5,8,10,12	0	-	2	2
9	23ATX01	Environmental Studies	1,7	-	-	-	-
10	23ATX02	Professional Ethics and Human Values	----	-	-	-	-
11	23ATX03	Indian Knowledge Systems	----	-	-	-	-
12	23ATX---	Audit Course	----	-	-	-	-

			Total	15	-	10	21
Seventh Semester							
1		Elective V (Professional Elective)		3	-	-	3
2		Elective VI (Professional Elective)		3	-	-	3
3		Elective VII (Open Elective III)		3	-	-	3
4	23SIX02	Summer Internship II	1,2,5,6,10,12	-	-	-	1
5	23PWX01	Project	All POs& PSOs	-	-	16	8
			Total	9	-	16	18
Eighth Semester							
1		Elective VIII (Professional Elective)		-	-	-	3
2		Elective IX (Open Elective IV)		-	-	-	2
3	23FIX01	Full Semester Internship (FSI)	1,2,5,8,9,10, PS01,PS02	-	-	-	8
			Total	-	-	-	13

List of Electives

Elective I							
Career Path I ,II,III and other Core Electives							
1	23CSC11	Artificial Neural Networks (AI&ML)	1,2,3,5,12	3	-	-	3
2	23CSC21	Backend Programming Languages (Full Stack Developer)	1,2,3,5,PS01,PS02	3	-	-	3
3	23ITC31	Fundamentals of Security (Cyber Security)	1,2,3,4,PS01,PS02	3	-	-	3
4	23MLC31	Fundamentals of Cloud Computing (Cloud Computing)	1,2,3,4,5,PS01,PS02	3	-	-	3
5	23CS004	Principles of Programming Languages	1, 2, 3, 4, PS01	3	-	-	3
6	23CS005	Mobile Computing	1,3, 8,10,12,PS02	3	-	-	3
7	23CS006	Distributed Operating Systems	1,2,3,12,PS01,PS02	3	-	-	3
Elective II							
Open Electives							
1	2300511	Data Wrangling and Preprocessing	1,2,3,5,12,PS01	3	-	-	3
Elective III							
Career Path I ,II,III and other Core electives							
1	23CSC12	Deep Learning (AI&ML)	1,2,3,4,5,PS01	3	-	2	4
2	23CSC22	Web Application Framework (Full Stack Developer)	1,2,3,5,PS01, PS02	3	-	2	4
3	23ITC32	Cybernet Security (Cyber Security)	1,3,4,12,PS01,PS02	3	-	2	4
4	23MLC32	Cloud Services using AWS(Cloud Computing)	1,2,3,4,5,PS01	3	-	2	4
5	23CS007	Cloud Computing Essentials	1,3,6,7,8,9	3	-	2	4
6	23CS008	Internet of Things	1,3,4,7,PS01	3	-	2	4
Elective IV							
Open Electives							
1	2300512	Data Visualization Techniques	1,2,3,PS01,PS02	3	-	-	3
Elective V							
Career Path I ,II,III and other Core electives							
1	23CSC13	Natural Language Processing (AI&ML)	2,3,4,12,PS01	3	-	-	3
2	23CSC23	Web Application Databases (Full Stack Developer)	1,3,5,PS01	3	-	-	3
3	23ITC33	Cloud Security (Cyber Security)	1,2,4,8,12,PS02	3	-	-	3
4	23MLC33	Cloud Security Essentials (Cloud Computing)	1,2,3,4,5,PS01	3	-	-	3
5	23IT010	Social Network Analysis	1,2,7,12,PS02	3	-	-	3
6	23CS011	Optimization Techniques	1,2, 3, 5,12	3	-	-	3
7	23CS012	Wireless Adhoc Networks	1,2,3,6,7,10	3	-	-	3

Elective VI: Professional Elective							
1	23CS014	Green Computing	1,2,3,6,7	3	-	-	3
2	23CS015	Software Project Management	1,2,3,11,12,PSO2	3	-	-	3
3	23CS016	Soft Computing	1,2,3,4,12,PSO2	3	-	-	3
Elective VII:							
Open Electives							
1	23O0513	Time series Analysis and Forecasting	1,2,3,PSO1	3	-	-	3
Elective VIII: Professional Elective							
1	23CS017	Fundamentals of Social Network Analysis	1,2, 4,5,10	-	-	-	3
2	23CS018	Information Retrieval Systems	1,2,3,4,10,PSO2	-	-	-	3
3	23CS019	Fundamentals of Devops	1,2,3,11,PSO2	-	-	-	3
Elective IX:							
Open Electives							
1	23O0514	AI for Business Intelligence	1,2,4,5,PSO1	2	-	-	2

Audit Course							
1	23AT001	Communication Etiquette in Workplaces	-	-	-	-	-
2	23AT002	Contemporary India: Economy, Policy and Society	-	-	-	-	-
3	23AT003	Design The Thinking	-	-	-	-	-
4	23AT004	Ethics and Integrity	-	-	-	-	-
5	23AT005	Indian Heritage and Culture	-	-	-	-	-
6	23AT006	Intellectual Property Rights and Patents	-	-	-	-	-
7	23AT007	Introduction to Journalism	-	-	-	-	-
8	23AT008	Mass Media Communication	-	-	-	-	-
9	23AT009	Science, Technology and Development	-	-	-	-	-
10	23AT010	Social Responsibility	-	-	-	-	-
11	23AT011	The Art of Photography and Film Making	-	-	-	-	-
12	23AT012	Gender Equality for Sustainability	-	-	-	-	-
13	23AT013	Women in Leadership	-	-	-	-	-
14	23AT014	Introduction to Research Methodology	-	-	-	-	-
15	23AT015	Climate Change and Circular Economy	-	-	-	-	-

B. Tech. (Honors)							
Domain I (Data Engineering)							
1	23CSH11	Advanced Data Structures	2,3,4	4	-	-	4
2	23CSH12	Advanced Databases	2,3,4	4	-	-	4
3	23CSH13	Programming, Data Structures and Algorithms Using Python	2,3,4,5	4	-	-	4
4	23CSH14	Bioinformatics	2,3	4	-	-	4
5		MOOCs		4	-	-	4
Domain II (Modern Software Engineering)							
1	23CSH21	DevOps	1,3,5,8,10	4	-	-	4
2	23CSH22	Design Patterns	2,3	4	-	-	4
3	23CSH23	Advanced Software Engineering	1,3,4, PSO1	4	-	-	4
4	23CSH24	Robotic Process Automation	3,5, 8, PSO2	4	-	-	4
5		MOOCs		4	-	-	4
Domain III (Security)							
1	23CSH31	Computer Systems Security	1,2	4	-	-	4
2	23CSH32	Python Programming for Security	2,3,4	4	-	-	4
3	23CSH33	Management of Information Security	3,6,7	4	-	-	4
4	23CSH34	Computer Forensics	2,3	4	-	-	4
5		MOOCs		4	-	-	4
Domain IV (User Interface Design)							
1	23CSH41	Computer Graphics	1,2,3,4	4	-	-	4
2	23CSH42	Multimedia Systems	3,4	4	-	-	4

3	23CSH43	Human Computer Interaction	2,3	4	-	-	4
4	23CSH44	Mobile Programming	3,4	4	-	-	4
5		MOOCs		4	-	-	4

B. Tech. (Minors)**Computer Science and Engineering**

1	23CSM01	Data Structures and Algorithms Using Python	--	4	-	-	4
2	23CSM02	Fundamentals of Data Base Management System	--	4	-	-	4
3	23CSM03	Fundamentals of Computer Networks & Operating Systems	--	4	-	-	4
4	23CSM04	Foundations of Software Engineering	--	4	-	-	4
5	23CSM05	Fundamentals of Web Development(MOOCs)	--	4	-	-	4

23PYX01 - ENGINEERING PHYSICS
(Common to all branches of Engineering)

3 0 0 3

Course Outcomes

1. Comprehend the basic principle of diffraction and observe the diffraction pattern in various cases
2. Illustrate the concepts of Interference and polarisation and their applications
3. Understand the space lattices and crystal symmetry
4. Summarize the fundamental concepts of quantum mechanics
5. Explore the properties and applications of dielectric and magnetic materials
6. Demonstrate the conduction process of charge carriers in semiconductors

COs – POs Mapping

COs	PO1	PO2	PO7	PO10	PO12
1	3	2	1	1	1
2	3	2	1	1	1
3	3	2	1	1	1
4	3	2	1	1	1
5	3	2	1	1	1
6	3	2	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit: I Wave Optics

13 Hours

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates

UNIT II Crystallography and X-ray diffraction

10 Hours

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC – Miller indices – separation between successive (hkl) planes. *X-ray diffraction:* Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT III Dielectric and Magnetic

12 Hours

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector –Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius-Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials

Unit: IV Quantum Mechanics, Free electron theory and Semiconductors

13 Hours

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy.

Semiconductors: Semiconductors: Formation of energy bands – classification of crystalline solids – Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications

Total: 48 hours

Textbooks:

1. A Text book of Engineering Physics - M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).
3. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning

Reference Books:

1. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
2. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
3. Engineering Physics - D.K.Bhattacharya and PoonamTandon, Oxford press (2015).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	
Understand	50	50	
Apply	10	10	70
Analyze			30
Evaluate			
Create			
Total (%)	100	100	100

Sample Question (s)

Remember

1. Define Polarization of light
2. State Bragg's law of x-ray diffraction
3. Define Bohr magneton
4. List any two merits of classical free electron theory

Understand

1. Draw and explain the variation in intensity in diffraction due to single slit
2. Explain with diagram the Powder method of X-ray diffraction
3. Explain hysteresis behavior of ferromagnetic materials
4. Derive Schrodinger's time dependent wave equation

Apply

1. A parallel beam of light of wavelength $6000 \text{ \AA}$ is incident on a thin glass plate of refractive index 1.5 such that the angle of refraction into the plate is 50° . Find the least thickness of the glass plate which will appear dark by reflection.
2. Draw and label (1 0 0), (0 2 0), (0 2 2) crystallographic planes.
3. Draw and compare soft and hard magnetic materials based on their hysteresis loops.
4. An electron is confined to a one dimensional potential box of length $2 \text{ \AA}$. Calculate the energies corresponding to the second and fourth quantum states in eV.

Course Outcomes

1. Illustrate the Molecular Orbital diagrams for simple diatomic and polyatomic molecules.
2. Identify the applications of super conductors, semi conductors and super capacitors & nano materials.
3. Explain the working of spectroscopy and Chromatography.
4. Explain the properties and applications of polymers & fibres.
5. Estimate the analytes using potentiometric & conductometric titrations and electrochemical sensors
6. Describe the construction and working of electrochemical cells.

COs – POs Mapping

COs	PO1	PO2	PO6	PO7	PO12
1	3	1	1	3	1
2	3	1	1	2	1
3	3	1	1	3	1
4	3	1	1	2	1
5	3	1	1	3	1
6	3	1	1	2	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I**Structure and Bonding Models, Modern Engineering materials:**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ (psi) and Ψ^2 (psi square), particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O₂ and CO, etc. π -molecular orbitals of butadiene and benzene, calculation of bond order.

Semiconductors – Introduction, basic concept, application-Super conductors-Introduction basic concept, applications. Supercapacitors: Introduction, Basic Concept-Classification – Applications

13**Hours****Unit II****Nano materials & Instrumental methods & applications**

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphene nanoparticles.

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

10**Hours****Unit III****Polymer Chemistry & Applications**

Introduction to polymers, functionality of monomers, chain growth and step growth, polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of –PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications. Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polylactic Acid (PLA)

Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

16 Hours**Unit IV**

Electrochemistry & Applications

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions. Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

09 Hours
Total: 48 Hours

Textbooks:

1. A Text book of Engineering Physics - M. N. Avadhanulu, P.G.Kshirsagar& TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).
3. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning

Reference Books:

1. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
2. Engineering Physics” - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
3. Engineering Physics - D.K.Bhattacharya and PoonamTandon, Oxford press (2015).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam
Remember	39	40	
Understand	53	53	
Apply	08	07	50
Analyze			50
Evaluate			
Create			
Total (%)	100	100	100

Sample Question (s)

Remember

1. Write the Schrodinger wave equation?
2. Define nanomaterial with an example
3. Define functionality
4. Write any two applications of PVC

Understand

1. Illustrate the molecular orbital energy level diagram of O₂ molecule
2. Write the classification and applications of carbon nanotubes
3. Illustrate construct and working of Li ion battery
4. What is fuel cell? Explain construction and working of hydrogen-oxygen fuel cell

Apply

1. By using MO rules, draw the π -molecular orbital energy level diagram of 1,3-butadiene
2. Calculate emf of the following cell at 25°C. Given the standard reduction potentials of zinc and copper –0.76 V and +0.37 V respectively. $\text{Zn(s)} | \text{Zn}^{2+} (0.1\text{M}) || \text{Cu}^{2+} (0.001\text{M}) | \text{Cu(s)}$.

Course Outcomes

1. CO1: Assess the quality of water and its treatment methods
2. CO2: Estimate the potentials for electrochemical cells
3. CO3: Describe corrosion factors and implement prevention methods.
4. CO4: Illustrate the types of polymers and Fuels with applications
5. CO5: Describe the concepts of colloids, micelle and nanomaterials
6. CO6: Explain the uses of refractory materials, lubricants and cements.

COs – POs Mapping

COs	PO1	PO2	PO6	PO7	PO12
1	3	1	1	3	1
2	3	1	1	2	1
3	3	1	1	3	1
4	3	1	1	2	1
5	3	1	1	3	1
6	3	1	1	2	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I: Water Technology

Soft and hardwater, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen -Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO)standards, Ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis

10 Hours

UNIT II: Electrochemistry and Applications

Electrodes –electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogenoxygen Fuel cell. Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

12 Hours

UNIT III: Polymers and Fuel Chemistry

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growthpolymerization. Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications ofpoly styrene. PVC Nylon 6,6 and Bakelite. Elastomers – Preparation, properties and applications of BunaS, Buna N, Thiokol rubbers. Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis ofcoal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetanenumeralternativefuels- propane, methanol, ethanol and bio fuel-bio diesel.

10 Hours

UNIT IV: Surface Chemistry and Modern Engineering Materials

Surface Chemistry- Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelleformation, synthesis of colloids (Braggs Method), adsorption isotherm (Freundlich and Longmuir), BETequation (no derivation).Nano Materials- Chemical and biological methods of preparation of nanometals and metal oxides,stabilization of colloids and nanomaterials by stabilizing agents, applications of colloids and

nanomaterials– catalysis, medicine, sensors, etc. Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications
Refractories and lubricants- Classification, Properties, Factors affecting the refractory materials and Applications. Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils– Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications. Building materials- Portland cement, constituents, Setting and Hardening of cement.

16 Hours
Total: 48 Hours

Textbook (s)

1. P.C. Jain and Monica Jain, Engineering Chemistry, 16th Ed., Dhanpat Rai Publishing Company, New Delhi, 2015.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.
3. C.N.R. Rao, A. Muller and A.K. Cheetham, Nanomaterials Chemistry: Recent Developments and New Directions, 2010.

Reference (s)

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heinemann, 1992.
3. Textbook of Polymer Science, Fred W. Billmeyer Jr, 3rd Edition

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book/ Assignment Exam(%)
Remember	40	40	--
Understand	50	50	-
Apply	10	10	50
Analyze	-	-	50
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)

Remember

1. Define hardness
2. Differentiate between primary and secondary battery
3. Define Octane and cetane number
4. What are the good characteristic properties of good refractory material?

Understand

1. Explain in detail how the hardwater is purified by ion exchange process
2. How the underground buried pipeline is protected by sacrificial anodic protection?
3. Explain the preparation of Nano metal oxide by chemical precipitation method
4. Explain the chemistry involved in setting and hardening of cement

Apply

1. What are different treatment methods for removal of hardness and compare their merits and demerits
2. What are the points are to be taken into account in the construction of a good battery with life?
3. How to get commercial products obtaining from crude oil and list out the byproducts with carbon content, Boiling point and its uses

Course Outcomes: At the end of the course, the student will be able to

1. Solve the system of linear equations
2. Construct the eigenvectors of a matrix, use the applications of Cayley Hamilton theorem
3. Identify the nature of the quadratic form using matrix theory
4. Apply Mean value theorems to solve single variable problems.
5. Make use of partial derivatives to solve multivariable problems
6. Utilize multiple integrals to find the area and volume of solids

COs – POs Mapping

COs	PO1	PO2	PO3	PO4	PO12
1	3	3	2	2	1
2	3	2	3	3	1
3	3	3	3	2	1
4	3	2	2	1	1
5	3	3	2	1	1
6	3	3	3	2	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT – I

Matrices

Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

12 Hours

UNIT – II

Linear Transformation and Orthogonal Transformation:

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

12 Hours

UNIT – III

Single and Multi-Variable Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

Partial differentiation: Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

14 Hours

UNIT – IV

Multiple Integrals

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

10 Hours

Total: 48 Hours

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
3. Glyn James, Advanced Modern Engineering Mathematics, 5/e, Pearson publishers, 2018.
4. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand, 2021.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	10	10	-
Understand	40	40	20
Apply	50	50	50
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)

Remember

1. Define rank of a matrix
2. State Cayley-Hamilton theorem
3. State Rolle's theorem
4. State Taylor's theorem

Understand

1. Find the rank of the matrix $A = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$ by reducing it to echelon form.
2. Using Cayley-Hamilton theorem find A^4 , for $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$
3. Verify Lagrange's mean value theorem for $(x)^{\frac{3}{4}}$ in $[-1, 2]$
4. Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \sqrt{a^2-x^2-y^2} dx dy$

Apply

1. Utilise Gauss-Jordan method, to find the inverse of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$
2. Find the eigen values and the corresponding eigen vectors of $A = \begin{bmatrix} 1 & 2 & -1 \\ 0 & 2 & 2 \\ 0 & 0 & -2 \end{bmatrix}$
3. If $a < b$, prove that $\frac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \frac{b-a}{1+a^2}$ using Lagrange's mean value theorem. Deduce that $\frac{5\pi+4}{20} < \tan^{-1} 2 < \frac{\pi+2}{4}$
4. Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$ by change into polar coordinates

23BEX01 BASIC ELECTRICAL & ELECTRONICS ENGINEERING
(Common to all branches of Engineering)

3 0 0 3

Course Outcomes

1. Demonstrate the electrical parameters of DC & AC circuits.
2. Illustrate the operation of electrical machines and power plants.
3. Summarize electrical measurements and safety measures
4. Explain the operation of semiconductor devices and their characteristics.
5. Illustrate the operation of rectifiers.
6. Illustrate the number systems, binary codes, and combinational circuits using logic gates.

COs – POs Mapping

COs	PO1	PO3	PO6	PO7	PO9	PO12
C01	3	2	1	1	1	1
C02	3	2	1	1	1	1
C03	3	2	1	1	1	1
C04	3	2	1	1	1	1
C05	3	2	1	1	1	1
C06	3	2	1	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I: ELECTRICAL CIRCUITS AND MACHINES

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: AC Fundamentals: Equation of AC Voltage and current, waveform, time-period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. (Simple Numerical problems).

Electrical Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer and (iv) Three Phase Induction Motor, Applications of electrical machines.

(12 Hours)

UNIT II: ELECTRICAL MEASURING INSTRUMENTS AND SAFETY MEASURES

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB) Personal safety measures: Electric Shock, Safety precautions to avoid shock, Earthing and its types.

(12 Hours)

PART B: BASIC ELECTRONICS ENGINEERING

UNIT III: SEMICONDUCTOR DEVICES AND ELECTRONIC CIRCUITS

Introduction - Evolution of electronics – Vacuum tubes to nanoelectronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

Rectifiers and power supplies: Block diagram description of a DC power supply, working of a half wave rectifier, full wave rectifier.

(12 Hours)

UNIT IV: DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits– Minterm, Maxterm, SOP, Standard SOP, POS, Standard POS, 3-Variable K-Map, Half and Full Adders.

(12 Hours)

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, "Electronic Devices & Circuit Theory," Pearson Education, 2nd Edition 2021.
2. D. C. Kulshreshtha "Basic Electrical Engineering" Tata McGraw Hill, 1st Edition, 2019
3. Ramana Pilla, N.V.Lalitha & G.Suresh, "Basic Electrical and Electronics Engineering", S Chand and Company Ltd., 1st Edition, 2024.

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. T. K. Nagsarkar & M. S. Sukhija, "Basic Electrical Engineering" Oxford University Press, 1st Edition, 2017
3. R. P. Jain, "Modern Digital Electronics" Tata Mc Graw Hill, 4th Edition, 2009.
4. Rajendra Prasad, "Fundamentals of Electrical Engineering," PHI publishers, 3rd Edition. 2014

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	20	20	30
Understand	50	50	50
Apply	30	30	20
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)**Remember**

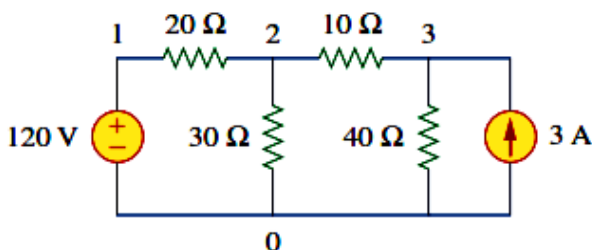
1. Define KVL and KCL
2. Define Units
3. Define amplifier
4. Define Rectifier

Understand

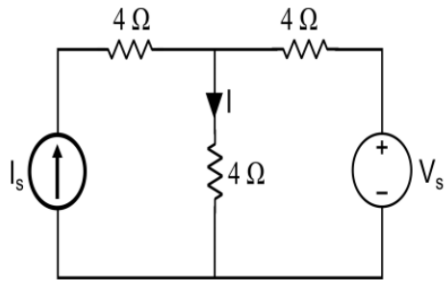
1. List out energy sources and explain anyone with a neat diagram
2. Illustrate the operation instruments with a neat diagram
3. List any three applications of Zener diode
4. Illustrate the CE amplifier circuit diagram.

Apply

1. Find currents in each branch using nodal analysis for the given circuit.



2. Find I by using the superposition theorem for the below circuit with $V_s=20V$, $I_s= 4A$.



3. Solve these conversions

- i) $(10101)_2$ to $(?)_{gray}$
- ii) $(23B)_{10}$ to $(?)_{10}$
- iii) $(45)_{10}$ to $(?)_8$

4. Minimize the given switching function using k-map $f(A, B, C) = \sum m(2,6,7)$

23BEX02 - BASIC CIVIL & MECHANICAL ENGINEERING

(Common to All branches of Engineering)

3 0 0 3

Course Outcomes:

1. Describe the basics of civil engineering streams, water resources and environmental engineering
2. Outline the concepts of surveying
3. Demonstrate the pavements and the concept of Airport, Harbour, Tunnel & Railway Engineering
4. Understand the different Engineering Materials, Manufacturing process and the role of mechanical Engineering in different sectors.
5. Understand the basic concepts of thermal engineering and working principles of different power plants
6. Describe the working of different mechanical power transmission systems and basic configurations and applications of robots

COs – POs Mapping

CO	PO ₁	PO ₂	PO ₃	PO ₆	PO ₇	PO ₈	PO ₁₂
1	3	-	-	2	2	2	2
2	3	3	3	1	2	-	2
3	3	-	-	1	2	-	2
4	3	-	-	2	2	-	2
5	3	-	-	2	2	-	2
6	3	-	-	2	2	-	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

UNIT I Basics of Civil Engineering

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering- Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to prefabricated construction techniques.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

12 Hours

UNIT II Surveying and Transportation Engineering

Surveying: Objectives of Surveying - Horizontal Measurements- Angular Measurements- Introduction to Bearings, Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

Transportation Engineering: Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering

12 Hours

UNIT III

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society-Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Material: Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

Manufacturing Processes: Principles of Casting, Forming, joining processes, Introduction to CNC machines, 3D printing, and Smart manufacturing.

11 Hours

UNIT IV

Thermal Engineering: working principle of Boilers, Otto cycle, Diesel cycle, Refrigerator and air-conditioner, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

Power plants: working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission: Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics: configurations and applications of robots.

13 Hours

Textbooks:

1. Basics of Civil and Mechanical Engineering, O. Srikanth and M. Sreenivasa Reddy, S. Chand and company limited, first edition, 2024.
2. Basic Civil Engineering, M. S. Palanisamy, Tata McGraw Hill publications (India) Pvt. Ltd. Fourth Edition.
3. Introduction to Civil Engineering, S. S. Bhavikatti, New Age International Publishers. 2022. First Edition.
4. Basic Civil Engineering, SatheeshGopi, Pearson Publications, 2009, First Edition.
5. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
6. A Text book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
7. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, cengage learning India pvt. Ltd.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016.
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S. K. Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.
6. AppuuKuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
7. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
8. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
9. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Assessments
Remember	9	9	9
Understand	63	63	63
Apply	28	28	28
Analyze			
Evaluate			
Create			
Total (%)	100	100	

Sample Question (s)**Remember**

1. What is Portland cement? Write the Cement composition?
2. Define surveying. What are the principles of surveying?
3. Outline the key elements of railway engineering?
4. Write the purpose of tunnels?

Understand

1. Describe the key characteristics of contour mapping?
2. Discuss the fundamental differences between flexible pavements and rigid pavements.
3. What are the various types of transportation system? How the transportation is contributing the economy of the country India?
4. What is the importance of construction materials such as brick, cement, aggregates, concrete and steel in building construction?

Apply

1. The following readings were taken with a level in sequence as follows 1.625, 1.535, 2.365, 1.355, 1.465, 1.105, 1.925, 2.015, 2.350, 1.815, 1.985, 2.115 and 2.560. The elevation of B.M at 1st reading is 210m. Find the reduced levels at each and every station using rise and fall method.

2. In a closed traverse the following bearings were observed with a compass. Calculate the included angles with sketch?

Line	Fore bearing
AB	$65^{\circ} 00'$
BC	$125^{\circ} 30'$
CD	$200^{\circ} 00'$
DE	$265^{\circ} 15'$
EA	$330^{\circ} 00'$

3. Convert the following whole circle bearings into reduced (quadrantal) bearings?

(i) 65° (ii) $143^{\circ} 15'$ (iii) $252^{\circ} 30'$ (iv) $320^{\circ} 42'$ (v) $181^{\circ} 12'$ (vi) $270^{\circ} 42'$

4. The following fore bearings were observed for lines, AB, BC, CD, DE, FE and FG respectively. Determine their back bearings.

- i) FB of AB $310^{\circ} 30'$
- ii) FB of BC $145^{\circ} 15'$
- iii) FB of CD $210^{\circ} 30'$
- iv) FB of DE $60^{\circ} 45'$
- v) FB of EF $39^{\circ} 50'$
- vi) FB of FG $289^{\circ} 30'$

23BEX03 - INTRODUCTION TO PROGRAMMING
(Common to all branches of Engineering)

3 0 0 3

Course Outcomes:

At the end of the Course, Student should be able to:

1. Illustrate the Algorithms for programming and problem solving.
2. Formulate sequential and iterative programming.
3. Implement Basic Dynamic Data structures
4. Develop Modular program aspects in solving complex problems.
5. Apply the concepts for optimal utilization of memory
6. Understand the techniques of storage and processing the data.

COs – POs Mapping:

COs	PO ₁	PO ₂	PO ₃	PO ₁₂
1	3	3	3	2
2	3	2	2	2
3	3	2	2	2
4	3	3	3	2
5	3	2	2	2
6	2	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I

Introduction to Computer Problem Solving:

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

Introduction, Structure of a C Program, Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion Relational Expressions

UNIT II

Introduction to C Programming:

Control Flow, Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

Arrays:

Introduction, Operations on Arrays, Arrays as Function Arguments, Two Dimensional Arrays, Multidimensional Arrays.

Strings: String Fundamentals, String Processing with and without Library Functions, Pointers and Strings.

UNIT- III

Functions: Introduction Function: Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes, Recursion.

Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

UNIT-IV

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type —Enum variables, Using Type def keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

Textbook(s)

1. A Structured Programming Approach Using C, Forouzan, Gilberg, 3rd Edition, Cengage.
2. How to solve it by Computer. G. Dromey, 12th Edition, Pearson Education.
3. Programming In C-A Practical Approach. Ajay Mittal, 1st Edition Pearson

References:

1. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2020, McGraw-Hill.
2. Computer Programming. Reema Thareja, 3rd Edition, 2023, Oxford University Press
3. The C Programming Language, Dennis Richie And Brian Kernighan, 2nd Edition, Pearson Education.
4. Programming In C, Ashok Kamthane, 2nd Edition, Pearson Publication.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Assessments
Remember	20	10	100
Understand	50	40	
Apply	30	30	
Analyze	--	20	
Evaluate			
Create			
Total (%)			

Sample Question (s)**Remember**

1. Define an algorithm.
2. List out the types of operators.
3. Define a function.
4. List any 5 file handling functions.

Understand

1. What is a 2D array? Explain the process of creating, initializing and accessing the elements of a 2D array.
2. Explain the 4 categories of functions.
3. Explain the difference between structure and union.
4. Explain the modes of opening a file.

Apply

1. Write a program to generate the Fibonacci sequence using recursion.
2. Write a program to perform matrix multiplication.
3. Write a program to copy the contents of

23BEX04 - ENGINEERING GRAPHICS
(Common to All branches of Engineering)

2 0 2 3

Course Outcomes

1. Understand the principles of engineering drawing, including engineering curves, scales.
2. Draw and interpret orthographic projections of points, lines, planes in front, top and side views.
3. Construct Ortho-graphic projections of planes inclined to both reference planes and Projections of Solids in simple positions.
4. Understand and apply concepts of projections of solids inclined to a reference plane and sectional views of solids in simple positions using CAD software.
5. Gain a clear understanding of the principles behind development of surfaces and to understand how to unfold basic geometric shapes into flat patterns using CAD software.
6. Develop the ability to draw isometric views and orthographic views and convert isometric views to orthographic views and vice versa using CAD software.

COs – POs Mapping

CO	PO ₁	PO ₅	PO ₁₀	PO ₁₂
1	3	-	3	3
2	3	-	3	3
3	3	-	3	3
4	3	3	3	3
5	3	3	3	3
6	3	3	3	3

3 – Strongly linked | 2 – Moderately linked | 1 – Weakly linked

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general and special methods – Arcs of circle method, concentric circles method, Oblong method, Rectangle method, Normal and tangent to Curves. **Scales:** Introduction to scales, Plain scales, Diagonal scales. **9 Hours**

UNIT II

Projections of Points & Straight Lines: Projections of points, Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes.

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes. **Projections of Solids:** Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane.

(Conventional drawing up to this)

9 Hours

(Using CAD)

UNIT III

Projections of Solids

Introduction to AUTOCAD, Projection of Solids with axis inclined to one reference plane and parallel to other, Projection of Solids with axis parallel to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone. **10 Hours**

UNIT IV

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. **10 Hours**

Total: 48 Hours

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016. **Reference**

Books:

1. Engineering Drawing, K.L. Narayana and P. Kanniah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc, 2009.

23HSX01 COMMUNICATIVE ENGLISH
(Common to all branches of Engineering)

2 0 0 2

Course Outcomes

1. Understand the context, topic, and specific information from social or transactional dialogues
2. Speak clearly using discourse markers on a specific topic in formal as well as informal discussions
3. Comprehend and appreciate literary texts by reading
4. Write summaries, coherent paragraphs, essays, letters/e-mails and resume
5. Apply grammatical structures to formulate sentence and use them appropriately
6. Improve communicative competence with enhanced vocabulary in formal and informal contexts

COs – POs Mapping

COs	PO1	PO09	PO10	PO11	PO12
1	1	1	3	1	2
2	1	1	3	1	2
3	1	1	3	1	1
4	1	1	3	1	2
5	1	1	3	1	1
6	1	1	3	1	1

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I

Lesson : The power of plate of Rice- Ifeoma Okoye

Listening: Identifying the topic, the context and specific pieces of information by listening to Short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words

Unit 2

Lesson: Night of the Scorpion by Nissim Ezekiel, Steve Jobs

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts. Listening for global comprehension and summarizing what is listened

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks and reporting what is discussed

Reading: Identifying sequence of ideas; verbal techniques that connect ideas in a paragraph, reading a text by making inferences-using context clues for comprehension.

Writing: Structure of a paragraph - Paragraph writing (specific topics), summarizing

Grammar: Cohesive devices -linkers, use of articles and zero article, prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

Unit 3

Lesson: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Note-making, paraphrasing Letter Writing: Official Letters, Resumes

Grammar: Verbs – tenses, subject-verb agreement Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Compound words, Collocations

Unit 4

Lesson: The Power of Interpersonal Communication

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic on texts

Reading: Reading comprehension.

Writing: Writings structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject-verb agreement)

Vocabulary: Jargons, Technical vocabulary

Textbook (s)

1. *Pathfinder*: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023.
2. *Empowering English* by Cengage Publications, 2023

Reference Books:

1. Dubey, Sham Ji& Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20%	20%	
Understand	29%	29%	
Apply	51%	51%	50%
Analyse			50%
Evaluate			
Create			
Total (%)			

Sample Question (s)

Remember

1. Explain the role of body language in inferential listening.
2. What announcement by the national peace council does Eleanor show her brother?
3. Reflect on the role of intrapersonal communication in personal growth, how can engaging in self-reflection and self-talk contribute in enhancing one's character and decision-making abilities?
4. Explain the role of body language in inferential listening.

Understand

1. What do you mean by listening for main ideas and supporting ideas?
2. What are the qualities of a good listener?
3. You recently have purchased a smartphone that has unexpectedly poor battery life. Compose a letter to the customer service department of the store where you bought it, explaining the issue and politely requesting a replacement or repair.
4. Explain briefly some situations that require inferential listening.

Apply

1. Write a short talk on 'memorable incident in your life'
2. Develop a conversation between two friends on positive impact that regular physical exercise can have on both physical and mental well-being.
3. Summarize the central idea of the poem *Night of the Scorpion* by Nissim Ezekel.
4. Imagine you are a customer support representative dealing with a dissatisfied customer. Create a role-playing scenario to address the customer's concerns and resolve the issue to their satisfaction.

23PYX02 - ENGINEERING PHYSICS LAB
(Common to all branches of Engineering)

0 0 2 1

Course Outcomes

1. Infer the knowledge from the scientific methods and learn the process of measuring different physical parameters
2. Develop the laboratory skills in handling of electrical and Optical instruments
3. Demonstrate the interference and diffraction phenomena of light
4. Inspect and experience physical principles of Magnetic fields and optical fiber communications
5. Apply the principles of physics and measure the solid state properties of materials
6. Design and analyze experiment based on physics concepts

COs – POs Mapping

COs	PO4	PO6	PO9	PO11	PO12
1	3	2	2	2	1
2	3	2	2	2	1
3	3	2	2	2	1
4	3	2	2	2	1
5	3	2	2	2	1
6	3	2	2	2	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

List of Experiments:

1. Study of variation of magnetic field along the axis of current-carrying circular coil-Stewart and Gee's Method.
2. Determination of wavelengths of spectral line of mercury spectrum using diffraction grating.
3. Determination of radius of curvature of convex lens by forming Newton's rings.
4. Study of series and parallel Resonance in LCR circuit.
5. Measurement of thickness of a thin paper using wedge method.
6. Calculation of Numerical Aperture (NA) and bending losses of a given fiber.
7. Determination of frequency of an electrically vibrating tuning fork in Transverse and longitudinal modes - Melde's Experiment.
8. Determination of wavelength of Laser by diffraction grating.
9. Determination of Hall Coefficient and charge carrier density of semi-conductor.
10. Determination of Band gap of a semiconductor.
11. Determination of Rigidity modulus of a given wire using torsional pendulum.
12. Determination of size of particle using diffraction pattern.
13. Verification of Malu's law.
14. Determination of temperature coefficients of a thermistor.
15. Determination of dispersive power of the material of a prism.
16. Determination of Time constant of an R-C circuit.

List of Augmented Experiments¹

1. To study the magnetization (M) of a ferromagnetic material in the presence of a magnetic field B and to plot the hysteresis curve (M vs. B)
2. Study the Thermoemf of the thermo couple
3. LCR Series and Parallel–Design of circuit for various resonance frequencies
4. Determination of characteristics of Laser beam
5. Determination of Horizontal component of earth's magnetic field
6. Study of double refraction in calcite crystals

¹ Students shall opt any one of the Augmented Experiments in addition to the regular experiments

7. Dispersive power of various liquids using spectrometer
8. Photo cell–Characteristics and determination of Planks constant
9. Michelson’s interferometer.

References:

1. Physics Lab manual–Department of Physics, BS & H, GMRIT, Rajam, 2019
2. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers, 2017
3. Y. Aparna and K. Venkateswararao, Engineering Physics–I and II, VGS Techno series, 2010
4. S. Panigrahi and B. Mallick, Engineering Practical Physics, Cengage learning, Delhi, 2015
4. <http://www.amrita.vlab.co.in> Virtual Labs, Amrita University.
5. <http://www.iitk.vlab.co.in>

Course Outcomes:

At the end of course student will be able to

- CO1: Determine the concentration of acids by Conductometry.
- CO2: Prepare the Bakelite polymer and ZnO nanomaterial
- CO3: Estimate the strength of an acid present in secondary battery by pH metry
- CO4: Identify the organic compounds by IR Spectroscopy.
- CO5: Verify the Beer- Lamberts law and measure the wavelength
- CO6: Estimate concentration of ferrous iron by potentiometry and dichrometry

COs – POs Mapping

COs	PO1	PO6	PO7	PO9	PO12
1	3	1	3	1	1
2	3	1	3	1	1
3	3	1	3	1	1
4	3	1	2	1	1
5	3	1	3	1	1
6	3	1	3	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

LIST OF EXERCISES:

1. Introduction to qualitative analysis- Demonstration
2. Measurement of 10Dq by spectrophotometric method
3. Conductometric titration of strong acid vs. strong base
4. Conductometric titration of weak acid vs. strong base
5. Determination of cell constant and conductance of solutions
6. Potentiometry - determination of redox potentials and emfs
7. Determination of Strength of an acid in Pb-Acid battery
8. Preparation of a Bakelite
9. Verify Lambert-Beer's law
10. Wavelength measurement of sample through UV-Visible Spectroscopy
11. Identification of simple organic compounds by IR
12. Preparation of nanomaterials by precipitation method
13. Estimation of Ferrous Iron by Dichrometry
14. Determination of acid number of lubricating oil
15. Determination of Hardness of a groundwater sample.
16. Determination of Viscosity of lubricating oil by Redwood Viscometer 1

List of Augmented Experiments1

1. Assessment of synthesis of carbon fibers by polymerization
2. Synthesis of nanomaterials by other nanomethodlogy
3. Identification of simple organic compounds by IR
4. Making a battery of required potential
5. Calculation of Ferrous Iron by Dichrometry.
6. Find the acid number of various industrial oils or edible oils

Reference Books

1. Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

Course outcomes:

At the end of course student will be able to

CO1: Asses the percentage moisture of a solid fuel

CO2: Prepare the Bakelite polymer and ZnO nanomaterial

CO3: Determine acid number and viscosity of lubricating oil

CO4: Estimate the Iron and Calcium in cement.

CO5: Estimate the hardness and dissolved oxygen in water.

CO6: Determine the Strength of an acid in lead acid Battery

COs – POs Mapping

COs	PO1	PO6	PO7	PO9	PO12
1	3	1	3	1	1
2	3	1	3	1	1
3	3	1	3	1	1
4	3	1	2	1	1
5	3	1	3	1	1
6	3	1	3	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

LIST OF EXERCISES:

1. Introduction to Quantitative Analysis - Demonstration
2. Determination of Hardness of a groundwater sample.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Determination of Fluoride in water sample
5. Determination of nitrite in water sample by spectrometric method
6. Determination of percentage of Iron in Cement sample by colorimetry
7. Estimation of Calcium in Portland cement
8. Determination of Strength of an acid in Pb-Acid battery
9. Preparation of a polymer (Bakelite)
10. Preparation of nanomaterials by precipitation method
11. Adsorption of acetic acid by charcoal
12. Determination of percentage Moisture content in a coal sample
13. Determination of acid number of lubricating oil
14. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
15. Determination of Viscosity of lubricating oil by Redwood Viscometer 2
16. Determination of Calorific value of gases by Junker's gas Calorimeter

List of Augmented Experiments1

1. Assessment of ground water quality of your village/Mandal (by taking min. 6 locations and determining min. 4 parameters – Fluoride, Chloride, Hardness, TDS etc.)
2. Preparation of a desired quality of Viscosity Index lubricating oil
3. Proximate analysis of coal – Ultimate analysis of coal
4. Making a battery of required potential
5. Energy scenario in India- Various sources, % consumption, solutions to meet future demand etc.
6. Find the viscosity of various edible and non-edible lubricating oils

Reference Books

1. Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar
2. Waste Water Engineering Treatment and Reuse, 4th Edition, Metcalf and Eddy, Inc
3. Engineering chemistry laboratory manual & record By Srinivasulu D. Parshva publications

23BEX05 - ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP
(Common to All branches of Engineering)

0 0 3 1.5

Course Outcomes

1. Apply fundamental electrical principles to resolve complex circuit problems.
2. Develop proficiency in conducting electrical measurements and studying machine characteristics for practical applications.
3. Demonstrate skills in measuring power parameters and calculate energy consumption for residential applications.
4. Analyze the characteristics of semiconductor devices
5. Find the frequency response of amplifiers using BJT
6. Verify the truth tables of logic gates and basic flip flops

CO-PO Mapping

COs	PO4	PO5	PO6	PO9	PO12
CO1	3	2	1	1	1
CO2	3	2	1	1	1
CO3	3	2	1	1	1
CO4	3	2	1	1	1
CO5	3	2	1	1	1
CO6	3	2	1	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
 - Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
 - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
 - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
 - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises **Note:** Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB List of

Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers Plot Input & Output characteristics of BJT in CE and CB configurations

4. Frequency response of CE amplifier.
5. Simulation of RC coupled amplifier with the design supplied
6. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
7. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

List of Augmented Experiments.

1. Connections of Tube Light wiring
2. Connections of Godown Wiring
3. Connections of stair case wiring
4. Generate fixed positive 5V using IC7405
5. Generate fixed Negative 5V using IC7905
6. Generate sinusoidal wave form using function generator

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.
4. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
5. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
6. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

23BEX06 - ENGINEERING WORKSHOP
(Common to all branches of Engineering)

0 0 3 1.5

Course Outcomes:

At the end of this course a student will be able to

1. Demonstrate the simple wooden components like Cross Lap joint, T-Lap joint, Dovetail Joint.
2. Develop the simple house hold items like Taper Tray, Square box, Open Scoop using sheet metal.
3. Build the V- Fit, Square fit, Dovetail fit using mild steel.
4. Understand simple house wiring circuits like Parallel/Series connection of three bulbs, Stair Case Wiring, Godown Wiring.
5. Create the Green Sand Mould for given the patterns like rectangular shape, circular shape.
6. Construct the metal joint using Arc Welding like: Lap joint, Butt joint.

COs – POs Mapping:

COs	PO ₁	PO ₉	PO ₁₂
1	3	3	2
2	3	3	2
3	3	3	2
4	3	3	2
5	3	3	2
6	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Demonstration: Safety practices and precautions to be observed in workshop.

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints: a) Cross Lap joint, b) T-Lap joint, c) Dovetail Joint.

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets: a) Taper Tray, b) Square box, c) Open Scoop.

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises: a) V- Fit, b) Dovetail fit, c) Half Round Fit.

Electrical Wiring: Familiarity with different types of basic electrical circuits and make the following connections: a) Parallel/Series connection of three bulbs, b) Stair Case Wiring, c) Godown Wiring
Foundry: Demonstration of Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns: a) rectangular shape mould, b) circular shape mould

Welding Shop: Demonstration and practice on Arc Welding. Preparation of a) Lap joint and b) Butt joint.

LIST OF EXPERIMENTS:

Wood Working:

1. Cross Lap joint,
 2. T-Lap joint,
 3. Dovetail Joint
- Sheet Metal Working:**
4. Taper Tray,
 5. Square box,
 6. Open Scoop

Fitting:

1. V- Fit,
 2. Square fit,
 3. Dovetail fit,
- Electrical Wiring:**
4. Parallel/Series connection of three bulbs,
 5. Stair Case Wiring,
 6. Godown Wiring

Foundry Trade:

1. Mould cavity for rectangular shape
 2. Mould cavity for a straight pipe
- Welding Shop:**
3. Lap joint

4. Butt joint.

Any two jobs from each trade must be performed by the student.

AUGMENTED EXPERIMENT / MINI PROJECT: An innovative and creative useful house hold product/model should be prepared by the group of 6-10 students using the knowledge gathered from the all shops in workshop.

TEXTBOOKS:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

REFERENCE BOOKS:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

23BEX07 - COMPUTER PROGRAMMING LAB
(Common to all branches of Engineering)

0 0 3 1.5

Course Outcomes:

At the end of the Course, Student will be able to:

1. Read, understand, and trace the execution of programs.
2. Select the proper control structure for solving the problem.
3. Construct programs using homogenous data types.
4. Develop modular programming using functions
5. Formulate programs for optimal utilization of memory.
6. Develop programs using files.

COs – POs Mapping:

COs	PO2	PO3	PO4	PO12
1	2	2	3	2
2	2	3	3	2
3	2	3	3	2
4	2	3	3	2
5	2	3	3	2
6	2	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

List of Experiments:

UNIT-I

WEEK 1:

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with the programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc. ii)

Exposure to Turbo C, gcc iii) Writing simple programs using printf(), scanf()

WEEK 2:

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps using textual and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs i) Sum and average of 3 numbers ii) Conversion of Fahrenheit to Celsius and vice versa iii)

Simple interest calculation

WEEK 3:

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions. i) Finding the square root of a given number ii) Finding compound interest

iii) Area of a triangle using Heron's formulae iv)

Distance traveled by an object

UNIT-II

WEEK4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression, and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator's precedence and associativity i) Evaluate the following expressions.

- a. $A+B*C+(D*E) + F*G$
- b. $A/B*C-B+A*D/3$
- c. $c. A+++B---A$
- d. $d. J= (i++) + (++i)$

ii) Find the maximum of three numbers using the conditional operator iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5:

Objective: Explore the full scope of different variants of —if construct||, namely if-else, null-- else, if-else if*-else, switch, and nested-if, including in what scenario each can be used and how to use them. Explore all relational and logical operatorswhile writing conditionals for —if construct||.

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions: Lab 5:

Problems involving if-then-else structures.

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill. iii) Find the roots of the quadratic equation. iv) Write a C program to simulate a calculator using a switch case.
- v) Write a C program to find whether the given year is a leap year.

WEEK 6:

Objective: Explore the full scope of iterative constructs, namely while loop, do-while loop, and for loop in addition to structured jump constructs like break and continue, including when each of these statements is more appropriate. Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems, e.g., the sum of series

- i) Find the factorial of a given number using any loop. ii) Find whether the given number is a prime or not. iii) Compute sine and cos series iv) Checking whether a number is palindrome
- v) Construct a pyramid of numbers.

UNIT-III

WEEK7:

Objective: Explore the full scope of the Arrays construct, namely defining and initializing 1-D and 2-D and, More generically, n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching. Lab 7:1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on the 1D array.
- iii) The reverse of a 1D integer array iv) Find 2's complement of the given binary number. v) Eliminate duplicate elements in an array.

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null characters and get comfortable with strings by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort i)

Addition of two matrices ii) Multiplication two matrices iii)

Sort array elements using bubble sort iv) Concatenate two strings without built-in functions

v) Reverse a string using built-in and without built-in string functions

UNIT-IV

WEEK9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation value initialization, resizing, changing, and reordering the contents of an array, and memory deallocation using malloc (), calloc (),realloc () and free () functions. Gain experience

processing command-line arguments received by C Suggested

Experiments/Activities:

Tutorial 9: Pointers, structures, and dynamic memory allocation Lab 9:

Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc() ii) Write a C program to find the total average of n students using structures iii) Enter n students data using calloc() and display failed students list iv) Read student name and marks from the command line and display the student details along with the total.

v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields self-referential structures(Singlylinked lists), and nested structures Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10: Bitfields

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bitfields

i) Create and display a singly linked list using self-referential structure.

ii) Demonstrate the differences between structures and unions using a C program. iii) Write a C program to shift/rotate using bitfields. iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT-V

WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by Parameter passing using call by value. Basic methods of numerical integration Suggested

Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.

ii) Write a C function to find the length of a string.

iii) Write a C function to transpose of a matrix. iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series. ii) Write a recursive function to find the lcm of two numbers. iii) Write a recursive function to find the factorial of a number. iv) Write a C Program to implement Ackermann function using recursion. v) Write a recursive function to find the sum of series.

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers. i) Write a C program to swap two numbers using call by reference.

ii) Demonstrate Dangling pointer problem using a C program. iii) Write a C program to copy one string into another using pointer. iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences Between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

- i) Write a C program to write and read text into a file. ii) Write a C program to write and read text into a binary file using fread() and fwrite() iii) Copy the contents of one file to another file. iv) Write a C program to merge two files into the third file using command-line arguments. v) Find no. of lines, words and characters in a file

List of Augmented Experiments:

1. Employee's Management System
2. Library management system
3. Automation of department store
4. Personal Dairy Management
5. Telecom Billing Management
6. Bank Management System
7. Contacts Management

Text books:

1. Ajay Mittal, Programming in C: A practical approach, 1 st Edition, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2020, McGraw Hill.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India. C Programming,
2. A Problem-Solving Approach, Forouzan, Gilberg, Prasad, 3rd Edn, CENGAGE.

23BEX08 - IT WORKSHOP
(Common to all branches of Engineering)

0 0 2 1

Course Outcomes:

At the end of the Course, Student will be able to:

1. Demonstrate the process of Assembling and disassembling the PC.
2. Illustrate the steps involved in installations of various operating systems.
3. Understand the process of Configuring IP address and perform virus free downloads.
4. Create projects using Latex/ Word and organize data and spreadsheets.
5. Design basic and interactive Power Point Presentations.
6. Improve Conversational abilities using AI-Tools.

COs – POs Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₉	PO ₁₂
1	3	2	3	2	3	3
2	2	3	2	3	3	2
3	3	2	2	2	3	2
4	2	3	2	2	3	2
5	3	3	3	2	3	2
6	2	2	2	2	3	2

3 - Strongly Linked | 2 - Moderately Linked | 1 - Weakly Linked

PC Hardware

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor. **Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there are no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN. **Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word to create a project certificate. Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colours, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 3: Creating project abstract Features to be covered: -Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered: - Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources. **Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function.

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWERPOINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dream tech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dream tech
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education. 4. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfins on and Ken Quamme. – CISCO Press, Pearson Education.
7. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by PatrickRegan– CISCO Press, Pearson Education.

23HSX02 - COMMUNICATIVE ENGLISH LAB
(Common to all branches of Engineering)

0 0 2 1

Course Outcomes

1. Acquire knowledge of the English sound system and get practice to gain accuracy in pronunciation
2. Apply the patterns of accent and intonation for better listening and speaking comprehension
3. Write emails, resume and statement effectively for the purpose for professional communication
4. Evaluate and exhibit professionalism in participating in debates and group discussions
5. Demonstrate the necessary verbal and non-verbal communication in technical presentations
6. Perform different roles and practice interpersonal communication in formal situations

COs – POs Mapping

COs	PO01	PO09	PO10	PO11	PO12
1	1	1	3	1	2
2	1	1	3	1	1
3	1	1	3	1	2
4	1	1	3	1	1
5	1	1	3	1	2
6	1	1	3	1	1

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

List of Experiments

1. Letters and Sounds of English
2. Role play/ Conversation Practice-1
3. Jam
4. E-Mail Writing
5. Pronunciation Rules
6. Role play/ Conversation Practice-II
7. Accent rules and Intonation
8. Presentation Skills
9. Resume Writing
10. Debating
11. Group Discussion
12. Interviews
13. Poster Presentation
14. Statement of Purpose
15. Role play/ Conversation Practice-3 16. Role play/ Conversation Practice-4

Augmented Experiment

List of Augmented Experiments²

1. Common Errors in English
2. Listening Skills
3. Writing Skills
4. Reading Skills
5. Public Speaking
6. Interview Skills
7. Business Communication
8. Functional English
9. Preparation for GRE/TOEFL
10. Preparation for IELTS/CAT/GMAT

¹Students shall opt any one of the Augmented Experiments in addition to the regular experiments

Reading Material (s)

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi& P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle, 2013
5. K. Nirupa Rani, Jayashree Mohan Raj, B. Indira, (Ed) Speak Well (C.D) Orient Black Swan Pvt Ltd, Hyderabad, 2012

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

23HSX11 - HEALTH AND WELLNESS, YOGA AND SPORTS
(Common to All branches of Engineering)

0 0 1 0.5

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

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

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.

CO2: Demonstrate an understanding of health-related fitness components.

CO3: Compare and contrast various activities that help enhance their health.

CO4: Assess current personal fitness levels. **CO5:** Develop Positive Personality

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

- i) Organizing health awareness programmes in community ii) Preparation of health profile
- iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

- i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
- Practicing general and specific warm up, aerobics ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc. 2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes: After completion of the course the students will be able to **C01:** Understand the importance of discipline, character and service motto.

C02: Solve some societal issues by applying acquired knowledge, facts, and techniques.

C03: Explore human relationships by analyzing social problems.

C04: Determine to extend their help for the fellow beings and downtrodden people. **C05:** Develop leadership skills and civic responsibilities.

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

- i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
- ii) Conducting orientations programs for the students –future plans-activitiesreleasing road map etc. iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
- iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature Care Activities:

- i) Best out of waste competition.
- ii) Poster and signs making competition to spread environmental awareness. iii) Recycling and environmental pollution article writing competition. iv) Organising Zero-waste day.
- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) Write a summary on any book related to environmental issues.

UNIT III Community Service Activities:

- i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.
- ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS, iii) Conducting consumer Awareness. Explaining various legal provisions etc. iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., –Introduction to Environmental Engineering||, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. –Introduction to Environmental Engineering and Science||, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

Course Outcomes:

At the end of the course, the student will be able to

1. Model and solve the first order differential equations
2. Experiment with the practical importance of solving first and higher order differential equations in engineering.
3. Solve higher order differential equations and understand about initial value problems
4. Identify methods for solving linear partial differential equations.
5. Make use of central concepts in partial differential equations and vector differentiation
6. Apply vector calculus in the context of estimating the work done, circulation, flux and vector integral theorems

COs	PO1	PO2	PO3	PO4	PO12
1	3	3	2	2	1
2	3	2	3	3	1
3	3	3	3	2	1
4	3	2	2	1	1
5	3	3	2	1	1
6	3	3	3	2	1

COs – POs Mapping

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT- I :**Differential equations of first order and first degree**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits

UNIT – II :**Linear differential equations of higher order (Constant Coefficients)**

Definitions, homogenous and non-homogenous, complimentary function, general particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT – III : Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT - IV : Vector Calculus**Vector differentiation:**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions - Divergence and Curl, vector identities

Vector integration:

Line integral- circulation- work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Assessments
Remember	10	10	
Understand	60	60	40
Apply	30	30	60
Analyze			
Evaluate			
Create			
Total (%)	100	100	100

Sample Question (s)**Remember**

1. State Newton's Law of Cooling
2. Find the Wronskian for the functions $\cos x$ and $\sin x$
3. Form the PDE by eliminating the arbitrary constants a and b from $z = ax + by + \frac{a}{b} - b$
4. State Gauss divergence theorem.

Understand

1. Solve $(1 + e^{x/y})dx + e^{x/y} \left(1 - \frac{x}{y}\right)dy = 0$
2. Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 2e^{3x}$
3. Form the PDE by eliminating the arbitrary functions from $Z = f(x) + e^y g(x)$

Apply

1. A bacterial culture, growing exponentially, increases from 200 to 500 grams in the period from 6 a.m. to 9 a.m. Find the number of grams which will be present at noon.
2. If a voltage of $20 \cos 5t$ is applied to a series circuit consisting of 10 ohm resistor and 2 Henry inductor, determine the current at any time t .
3. Find the work done in moving a particle in the force field $F = 3x^2\bar{i} + (2xz - y)\bar{j} + z\bar{k}$ along the straight line from $(0,0,0)$ to $(2,1,3)$.

23ME201 ENGINEERING MECHANICS
(Common to MECH & CIVIL)

3 0 0 3

Course Outcome:

1. Compute the resultant force in concurrent and coplanar force systems.
2. Analyze the equilibrium condition for different force systems with and without friction.
3. Determine the forces and their nature in the members of trusses.
4. Determine the centroids, centre of gravity and moment of inertia of different geometrical shapes.
5. Analyze the kinematics of rectilinear and curvilinear motions.
6. Assess the kinetics of rectilinear, curvilinear and rigid body motion.

CO-PO Mapping

COs	PO1	PO2	PO3	PSO ₁
1	3	2	2	2
2	3	2	2	2
3	3	2	2	2
4	3	2	2	2
5	3	3	2	2
6	3	3	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I: Introduction to Engineering Mechanics – Basic Concepts, Scope and Applications, Systems of Forces: Coplanar Concurrent Forces– Components in Space–Resultant– Moment of Force and its Application –Couples and Resultant of Force Systems.

Friction: Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction. **12 hours**

UNIT II: Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Analysis of plane trusses by method of joints and sections. **12 hours**

UNIT III: Centroid and Centre of Gravity: Centroids of simple figures (from basic principles)–Centroids of Composite Figures. Centre of gravity of composite bodies,

Area Moments of Inertia: Definition– Polar Moment of Inertia, Parallel and perpendicular axis theorems, Moments of Inertia of Composite Figures. **12 hours**

UNIT IV: Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics –D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method.

Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method. **12 hours**

Total: 48
hours

Textbooks:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education.
2. Engineering Mechanics, S.S Bhavikatti, 8th Edition, New Age International, 2022.
3. Engineering Mechanics, A.K Tayal, Statics and Dynamics, 14th Edition, Umesh Publishers, 2021
4. Engineering Mechanics: Principles of Statics and Dynamics, R.C. Hibbeler., Pearson Press, 2006.
5. Introduction to Statics and Dynamics, Andy Ruina and Rudra Pratap., Oxford University Press, 2011.

Sample Questions(s)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examinations (%)
Remember	15	15	-
Understand	30	30	-
Apply	55	55	70
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Remember

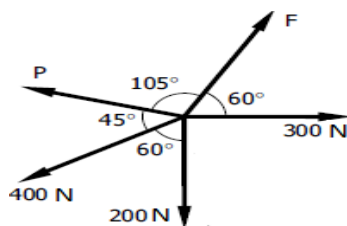
1. Name different types of system of forces
2. Define centroid
3. Define area moment of inertia
4. State the laws of friction
5. List the assumptions of perfect frame
6. Define Rectilinear and Curvilinear motions

Understand

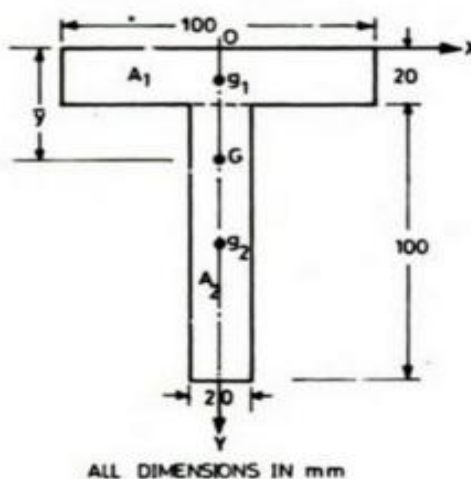
1. Explain Lami's theorem
2. Compare centroid and centre of gravity
3. Explain about area moment of inertia
4. How will you distinguish between static friction and dynamic friction?
5. Explain the difference between frame and truss
6. Explain the D'Alembert's principle

Apply

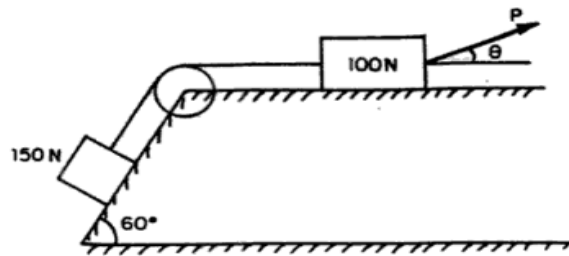
1. Figure represents the concurrent force system acting at a joint of a bridge truss. Determine the value of P and E to maintain equilibrium of the forces



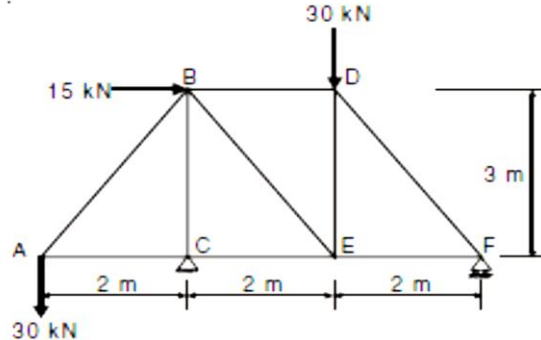
2. Identify the centroid of T-section shown in below Fig.



3. Determine the moment of inertia of the areas of Triangle about its base by first principle
4. Determine the least value of force P to cause motion to impend rightwards. Assume the co-efficient of friction under the blocks to be 0.2 and pulley to be frictionless.



5. Determine the forces in all the members of the truss shown in Fig.



6. A stone is dropped into a well and the splash is heard two seconds later. If sound travels 335m/s, what is the depth of the well?
7. An 1800 kg Toyota Innova travels down the 10° inclined road at a speed of 6 m/s. If the driver jams on the brakes, causing his wheels to lock, solve how far the tires skid on the road using: a. Equation of the motion b. Principles of work-Energy The coefficient of kinetic friction between the wheels and the road is 0.5 **(For Open Book Examination and not for semester end examination)**

Analyze

1. A uniform ladder 3 m long weighs 200 N. It is placed against a wall making an angle of 60° with the floor as shown in Fig. The coefficient of friction between the wall and the ladder is 0.25 and that between the floor and ladder is 0.35. The ladder, in addition to its own weight, has to support a man of 1000 N at its top at B. Calculate: i) The horizontal force P to be applied to ladder at the floor level to prevent slipping. ii) If the force P is not applied, what should be the minimum inclination of the ladder with the horizontal, so that there is no slipping of it with the man at its top?
2. Compare the location of the centroids of an arc of circle and a sector of a circle subtending the same angle at the centre of the circle
3. A car A is travelling on a straight level road with a uniform speed of 60 km/hr. it is followed by another car B moving at a speed of 70 km/hr. when the distance between them is 2.5 km, the car B is decelerated at 20 km/hr^2 . will the car be catch up with A? if not, why not? If yes, at what distance and time?
4. Analyze the ability of a hook (used by a crane) to raise prefabricated walls upright. The hook was approximately J-shaped, with a lip. The hook would grip one end of the wall and lift, while the other end of the wall remained in contact with the ground **(For Open Book Examination and not for semester end examination)**
6. The car A has a forward speed of 18 km/h and is accelerating at 3 m/s^2 Determine the velocity and acceleration of the car relative to observer B, who rides in a nonrotating chair on the Ferris wheel. The angular rate $\omega = 3 \text{ rev/min}$ of the Ferris wheel is constant **(For Open Book Examination and not for semester end examination)**

Course Outcomes

At the end of the course, Student will be able to

1. Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
2. Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
3. Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
4. Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between dequeues and priority queues, and apply them appropriately to solve data management challenges.
5. Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
6. Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

CO-PO Mapping

COs	PO1	PO2	PO3	PO12	PSO1
1	3	2	2	1	3
2	3	3	3	1	3
3	3	3	3	1	3
4	3	3	3	1	3
5	3	3	3	1	3
6	2	3	3	1	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures.

Searching Techniques: Linear & Binary Search, **Sorting Techniques:** Bubble sort, Selection sort, Insertion Sort

11Hours

Unit II

Linked Lists and Stacks: Singly linked lists, representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists. **Stacks:** Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists,

Hours

13

Unit III

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists. **Dequeues:** Introduction to dequeues (double-ended queues), Operations on dequeues and their applications. **Applications of Stack and Queue:** Applications of stacks in expression evaluation, backtracking, reversing list etc., Applications of queues in breadth-first search, scheduling, etc.

Hours

12

Unit IV

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversals Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

12 Hours

Total: 48 Hours

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.

2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Assessments
Remember	25	25	
Understand	38	38	
Apply	37	37	
Analyze	--		30
Evaluate	--		25
Create	--		45
Total (%)	100	100	100

Sample Question (s)**Remember**

1. Compute the time complexity of insertion in a linked list.
2. Define Abstract Data Type (ADT)?
3. Define a linear data structure and give one example.

Understand

1. How does the implementation of ADTs benefit software development?
2. What is the time complexity of a linear search in the worst case?
3. Differentiate between stack and queue.

Apply

1. Describe the process of implementing an ADT for a stack.
2. Draw the logical structure of a doubly linked list.

Course Outcomes

At the end of the course, Student will be able to

1. Summarize the V-I relations of electrical circuit elements.
2. Outline magnetic and couple circuits
3. Apply network reduction techniques to DC circuits
4. Summarize the behaviour of AC circuits
5. Apply network theorems to AC and DC circuits.
6. Outline the characteristics of series/parallel resonant circuits

COs – POs Mapping

COs	PO1	PO2	PO3	PO6	PO7	PO9	PO12	PSO1	PSO2
CO1	3	1	2	1	1	1	1	3	3
CO2	3	1	2	1	1	1	1	3	3
CO3	3	1	2	1	1	1	1	3	3
CO4	3	1	2	1	1	1	1	3	3
CO5	3	1	2	1	1	1	1	3	3
CO6	3	1	2	1	1	1	1	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT-I: Introduction to Electrical Circuits

Basic circuit elements R, L, C and their V-I relations, dependent and independent sources, Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation, source transformation), nodal and mesh analysis to DC networks with dependent and independent voltage and current sources *supernode and supermesh analysis* **(12 Hours)**

UNIT-II: Magnetic Circuits

Terminology used in magnetic circuits, series, parallel and composite magnetic circuits, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling.

Conductively coupled equivalent circuit **(10 Hours)**

UNIT-III: Single Phase Circuits

Characteristics of periodic functions, Average value, R.M.S. value, form factor, peak factor, and representation of a sine function, concept of phasor, phasor diagram.

Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL, RC and RLC circuits, parallel RL, RC and RLC parallel circuits, power and power factor

Resonance: Series Resonance-Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance- Q-factor, selectivity and bandwidth.

Locus diagram: RL, RC, RLC series circuits with R, L and C variables.

Comparison between series and parallel resonance, applications of resonant circuits **(15 Hours)**

UNIT-IV: Network theorems (DC & AC Excitations)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem and Millman's theorem and compensation theorem.

Tellegen's theorem **(11 Hours)**

(Total: 48 Hours)

Textbook (s)

1. W.H.Hayt, J.E.Kimmerly, and S.M.Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition, 2015.
2. Charles K Alexander and Mathew N.O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, 5th Edition, 2013.

3. M.E Van Valkenburg, "*Network Analysis*", Prentice Hall of India, 4th Edition, 2018.
4. P. Ramana, G.T.Chnadra Sekhar, G.Suresh, "*Network Theory*", SChand and Company Ltd., 1st Edition, 2024.

Reference (s)

1. Abhijit Chakrabarti, "*Circuit Theory Analysis and Synthesis*", Dhanpat Rai & Co., 6th Edition, 2014.
2. A Sudhakar, and Shyammohan S. Palli, "*Circuits and Networks: Analysis and Synthesis*", McGraw Hill Higher Education, 5th Edition, 2015.
3. M Nahvi, Joseph Edminister, K Uma Rao, "Electric Circuits, (Schaum's Outline Series)", McGraw Hill Higher Education, 7th Edition, 2017.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test(%)
Remember	20	20	-
Understand	20	20	-
Apply	60	60	60
Analyze	-	-	40
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)

Remember

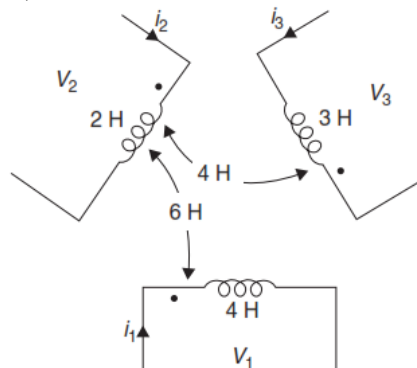
1. When a 25 Ω resistor, 100 Ω resistor, 75 Ω resistor and 50 Ω resistor are connected in parallel, then find the total resistance of the circuit.
2. Define statically induced emf.
3. List the limitations of Millman's theorem
4. State superposition theorem.
5. Define Quality factor and bandwidth.

Understand

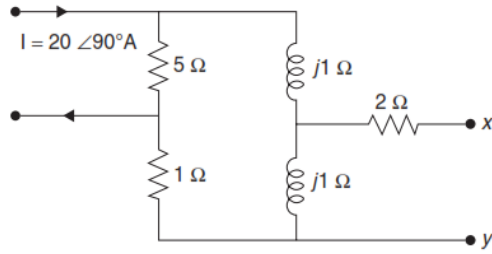
1. Find the two elements in a series circuit, given that the current and total voltage are $i = 10 \cos(5000 t - 23.13^\circ) \text{ A}$, $v = 50 \cos(5000 t + 30^\circ) \text{ V}$
2. When two coils are connected in series their effective inductance is found to be 10 H. When the connection of one coil is reversed, the effective inductance is 6 H. If the coefficient of coupling is 0.6, calculate the self inductance of each coil and the mutual inductance.
3. State dot rule for coupled coils and explain its significance.

Apply

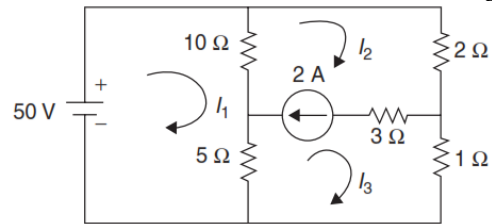
1. For the circuit as shown in the figure, write the inductance matrix.



2. Find the power consumed by a load of $5\angle 60^\circ \Omega$ connected between terminals x and y in the circuit as shown in the figure, using Thevenin's theorem.



3. Determine the current in the 5Ω resistor in the network shown in the figure.



Course Outcomes

At the end of the course, Student will be able to

1. Apply network reduction techniques to DC circuits.
2. Apply network theorems to simplify complex networks.
3. Summarize the behavior of AC circuits.
4. Explain series and parallel connected coupled circuits.
5. Interpret various parameters for a given two-port network.
6. Illustrate the transient response of R, L, C circuits for DC and AC excitations.

COs – POs Mapping

COs	PO1	PO2	PO3	PO6	PO7	PO9	PO12	PSO1	PSO2
CO1	3	1	2	1	1	1	1	1	1
CO2	3	1	2	1	1	1	1	1	1
CO3	3	1	2	1	1	1	1	1	1
CO4	3	1	2	1	1	1	1	1	1
CO5	3	1	2	1	1	1	1	1	1
CO6	3	1	2	1	1	1	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT-I**Introduction to Electrical Circuits and Network theorems**

Introduction to Electrical Circuits: Types of circuit elements, types of sources, ohm's law, Kirchoff's laws, source transformation, star-delta conversion, mesh and nodal analysis, problem solving with resistances, principle of duality with examples.

Network Theorems: Superposition, Thevenin's, Norton's, Millman's, Reciprocity, Compensation, Substitution, Max Power Transfer, Tellegen's theorems.

13 Hours

UNIT-II**Steady state AC analysis and Resonance**

Steady State AC Analysis: Impedance concept, j-operator, phasor notation, RL, RC, RL C circuits problem solving, calculation of different powers and power factor.

Resonance: Definition of resonance, series resonance, parallel resonance, bandwidth, quality factor of series and parallel resonance.

11 Hours

UNIT-III**Coupled Circuits and Two Port Networks**

Coupled Circuits: Faraday's laws of electromagnetic induction, self-inductance, mutual inductance, coefficient of coupling, dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

Two-port Networks: Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Interrelationship between parameters, Interconnection of two port networks.

12 Hours

UNIT-IV**Transient Analysis**

Transients: First order differential equations, Definition of time constants, RL circuit, RC circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, problem-solving using RLC elements with DC excitation and AC excitation, Response of second order circuit as related to location of poles in s-plane.

Laplace transforms: introduction to Laplace transformation, problem solving using Laplace transform,

12 Hours

Total: 48 Hours

Textbook (s)

1. W.H.Hayt, J.E.Kimmerly, and S.M.Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition, 2015.
2. Charles K Alexander and Mathew N.O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, 5th Edition, 2013.
3. M.E Van Valkenburg, "Network Analysis", Prentice Hall of India, 4th Edition, 2018.
4. P. Ramana, G.T.Chnadra Sekhar, G.Suresh, "Network Theory", SChand and Company Ltd., 1st Edition, 2024.

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2. A Sudhakar, and Shyammohan S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill Higher Education, 5th Edition, 2015.
3. M Nahvi, Joseph Edminister, K Uma Rao, "Electric Circuits, (Schaum's Outline Series)", McGraw Hill Higher Education, 7th Edition, 2017.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book/Assignment Exam(%)
Remember	10	10	
Understand	30	30	
Apply	60	60	70
Analyze			20
Evaluate			10
Create			
Total (%)	100	100	100

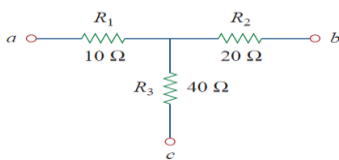
Sample Question (s)

Remember

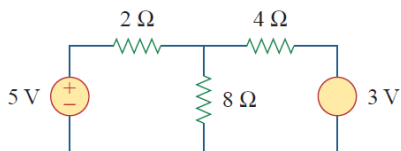
1. Define Kirchhoff of current law
2. Define Thevenin Theorem
3. Define Superposition theorem
4. Define time constant of a RL circuit

Understand

1. Convert the below Star network to Delta network.



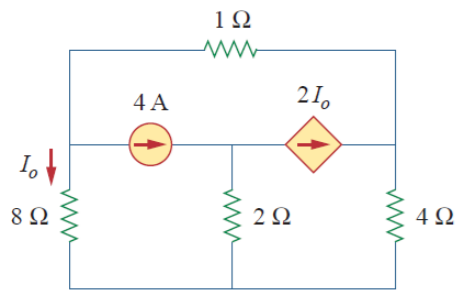
2. What is the Voltage across 8Ω resistor



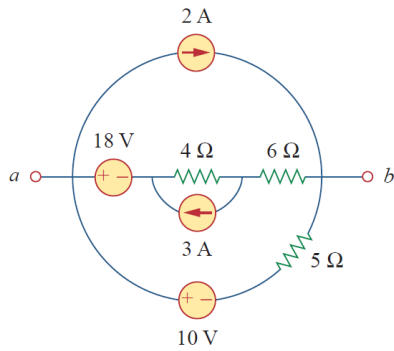
3. An incandescent lamp draws 2 A at 100 V. Find its resistance

Apply

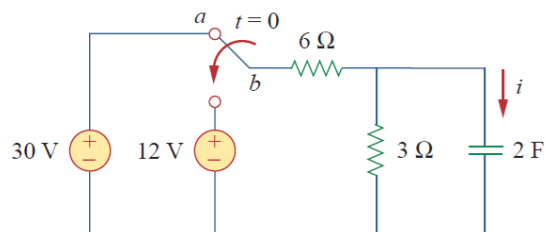
1. Find the value of voltage across 2Ω resistor by using Thevenin's theorem.



2. Find the Thevenin equivalent circuits at terminals ***a-b***.



3. The switch in circuit has been in position *a* for a long time. At $t=0$, it moves to position *b*. Calculate $i(t)$ for all $t > 0$.



Course Outcomes

At the end of the course, Student will be able to

- Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between dequeues and priority queues, and apply them appropriately to solve data management challenges.
- Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

CO-PO Mapping

COs	PO2	PO3	PO4	PO12	PSO1
1	2	3	2	1	3
2	2	3	2	1	3
3	2	3	2	1	3
4	2	3	2	1	3
5	2	3	2	1	3
6	2	3	2	1	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments:

1. Array Manipulation
 - a. Write a program to reverse an array.
 - b. Basic Array Programs
2. Searching Techniques
 - a. C Programs to implement the Searching Techniques – Linear
 - b. C Programs to implement the Searching Techniques - Binary Search
3. Sorting Techniques
 - a. C Programs to implement Sorting Techniques – Bubble Sort
 - b. C Programs to implement Sorting Techniques - Insertion Sort
4. Linked List Implementation
 - a. Implement a singly linked list and perform insertion and deletion operations.
 - b. Develop a program to reverse a linked list iteratively and recursively.
5. Linked List Applications
 - a. Create a program to detect and remove duplicates from a linked list.
 - b. Implement a linked list to represent polynomials and perform addition.
6. Double and Circular Linked List Implementation
 - a. Implement a doubly linked list and perform various operations to understand its properties and applications.
 - b. Implement a circular linked list and perform insertion, deletion, and traversal.
7. Stack Operations
 - a. Implement a stack using arrays
 - b. Implement a stack using linked lists
8. Queue Operations
 - a. Implement a queue using arrays
 - b. Implement a queue using linked lists
9. Queue Types
 - a. Implement a circular queue
 - b. Implement a double-ended queue (deque) with essential operations.

10. Stack Applications -I
 - a. Use a stack to convert an infix expression to postfix
 - b. Write a program to evaluate a postfix expression using a stack.
11. Stack Applications -II
 - a. Implement a program to check for balanced parentheses using a stack.
 - b. Create a program to determine whether a given string is a palindrome or not.
12. Queue Applications
 - a. Develop a program to simulate a simple printer queue system.
 - b. Implement a stack or queue to perform comparison and check for symmetry
13. Binary Search Tree
 - a. Implementing a BST using Linked List.
 - b. Traversing of BST.
14. Closed Hashing: Implement a hash table with open Addressing techniques.
15. Open Hashing: Implement a hash table with Separate chaining techniques.
16. Hashing- Application: Write a program to implement a simple cache using hashing.

Indicative list of applications-based experiments

1. **Integer to Roman**
 Problem Description: Given an integer, convert it to a Roman numeral. Input is guaranteed to be within the range from 1 to 3999.
 Implementation: You can create a function that iteratively subtracts the largest possible Roman numeral values from the given integer and appends the corresponding symbols until the integer becomes zero.
2. **Merge Two Sorted Linked Lists**
 Problem Description: Merge two sorted linked lists and return it as a new sorted list.
 Implementation: Create a function that takes two sorted linked lists as input and iteratively compares the nodes, merging them into a new sorted linked list.
3. **Task Scheduler**
 Problem Description: Given a character array representing tasks, each task is represented by a character. Tasks could be done without the original order. Each task is done in one unit of time. For each unit of time, any CPU can execute at most one task. Given the character array, find the minimum time required to finish all the tasks.
 Implementation: Implement a function that schedules the tasks efficiently based on their frequencies and calculates the minimum time required.
4. **Find the kth Smallest or Largest Element in a BST**
 Problem Description: Given a binary search tree, find the kth smallest or largest element in it.
 Implementation: Write a function that performs an in-order traversal of the BST while keeping track of the count of visited nodes. Return the kth element when the count matches k.
5. **Construct BST from Preorder or Postorder Traversal**
 Problem Description: Given an array representing either the preorder or postorder traversal of a binary search tree, construct the tree.
 Implementation: Create a function that recursively builds the binary search tree using the given traversal order.
6. **Binary Tree Level Order Traversal**
 Problem Description: Given a binary tree, return the level order traversal of its nodes' values. (i.e., from left to right, level by level).
 Implementation: Implement a function that performs a level order traversal using a queue to keep track of each level.
7. **Checking for Anagram Pairs using Hash Table**
 Problem Description: Given an array of strings, group anagrams together.
 Implementation: Create a function that uses a hash table to group anagrams. Anagrams will have the same sorted characters, which can be used as keys in the hash table.
8. **Check if the Tree is Balanced**
 Problem Description: Given a binary tree, determine if it is height-balanced.
 Implementation: Write a function that calculates the height of each subtree and checks if the difference in heights between left and right subtrees is within one.

Course Outcomes:

1. Demonstrate knowledge of the principles governing the Law of forces and validate them through experimental setups
2. Execute the experiments to achieve equilibrium in coplanar-concurrent force system
3. Assess the significance of friction in mechanical systems.
4. Check the equilibrium of objects subjected to diverse forces, delve into rotational dynamics, and apply principles of conservation laws
5. Apply the principles of static equilibrium to analyse coplanar non-concurrent, parallel force systems
6. Apply the principle of mechanics to system of pulleys, compound pendulum and Bell-crank lever

COs – POs Mapping

CO	PO ₁	PO ₄	PO ₆	PO ₉	PO ₁₀	PSO ₁
1	3	2	2	3	2	2
2	3	2	2	3	2	2
3	3	2	2	3	2	2
4	3	2	2	3	2	2
5	3	2	2	3	2	2
6	3	2	2	3	2	2

Students have to perform any 10 of the following Experiments:**List of Experiments:**

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non- concurrent, parallel force system with the help of a simply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

1. Engineering Mechanics Lab manual.
2. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
3. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022.

List of Augmented Experiments

1. Prepare a couple for any engineering application
2. Prepare a truss and draw a FBD for it
3. Find the centroid of a composite plane
4. Prepare a demonstrative model for different force systems
5. Analysis of Projectile Motion: Launch projectiles at different angles and measure their range, height, and time of flight. With an Objective: Verify the equations of motion for projectiles and determine the effect of launch angle on range and maximum height.

Course Outcomes:

At the end of the course, Student will be able to

- 1 Analyze the DC Transients of RL & RC circuits
- 2 Make use of network theorems to simplify the electrical circuits
- 3 Analyze the DC Transients of RL & RC circuits
- 4 Demonstrate the characteristics of series RL, RC circuits
- 5 Demonstrate the characteristics of series RLC circuits and resonant circuit for given specifications
- 6 Characterize and model the network in terms of all network parameters: Illustrate Kirchhoff's laws, mesh, and nodal analysis for DC circuits

COs – POs Mapping

COs	PO4	PO5	PO6	PO9	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1
CO2	3	2	1	1	1	1	1
CO3	3	2	1	1	1	1	1
CO4	3	2	1	1	1	1	1
CO5	3	2	1	1	1	1	1
CO6	3	2	1	1	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

SYLLABUS:

The following experiments need to be performed using Simulation Software.

1. Verification of KCL and KVL for DC circuits.
2. Verification of mesh and nodal analysis for DC circuits
3. Verification of Superposition theorems for DC circuits
4. Verification of Thevenin's and Norton's theorems for DC circuits
5. Verification of Maximum power transfer theorem for DC circuits
6. Determination of Impedance and Power factor of Series RL & RC circuits
7. Determination of Active, reactive, and apparent power of Series RL & RC circuit
8. Determination of Impedance, Power factor, Active, Reactive, and Apparent power of a series RLC circuit
9. Construct a Series Resonance circuit to find the Q Factor and Bandwidth
10. Construct a Parallel Resonance circuit to find the Q Factor and Bandwidth
11. Determination of open circuit (Z) and short circuit (Y) parameters
12. Determination of hybrid (H) and transmission (ABCD) parameters
13. Analysis of DC transients in Series RL and Parallel RL circuits
14. Analysis of DC transients in Series RC and Parallel RC circuits
15. Analysis of DC transient and steady-state response of a 2nd order circuit by varying its various parameters and studying their effects on responses.

Textbook (s):

1. M.E Van Valkenburg, Network Analysis, Prentice Hall of India, 3rd Edition, 2015
2. W.H.Hayt, J.E.Kimmerly, and S.M.Durb, Engineering circuit analysis, McGraw Hill Education private limited, 8th Edition, 2013

Software requirements:

Multisim/ Pspice/Orcad Equivalent simulation software tool, Computer Systems with required specifications

References:

1. Network Analysis ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
- Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020

Course Outcomes:

At the end of the course, Student will be able to

1. Demonstrate network reduction techniques using basic laws.
2. Compute the parameters of electrical equipment
3. Compute the parameters of magnetic circuit
4. Analyse series and parallel resonant circuits
5. Analyse maximum Power transfer from source to load
6. Apply network theorems to solve electrical circuits

COs – POs Mapping

COs	PO4	PO5	PO6	PO9	PO12	PSO1	PSO2
C01	3	2	1	1	1	2	2
C02	3	2	1	1	1	2	2
C03	3	2	1	1	1	2	2
C04	3	2	1	1	1	2	2
C05	3	2	1	1	1	2	2
C06	3	2	1	1	1	2	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

List of Experiments

S.No	Name of Experiment	COs
CYCLE 1 (Hardware)		
1	Verification of Kirchhoff's circuit laws.	C01
2	Determination of self, mutual inductances, and coefficient of coupling.	C03
3	Determination of Parameters of a choke coil.	C02
4	Verification of Superposition theorem	C06
5	Series and parallel resonance	C04
CYCLE 2 (Simulation)		
1	Verification of node and mesh analysis	C01
2	Verification of Thevenin's and Norton's Theorems	C06
3	Verification of Maximum power transfer theorem	C05
4	Verification of Compensation theorem	C06
5	Verification of Reciprocity and Millman's Theorems	C06

List of Augmented Experiments:

1. Locus diagrams of R-L(L Variable) and R-C (C Variable) series circuits
2. Verification of network reduction techniques.
3. Determination of cold and hot resistance of an electric lamp
4. Determination of resonance frequency for a parallel tank circuit.
5. Verification of tellegan's theorem.

Reference Books:

1. W.H.Hayt, J.E.Kimmerly, and S.M.Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition, 2015.
2. Charles K Alexander and Mathew N.O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, 5th Edition, 2013.
3. M.E Van Valkenburg, "Network Analysis", Prentice Hall of India, 4th Edition, 2018.
4. P. Ramana, G.T.Chnadra Sekhar, G.Suresh, "Network Theory", SChand and Company Ltd., 1st Edition, 2024.

Course Outcomes:

At the end of the course, the student will be able to

1. Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.
2. Verify Law of Parallelogram of forces and Law of Moment using force polygon and bell crank lever.
3. Determine the Centre of gravity different configurations
4. Understand the Quality Testing and Assessment Procedures
5. Understand the principles of Non- Destructive Testing.
6. Exposure to safety practices in the construction industry.

COs – POs Mapping

COs	PO1	PO6	PO8	PO9	PO10
CO1	3	2	3	3	2
CO2	3	2	3	3	2
CO3	3	2	3	3	2
CO4	3	2	3	3	2
CO5	3	2	3	3	2
CO6	3	2	3	3	2

3–Strongly linked | 2–

Moderately linked | 1–Weakly linked

Students have to perform any 10 of the following Experiments:**List of Experiments:**

1. To study various types of tools used in construction.
2. Forces in Pin Jointed Trusses
3. Experimental Proof of Lami's Theorem
4. Verification of Law of Parallelogram of Forces.
5. Determination of Center of Gravity of different shaped Plane Lamina.
6. Determination of coefficient of Static and Rolling Friction.
7. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever
8. Study of Alternative Materials like M-sand, Fly ash, Sea Sand etc.
9. Field-Visit to understand the Quality Testing - report.
10. Safety Practices in Construction industry
11. Demonstration of Non-Destructive Testing - using Rebound Hammer & UPV
12. Study of Plumbing in buildings.

References:

1. Engineering Mechanics and Building Practices Lab manual.
2. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
3. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022.

3rd Semester

23CS301 Problem Solving using Python

3 0 2 4

Course Outcomes

At the end of the course, students will be able to

1. Explain the fundamentals of Python with syntax and semantics.
2. Apply conditional and control flow statements, and analyze strings and regular expressions for pattern matching and text processing.
3. Apply the built-in data structures such as dictionaries, sets, lists, and tuples for data manipulation.
4. Apply the concepts of functions and functional programming techniques.
5. Apply the file Handling and exception handling techniques.
6. Describe the principles of object oriented programming in Python and demonstrate the use of Modules and Packages.

CO – PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	3	-	-	-	-	-	-	1	-	-
CO2	2	3	3	-	3	-	-	-	-	-	-	2	-	-
CO3	2	3	3	-	3	-	-	-	-	-	-	2	-	-
CO4	2	2	3	-	3	-	-	-	-	-	-	2	-	-
CO5	2	3	2	-	3	-	-	-	-	-	-	2	-	-
CO6	3	2	3	-	3	-	-	-	-	-	-	2	-	-

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

12 Hours

Introduction: History and need for python programming, Identifiers, Statements, Variables, Keywords, Input-Output statements, Indentation, command line arguments.

Data Types - Integers, Strings, Booleans. **Operators** - Arithmetic, Comparison/Relational, Assignment, Logical, Bitwise, Membership, Identity. **Expressions and order of evaluations** - Precedence and Associativity. **Built-in Functions** – Importing from Packages. **Conditional Statements:** If, Elif, Else statements, iteration statements - While, For - Break, Continue and pass statements.

Applications of Python, REPL (Read, Evaluation, Print, Loop)

Practical Components

1. Basic Operations: Validating and Converting Data Formats and Numeric Systems in Python
2. Control Statements: Implementing Fibonacci Series and Advanced List Operations
3. Array Manipulations : Matrix Operations: Transpose, Symmetry Check, and Multiplication

Unit II

12+6 Hours

Collections: Lists: Create, Access, Slicing, Negative indices, List methods, List comprehensions – Tuples: Create, Indexing and slicing, Operations on tuples – Dictionary: Create, add, and replace values, Operations on dictionaries – Sets: Creation and operations.

Strings: Strings: Comparison, Formatting, Slicing, Splitting, Stripping . **Regular Expressions:** Matching, Search and replace, Patterns.

collections.deque, grouping with Dictionaries

Practical Components

1. Array Manipulations: Intersection, Kth Largest Element, and Maximum Subarray in Lists
2. Working with Dictionaries: Word Frequency Counting, Dictionary Merging, and Filtering
3. String Manipulation: Acronyms, Valid Parentheses, Anagram Check, and Common Prefix

- Regular Expressions for Email Validation, Phone Number Extraction, and Password Strength Checking

Unit III

12 +8 Hours

Functions- Defining Functions, Calling Functions, Types of Arguments, Recursion, Anonymous Functions: Lambda Expressions, Global and Local Variables. Functional Programming: map, filter and reduce, decorators. **Modules and Packages-** Built-in modules, User-Defined modules, itertools module. **Numpy and Pandas:** Introduction to Numpy and Pandas packages of python, Basic operations on Numpy and Pandas.

Higher order function, keyworded variable length arguments.

Practical Components

- Recursive Functions: Prime Factorization, Subsets Generation, and Fibonacci Sequence
- Exploring Default and Keyword Arguments, Variable Scopes, and Lambda Functions
- Functional Programming: Map, Filter, and Reduce Operations
- Itertools Applications: Counting, Cycling, Permutations, Combinations, and Sliding Windows
- Working with Numpy Arrays and Pandas DataFrames

Unit IV

12+10 Hours

Classes and Objects: Defining and instantiating Class, Class Attributes and Methods, Constructor, self-keyword - inheritance - overriding methods from parent class - Instances as Attributes, inner class. **File Handling-**Creating files, operations on files - Open, Close, Read and Write - Working with File Paths - File and Directory Operations. **Exception Handling-** Exception, try except block, Raising Exceptions, User Defined Exception.

polymorphism, Abstract class and abstract methods.

Practical Components

- Object-Oriented Programming: Creating and Using Classes and Objects
- Inheritance and Method Overloading/Overriding in Python
- File Handling and Simple File Explorer Implementation
- Exception Handling: Custom Exceptions

Total: 48+32 Hours

Textbook (s)

- Richard L. Halterman, "Fundamentals of Python Programming", 3rd Edition, Southern Adventist University, 2019.
- Matthes, E., "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
- Willaim Mckenny, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" 2nd Edition, O'Reily 2017.

Reference(s)

- Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015.
- Mertz, D., "Functional Programming in Python", 1st Edition, O'Reilly Media, 2015.
- Kenneth A. Lambert. "Fundamentals of Python: First Programs", 2nd Edition, Publisher: Cengage Learning 2018
- Python Programming: A Modern Approach, VamsiKurama, Pearson 2017 Learning Python, Mark Lutz, Orielly, 5th Edition.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	20	10	--
Understand	50	40	--

Apply	30	30	--
Analyze	--	20	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

Remember

1. What are the benefits of Python?
2. What is an Interpreted language?
3. List any four string handling functions

Understand

1. Explain lists and tuples?
2. Differentiate between the two?
3. What are Dict and List comprehensions?

Apply

1. Explain user defined exception
2. Justify multiple inheritance is supported in python?
3. Design a simple GUI page using Tkinter

23HSX10 Engineering Economics and Project Management**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Illustrate the basic principles of engineering economics.
2. Demonstrate Cost-Volume-Profit (CVP) analysis in business decision making.
3. Implement the simple financial statements for measuring financial performance of a firm.
4. Evaluate investment proposals through various capital budgeting methods.
5. State key issues of organization, management and administration.
6. Determine the accurate project cost estimates and plan future activities.

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	-	-	-	-	-	-	-	2	1	-	-	2
CO2	3	2	-	-	-	-	-	-	-	1	2	-	-	2
CO3	1	3	-	-	-	-	-	-	-	3	2	-	-	2
CO4	1	3	-	-	-	-	-	-	-	3	2	-	-	2
CO5	2	2	-	-	-	-	-	-	-	1	3	-	-	2
CO6	1	2	-	-	-	-	-	-	-	2	3	-	-	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-I**11 Hours****Introduction to Engineering Economics - Demand Forecasting & Cost Analysis**

Concept of Engineering Economics – Types of efficiency – Managerial Economics Nature and Scope – Law of Demand – Types of Elasticity of demand.

Demand Forecasting & Cost Analysis: Demand Forecasting: Meaning, Factors Governing Demand Forecasting, Methods of Demand Forecasting (Survey and Statistical Methods) – Cost Analysis: Basic Cost Concepts, Break Even Analysis.

Factors affecting the elasticity of demand – Supply and law of Supply

Unit-II**13 Hours****Market Structures - Financial Statements & Ratio Analysis**

Different type of Markets Structures – Features – Price Out-put determination under Perfect Competition and Monopoly

Financial Statements & Ratio Analysis: Introduction to Financial Accounting – Double entry system – Journal – Ledger – Trail Balance – Final Accounts (with simple adjustments) – Financial Analysis through Ratios: Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio, Creditors Turnover Ratio, Capital Turnover Ratio), Solvency Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

Price output determination under Monopolistic markets, Accounting concepts and conventions

Unit-III**12 Hours****Investment Decisions and Fundamentals of Management**

Time Value of Money – Capital Budgeting: Meaning, Need and Techniques of Capital Budgeting

Introduction to Management: Nature – Importance – Classical Theories of Management: F.W.Taylor's and Henri Fayol's Theory – Functions and Levels of Management – Decision Making Process – Inventory Control, Objectives, Functions – Analysis of Inventory – EOQ.

Maslow & Douglas McGregor theories of Management, ABC Analysis

Unit-IV**12 Hours****Project Management**

Introduction – Project Life Cycle and its Phases – Project Selection Methods and Criteria – Technical Feasibility – Project Control and Scheduling through Networks – Probabilistic Models of Networks –

Time-Cost Relationship (Crashing) – Human Aspects in Project Management: Form of Project Organization – Role & Traits of Project Manager.

Sources of Long-term and Short-term Project Finance

Total: 48 Hours

Textbook (s)

Pravin Kumar, Fundamentals of Engineering Economics, Wiley India Pvt. Ltd. New Delhi, 2015

Rajeev M Gupta, Project Management, 2ndEd., PHI Learning Pvt. Ltd. New Delhi, 2014

PanneerSelvam. R, Engineering economics, 2nd Ed., Prentice Hall of India, New Delhi, 2013

Reference (s)

R.B.Khanna, Project Management, PHI Learning Pvt. Ltd. New Delhi, 2011

R. PanneerSelvam&P.Senthil Kumar, Project Management, PHI Learning Pvt. Ltd. New Delhi, 2010

A. Aryasri, Management Science, 4thEd., Tata McGraw Hill, 2014

A. Aryasri, Managerial Economics and Financial Analysis, 4thEd., Tata McGraw Hill, 2014

Koontz & Weihrich, Essentials of Management, 6thEd., TMH, 2010

Chuck Williams and Mukherjee, Principle of Management 7thEd., Cengage Learning, 2013

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	25	25	--
Understand	35	35	--
Apply	40	40	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	--
Total (%)	100	100	100

Remember

Define Managerial Economics. Explain its nature and scope.

Define Production Function? List the various types of production functions.

Define the meaning of productivity? Explain how productivity can be enhanced in the Indian industries.

Define management and its functions.

List out short-term source of finance and explain briefly.

Why is it essential to define project life cycle and divide it into various phases?

Understand

Summarize engineering economics with suitable examples.

Explain different elements of costs used in cost analysis.

Illustrate the effect of price on demand and supply with the help of a diagram.

Explain the features of Perfect Competition.

Describe the Top level Upper Middle level of management and its functions.

Explain Price-Output determination under Perfect Competition under Market period.

Apply

- Consider the following data of company for the year 2015

Sales = Rs.2,40,000/-

Fixed cost = Rs.50,000/-

Variable cost = Rs.75,000/-

Find out the followings

a) Profit b) BEP c) Margin of safety

- The following trial balance of Mr. Ramesh, prepare trading, profit & loss A/c for the year ended 31.12.2018 and balance sheet as on that date.

Particulars	Debit (Rs.)	Credit (Rs.)
Capital		1,00,000
Drawing	18,000	
Furniture	32,500	
Machinery	15,000	
Bills payable		15,000
Interest paid	900	

Sales		1,00,000
Purchases	75,000	
Opening stock	25,000	
Advertisement	15,000	
Wages	2,000	
Insurance	1,000	
Commission received		4,500
Sundry debtors	28,100	
Cash in hand	20,000	
Sundry creditors		10,000
Interest received		3,000
Total	2,32,500	2,32,500

Adjustments:

Closing Stock Rs.60,000 b) Outstanding wages Rs.500

3. From the following balances as on the date March 31st, 2014.

Particulars	Amount (Rs.)	Particulars	Amount (Rs.)
10% Debentures	3,00,000	Cash in hand	30,000
6% Long term Loans	50,000	Debtors	15,000
Share capital	2,50,000	Opening stock	50,000
Creditors	1,00,000	Closing stock	40,000
Bill payable	45,000	Gross Profit	20,000
Sales	100000	Building	700000

Calculate: Current Ratio, Debt-equity ratio, Quick ratio, Inventory turnover ratio, Debtors turnover ratio

4. A company requires 40,000 kg of raw materials. The company incurs a handling cost of Rs.360/- plus freight of Rs.390 per order. The incremental carrying cost of inventory of raw material is Rs. 15 per kg. Calculate:
 a) EOQ b) Number of orders per annum c) How frequently should orders be placed
5. The following table gives the activities in a construction project and other related information:

Activity	Immediate Predecessors	t_0	t_m	t_p
A	-	1	9	11
B	-	5	6	7
C	A	5	7	9
D	A,B	4	7	10
E	C,D	1	4	7
F	C,D	7	9	11

- a) Draw PERT diagram
 b) Calculate total project duration
 c) Mark the critical path
 d) Find out the S.D and Variance of each activity
6. ABC Ltd., a US based organization, is engaged in manufacturing television screens. It is planning to establish a subsidiary organization in India to manufacture picture tubes. Cost studies produced the following estimates for the Indian subsidiary based on the estimated annual sales of picture tube (Rs.400000/-):

Particulars	Total Annual Cost (Rs.)	Percent of total annual cost that is variable
Materials	1936000	100%
Labour	900000	70%
Overhead	800000	64%
Administration	300000	30%

The Indian production would be sold by manufacturer's representatives who would receive a

commission of 8% of the sales. No portion of the parent organizations' expenses is to be allocated to the Indian subsidiary.

Questions:

1. Compute the sale price per picture tube to enable management to realize an estimated 10% profit on sale proceeds in India.
2. Is it feasible for ABC Ltd., to invest in the Indian market by studying the preceding calculation? **(For Open Book Examination and not for semester end examination)**

Analyze:

1. From the following cases analysis the situation of price elasticity of product.

Case 1:

Price of product (Rs.) Quantity of Demand (Units)

100 1000

90 1500

Case 2:

Price of product (Rs.) Quantity of Demand (Units)

100 1000

70 1100

2. Analyze the attributes to be consider for selection project.
3. Differentiate between Perfect Competition & Monopoly Competition.
4. Compare significances and limitation of liquidity and solvency ratios.
5. You are given the following information about two companies in the year 2020.

Particular	Company – A	Company – B
Sales	Rs. 50,00,000	Rs. 50,00,000
Fixed Expenses	Rs. 12,00,000	Rs. 17,00,000
Variable Expenses	Rs. 35,00,000	Rs. 30,00,000

A friend seeks your advices as to which company's shares be should purchase. Assuming the capital invested is equal for the two companies, state the advice that you will give.

6. A private school is considering the purchase a school bus to transport students to school. The initial cost of the bus is Rs.600,000. The life of bus is estimated to be five years, after the life time the vehicles would have to be scrapped with no salvage value. The school's management team has derived the following estimates for annual revenues and cost for the next five years.

year	Annual Revenue	Diver Cost	Repairs & maintenance	Other costs	Annual depreciation
1	330000	33,000	8,000	130000	120000
2	330000	35,000	13,000	135000	120000
3	350000	36,000	15,000	140000	120000
4	380000	38,000	16,000	136000	120000
5	400000	40,000	18,000	142000	120000

The buses would be purchased at the beginning of the project (i.e., in Year 0) and all revenues and expenditures shown in the table above would be incurred at the end of each relevant year. A business consultant has advised management that they should use a cost of capital of 10% to evaluate this project.

Questions:

1. Attributes to be involved to estimate the net cash flow for each year in this project.
2. Justify the steps involved in the calculation process of net present cash flows above the project investment.

23CS303 Design and Analysis of Algorithms**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Analyse the performance of algorithms using space and time complexity, and asymptotic notations.
2. Implement algorithms using brute force and divide and conquer approaches.
3. Apply advanced data structures and graph algorithms to solve complex computational problems effectively.
4. Demonstrate the ability to solve problems efficiently using greedy approach.
5. Develop problem-solving skills by tackling complex computational problems using dynamic programming and backtracking.
6. Apply branch and bound techniques to solve complex problems, and understand the concepts of NP-completeness to identify NP-complete problems.

COs-POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	3	-
CO2	2	2	3	-	-	-	-	-	-	-	-	1	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO4	3	2	3	-	-	-	-	-	-	-	-	2	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	-
CO6	3	3	2	-	-	-	-	-	-	-	-	2	3	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 hours****Algorithm Analysis and Divide and Conquer**

Fundamentals of algorithmic problem solving - Analysis framework - Performance Analysis: Space and Time complexity - Growth of Functions: Asymptotic Notations - Mathematical Analysis of Non-recursive and Recursive algorithms - Master's theorem - Brute Force String Matching Algorithm- Divide and Conquer: Merge sort, Quick sort, Fibonacci search.

Interpolation search and Radix sort

Unit II**12 hours****Advanced Data Structures and Graph Algorithms:**

Balanced Search Trees: AVL trees, B-trees - Heaps: Heapsort - Disjoint set: Find and Union Operations - Graphs: Introduction, Representation - Graph Traversals: BFS, DFS, Topological sort.

Tries and Strongly Connected Components

Unit III**12 hours****Greedy and Dynamic Programming**

Greedy Method: General method, Job sequencing with deadlines, Optimal Merge Patterns - Minimum cost spanning trees: Prim's and Kruskal's Algorithms - Single source shortest path problem: Dijkstra's Algorithm - Dynamic Programming: General method, Matrix chain multiplication, 0/1 knapsack problem, All pairs shortest path problem: Floyd Warshall Algorithm.

Graph coloring problem, Huffman Trees and Codes

Unit IV**12 hours****Backtracking and Branch and Bound**

Backtracking: General method, n-queen problem, sum of subsets problem, Hamiltonian Circuit problem. Branch and Bound: General method, Knapsack Problem, Traveling sales person problem, Assignment Problem. Complexity Classes : P, NP and NP-Complete Problems.

Exhaustive Search, Space and Time Trade-Offs

Total: 48hours

Textbook (s)

1. Introduction to The Design and Analysis of Algorithms, 3rd Edition, Anany Levitin, Pearson Education, 2017.
2. Introduction to Algorithms, second edition, T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, PHI Pvt. Ltd./ Pearson Education
3. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekaran, University press.

Reference (s)

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson Education.
2. Algorithms – Richard Johnsonbaugh and Marcus Schaefer, Pearson Education.
3. www.geeksforgeeks.org
4. www.hackerearth.com
5. www.tutorialspoint.com

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	20	20	50
Analyze	20	20	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember :

1. Define time complexity and space complexity in the context of algorithms.
2. What is the purpose of asymptotic notations like Big O, Big Omega, and Big Theta?
3. List the steps involved in the Merge Sort algorithm.
4. State the Master's theorem for divide-and-conquer recurrences.
5. What are the key differences between AVL trees and B-trees?

Understand :

1. Explain how the Brute Force String Matching Algorithm works and its time complexity.
2. Describe the basic idea of the Divide and Conquer approach with an example.
3. How does the Floyd-Warshall algorithm find the shortest paths between all pairs of vertices in a graph?
4. Explain the difference between a min-heap and a max-heap.
5. What is the significance of the depth-first search (DFS) in finding strongly connected components in a graph?

Apply :

1. Apply the Quick Sort algorithm to the following list of numbers: [34, 7, 23, 32, 5, 62].
2. Using Dijkstra's algorithm, find the shortest path from a given source vertex to all other vertices in a weighted graph.
3. Given a set of jobs with deadlines and profits, use the Greedy method to find the maximum profit sequence.
4. Implement the BFS algorithm on a graph represented by an adjacency list.
5. Use the dynamic programming approach to solve the 0/1 Knapsack problem with given weights and values.

Analyze :

1. Analyze the time complexity of the Radix Sort algorithm and compare it with other sorting algorithms like Quick Sort and Merge Sort.
2. Compare and contrast the space efficiency of AVL trees and B-trees.
3. Analyze the advantages and disadvantages of using the Backtracking approach for solving the n-queen problem.
4. Discuss the time complexity of the Floyd-Warshall algorithm and its feasibility for large graphs.
5. Examine the differences between P, NP, and NP-Complete problems, and provide examples of each.

23CS304 Digital Logic Design**3 0 2 4****Course Outcomes**

1. Demonstrate different number systems, its conversions, and binary arithmetic.
2. Classify logic circuits using basic Logic gates and simplify logic expressions using theorems, K-map.
3. Design and implement logical devices using combinational circuits.
4. Demonstrate and compare the construction of programmable logic devices and different types of ROM.
5. Analyze Sequential circuits like latches and flip-flops.
6. Analyze and Design sequential circuits like Registers and Counters.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	1	1	1	-	-	-	-	-	-	-	2	-
CO3	3	1	3	2	2	-	-	-	-	-	-	-	3	-
CO4	2	3	3	2	2	-	-	-	-	-	-	-	3	-
CO5	3	2	2	-	2	-	-	-	-	-	-	-	3	-
CO6	3	3	3	2	2	-	-	-	-	-	-	-	3	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+6 Hours****Number systems and Boolean algebra**

Review of Number Systems, Conversion of Numbers from One Radix to Another Radix, Complements, Representation of Negative Numbers, Binary Arithmetic, Binary Codes, Error detecting & correcting codes, Basic Theorems and Properties of Boolean Algebra, Digital Logic Gates, Universal Gates.

IC specifications and pin diagram of gates

Practical Components

Realization of Logic gates and verification of Truth tables
 Realization of basic gates using Universal gates (NOR)
 Realization of basic gates using Universal gates (NAND)

Unit II**12+12Hours****Boolean Function Minimization**

Minimization of Switching Functions using K-Map up to 4-variables, Prime implicants, don't care combinations, Minimal SOP and POS forms

Combinational Arithmetic Logic Circuits-1

Adders, Subtractors, Binary Multiplier-*parity bit Generator*, Ripple carry adder, Multiplexer, De-Multiplexer, Encoder, Priority encoder, Decoder, MUX Realization of switching functions.

Code Converters, Magnitude Comparator

Practical Components

1. Implementation of Half Adder
2. Implementation of Full Adder
3. Implementation and verification of Encoder
4. Implementation and verification of Decoder
5. Implementation and verification of MUX
6. Implementation and verification of DE-MUX

Unit III**12+6Hours****Programmable Logic Devices and Sequential Logic Circuits-1**

Basic PLD's-ROM-PROM-PLA-PAL - Realization of Switching functions using PLD's Classification of Sequential Circuits (Synchronous and Asynchronous): Latches and Basic Flip-Flops-Truth Tables and

Excitation Tables

Conversion of flip-flops

Practical Components

1. Realization of Flip-Flops using ICs (SR Flip Flop]
2. Realization of Flip-Flops using ICs (JK Flip Flop]
3. Realization of Flip-Flops using ICs (D and T Flip Flop]

Unit IV

12+8 Hours

Sequential Logic Circuits - II

Design of Registers - Buffer Register - Control Buffer Registers - Bidirectional Shift Registers - Universal Shift Register - Design of Synchronous Counters – Ripple counter, Up-down Counters, Design of Asynchronous Counters-Variable Modulus Counters (Mod-2,4,6,10 & 16), Ring Counter, Johnson Counter, Sequence generator.

Sequence detector

Practical Components

1. Verification of SISO and SIPO Shift Registers
2. Verification of PIPO and PISO Shift Registers
3. Implementation of Synchronous Counter
4. Implementation of Asynchronous Counter

Total: 48+32 Hours

Textbook (s)

1. Digital Design 6th Edition by M Morris Mano, PEARSONINDIA,2018.
2. Charles H. Roth, Fundamentals of Logic Design,3rdEdition, ThomsonPublications,2014
3. John F. Wakerly, Digital Design Principles & Practices, 4thEdition, PHI/ Pearson EducationAsia,2008

Reference (s)

1. ZviKohavi, Switching & Finite Automata theory, 2nd Edition,TMH,2008
2. R P Jain,Modern Digital Electronics, 3rd Edition,TMH,2003
3. A. Anand Kumar, Switching Theory and Logic Design, 3rd Edition,PHP,2016.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	20	10	--
Understand	50	40	--
Apply	30	30	--
Analyze	--	20	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

SAMPLE QUESTION (S)

Remember

1. Retrieve the decimal value of the fractional binary number0.1011
2. List any two postulates of Boolean algebra
3. List the four uses of Multiplexer.
4. Define Flip flop and Latch
5. Define Synchronous sequential circuit

Understand

1. Explain working functionality of Programable Logic Devices(PLD).

2. Represent the following Boolean expression to SOP and POS form: $A+BC'+ABD'+ABCD$
3. Represent the Boolean function $T=F(w, x, y, z) = \sum m(0,1,2,4,5,7,8,9,12,13)$ by using 8 to 1 mux.
4. Illustrate a half adder using NAND –NAND
5. Represent a T flip flop using JK flipflop.
6. Differentiate between Bi-directional and Universal Shift-Registers.

Apply

Find a circuit that has no static hazards and implements the Boolean function $F(A,B,C,D) = \sum (0,2,6,7,8,10,12)$.

Construct a four input NAND gate using gates with 2 inputs. Write down the truth table. Do the same for a 4 input NOR gate.

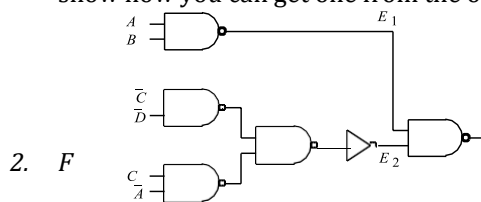
Implement MOD-6 and Johnson Counter.

Construct a combinational circuit to convert BCD to EX-3code.

Implement a combinational logic circuit, which can compare two bits binary numbers.

Analyze

1. Analyze the following in two ways to get sums of product and product of sums equations. Then show how you can get one from the other using DeMorgan's Theorem



3. Why the input variables to a PAL are buffered
4. Why the fixed format is not used and floating format is used
5. What happens when an electric signal is grounded?
6. Design a Sequence detector to detect 10111001

23CS305 Discrete Mathematical Structures**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Construct and Verify the Correctness of Statements using Propositional and Predicate Logic.
2. Illustrate the Operations on Discrete Structures such as Relations and Functions
3. Demonstrate the Lattices and Algebraic Structures for the Modeling of Objects
4. Utilize the Counting Techniques to Solve Combinatorics Problems
5. Make use of the Binomial and multinomial Theorems to Solve Problems involving Recurrence Relations and Generating Functions
6. Demonstrate Graphs and Trees as Tools to Visualize and Simplify Situations

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	1	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO3	3	1	1	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO6	3	3	3	-	-	-	-	-	-	-	-	1	1	-

3-Strongly linked | 2-Moderately linked | 1-Weaklylinked

Unit I**12 Hours****Statement Logic and Predicate Logic**

Statements and Notations - Connectives - Well-formed Formulas - Truth Tables - Tautology – Equivalence Implication - Normal Forms - Rules of Inference for Statement Logic - Proof Techniques - Proof by Contradiction - Method of Induction.

Predicative Logic - Quantifiers - Universal Quantifiers - Free & Bound Variables - Rules of Inference for Predicate Logic

Program Correctness - Design of Logic Circuits

Unit II**12 Hours****Binary Relations, Functions and Algebraic Structures**

Binary Relations - Properties and Operations - Relational Graphs - Relation Matrices - Equivalence Relations - Compatibility Relations - Partial Ordering Relations - HasseDiagram

Lattices - Properties and Types

Functions – Types of functions - Inverse Function - Composition of Functions

Algebraic Structures – Properties - Semi Groups – Monoids – Groups - Abelian Groups – Subgroups

Relations in Databases – Rings - Fields

Unit III**12 Hours****Combinatorics, Generating Functions and Recurrence Relations**

Basics of Counting – Cardinality - Sum and Product Rules - Permutations and Combinations with Repetitions Binomial Coefficients - Binomial and Multinomial Theorems - The Principle of Inclusion and Exclusion - Pigeonhole Principle.

Generating Functions - Function of Sequences - Calculating Coefficient of Generating Functions - Recurrence Relations - Solving Recurrence Relation by Substitution.

Algorithm Analysis - Time and Space Complexity - Combinatorics for Bioinformatics

Unit IV**12 Hours****Basics of Graph Theory**

Representation of Graphs - Degree of a Graph - Handshaking Property - Complete Graphs - Regular Graphs - Bipartite Graphs - Walk – Path – Circuit – Cycle - Planar Graphs - Euler's Formula – Isomorphism - Euler Circuit and Hamilton Cycle - Chromatic Number - Trees and its Properties - Binary Trees and its Types.

Operations on Graphs, Four Color Problem, Applications of Graphs and Trees, Ternary Tree

Total: 48 Hours**Textbook(s)**

1. Kenneth H. Rosen, Discrete Mathematics and Applications, 7th Edition, Tata McGraw Hill, 2015.
2. J.L.Mott, A.Kandel & T.P.Baker, Discrete Mathematics for Computer Scientists & Mathematicians, Prentice Hall India, 2nd Edition, 2010.

Reference (s)

1. Tremblay J.P. and P. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2097.
2. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, A Computer Oriented Approach, 3rd Edition, Tata McGraw Hill, 2008.
3. D. S. Chandrasekharaiah, Mathematical Foundation to Computer Science, Prism Books Pvt. Ltd, Hyderabad, 4th Edition, 2012.
4. Ralph P. Grimaldi, B. V. Ramana, —Discrete and Combinatorial Mathematics - An Applied Introduction||, Pearson Education, India, 5th Edition, 2011.
5. Seymour Lipschutz and Marc Lipson, Discrete Mathematics, Revised 3rd Edition, Schaum's Outline Series, Tata McGrawHill, New Delhi, 2009.

Web References:

1. <http://www.web.stanford.edu/class/cs103x>
2. http://www.cs.odu.edu/~cs381/cs381content/web_course.html
3. <http://www.cse.iitd.ernet.in/~bagchi/courses/discrete-book>
4. <http://www.saylor.org/course/cs202/>
5. <http://www.nptel.ac.in/courses/106106094/>

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	60
Analyze	--	--	30
Evaluate	--	--	10
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define converse, contra positive and inverse of an implication
2. List out the different Principal normal forms with example
3. State the property of first theory of digraph theory by taking a suitable example
4. Define monoid and Abelian group with a suitable example
5. Define Pigeonhole Principle and the generalization of the Pigeonhole Principle

Understand

1. Explain the Planarity of the Kuratowski's two planar graphs
2. Explain the General Principle of Inclusion-Exclusion for n-sets
3. Draw the Hasse diagram of the following relation R. The relation R is defined as the divisors of 60 and denoted by D₆₀.
4. Compare between Eulerian graph and Hamiltonian graph.

Apply

1. Show that the identity. $C(n, r-1) + C(n, r) = C(n+1, r)$
2. Show that the complete graphs K_2, K_3, K_4 are planar
3. Let G be the set of all non-zero real numbers with a binary operation *, defined as $a*b = a^2b^2$. Show

that $\langle G, * \rangle$ is an abelian group.

4. Find the coefficient of x^9y^3 in the expansion of $(2x^2-3y)^{12}$

Analyze

1. Differentiate between Permutation and Combination and find the relation between them.
2. Compare the Equivalence Relation, Compatible relation and Partial Order Relation.
3. Justify, whether the following argument is valid or not.

$p \rightarrow q$

$r \rightarrow s$

$V r$

$q \vee s$

4. Identify the combinations in set of electives of 7 subjects that has no repetitions for a group of 10 members having 5 students in each group.

23CS306 Object Oriented Programming with JAVA**3 0 0 3****Course Outcomes**

1. Apply the object oriented programming concepts to develop modular and reusable software solutions.
2. Develop applications using different types of inheritances
3. Implement user-defined packages to promote code reusability and modular programming.
4. Analyze and recover runtime exceptions arise in the applications
5. Apply parallel processing applications using threads
6. Develop interactive applications for standalone and Internet

COs-POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	2	-	1
CO2	3	3	1	-	-	-	-	-	-	-	-	2	-	1
CO3	3	3	1	-	-	-	-	-	-	-	-	2	-	1
CO4	2	2	2	-	-	-	-	-	-	-	-	2	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	-	2
CO6	3	2	2	-	-	-	-	-	-	-	-	2	-	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours`****Introduction to Java**

Overview of Object Oriented Programming principles, Importance of Java to the Internet, Byte code, Methods, classes and instances, Data types, arrays, control statements, simple java program, Classes and Objects- constructors, methods, access control, this keyword, overloading methods and constructors, garbage collection, java.lang - String, StringBuffer, StringBuilder, Type wrappers - Integer, Character, Float, Double, Boolean.

Features of object oriented programming-Java History-Computer Programming Hierarchy-Role of Java Programmer in Industry

Unit II**12 Hours****Inheritance, Packages & Interface**

Inheritance: Basics, Using super, Multilevel Hierarchy, Method overriding, Dynamic Method Despatch, Using Abstract classes, Using final with inheritance, Sealed Classes.

Java Collections - Arrays, ArrayList, Hashtable, StringTokenizer, Vector.

Interface: Defining an interface, differences between classes and interfaces, implementing interface, variables in interface and extending interfaces, Default Methods in Interfaces, Static Methods in Interface
 Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, Member access rules.

Nested-Inner Class & Anonymous Classes-Generic Class Types

Unit III**11 Hours****Exception Handling & Multithreading**

Exception handling: Concepts and benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built-in and User Defined Exceptions.

Multithreading: Definition thread, thread life cycle, creating threads, synchronizing threads, daemon threads.

Control Flow in Exceptions- JVM reaction to Exceptions- Inter Communication of Threads- Critical Factor in Thread-Deadlock

Unit IV**13 Hours****Applets & Event Handling**

Applets: Concepts of Applets, life cycle of an applet, types of applets, creating applets, passing parameters to applets, The AWT class hierarchy, user interface components labels, button, Text components.

Event Handling: Events, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes, Compare basic AWT components with swing components, More user interface components-canvas, scrollbars, check box, choices, lists panels-scroll pane, dialogs, menu bar, layout managers.

Applet Security Policies–Anonymous Inner classes a Short-cut to Event Handling–Java Utilities (java.util Package)

Total: 48 Hours**Textbook (s)**

1. H. Schildt, Java: The complete reference, 7th Edition, TMH, 2006
2. T. A. Budd, An Introduction to Object-Oriented Programming, 3rd Edition, Addison Wesley Longman, 2002

Reference (s)

1. Dietal&Dietal, Java: How to Program, 8th Edition, PHI, 2010
2. C. S. Horstmann and G. Cornell, Core Java, Vol 1. Fundamentals, 7th Edition, Pearson Education, 2004
3. C. Horstmann, BIG JAVA Compatible with Java 5 & 6, 3rd Edition, Wiley Publishers, 2008

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	25	15	10
Understand	30	15	30
Apply	25	40	30
Analyze	20	20	30
Evaluate	--	10	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. List all OOPs principles
2. Define class and object
3. Illustrate various data types supported by JAVA
4. State various access controls available in JAVA
5. Define inheritance
6. Define thread

Understand

1. Explain byte code
2. Explain the use of super, static and final keywords
3. Illustrate the use of try, catch, throw and throws
4. Java is purely object oriented programming language. Explain
5. Explain types of polymorphism with Example

Apply

1. Write statements that perform the following one-dimensional-array operations:
 - a. Set the 10 elements of integer array counts to zero
 - b. Add one to each of the 15 elements of integer array bonus
 - c. Display the five values of integer array best Scores in column format
2. Create two arrays that store all even no's in one array and all odd no's in another array for a given set of elements
3. Write a java program to implements final variable, Method and classes
4. Explain the reason for the following code giving compiling errors.

```
abstract class AbstractClass
{
    abstract void abstractMethod()
    {
        System.out.println("First Method");
    }
}
```

5. Write a java program to implement the following techniques
 1. Method Overloading
 2. Method Overriding
6. Write a Java program to implement Virtual function technique

Analyze

1. Compare and Contrast an abstract class and an interface
2. Differentiate method overloading and overriding
3. Differentiate abstraction and encapsulation
4. Identify the uses of calling a synchronize method inside a synchronize method
5. Identify memory leak problems in Java objects

23CS307 Design and Analysis of Algorithms Lab**0 0 3 1.5****Course Outcomes**

At the end of the course, students will be able to

1. Analyze the performance of algorithms by implementing and measuring their space and time complexity using asymptotic notations.
2. Implement algorithms using brute force and divide and conquer approaches, and assess their efficiency.
3. Implement advanced data structures and graph algorithms to solve complex computational problems, and evaluate their performance.
4. Solve optimization problems efficiently using a greedy approach, and analyze the results.
5. Develop dynamic programming solutions to tackle complex computational problems, and measure their effectiveness.
6. Apply backtracking and branch and bound techniques to solve complex problems.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	1	2	-	-	-	-	-	1	-	2	2	-
CO2	3	2	2	2	-	-	-	-	-	1	-	2	2	-
CO3	3	3	3	3	-	-	-	-	-	1	-	2	2	-
CO4	3	2	3	3	-	-	-	-	-	1	-	2	2	-
CO5	3	2	2	3	-	-	-	-	-	1	-	2	2	-
CO6	3	3	2	2	-	-	-	-	-	1	-	2	2	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Analysis of recursive algorithms
2. Analysis of Non-recursive algorithms
3. Solve the String matching problem using Brute Force approach
4. Solve sorting problem using divide and conquer approach
5. Implement heapsort algorithm using a max-heap.
6. Implement Simple Union and Find operation on disjoint-sets
7. Implement the graph traversal algorithm.
8. Implement topological sorting of a directed acyclic graph (DAG).
9. Find the minimum cost spanning tree for a given graph using greedy approach
10. Implement dijkstra's algorithm using greedy approach
11. Solve matrix chain multiplication problem using dynamic programming
12. Solve the 0/1 knapsack using dynamic programming
13. Implement Floyd algorithm using dynamic programming
14. Find the sum of subsets using backtracking technique
15. Solve N queen problem using the backtracking technique.
16. Find the solution for Assignment Problem using branch and bound method

Indicative list of Augmented Experiments:

1. Basic File System Simulation Using B-Trees
2. Implementation of Huffman Coding for Data Compression
3. Topological Sorting of Courses with Prerequisites
4. Implementation of Tries for Auto-Completion and Spell Checking
5. Route Optimization for a Delivery Service Using Traveling Salesman Problem (TSP) Algorithms
6. Implementation of a Priority Queue Using a Binary Heap for Task Scheduling
7. Graph Coloring Problem for Map Coloring
8. Dynamic Programming for Optimal Binary Search Tree Construction
9. Visualizing Strongly Connected Components in Social Network Analysis

10. Rod Cutting Problem

Reading Material (s)

1. Design and Analysis of Algorithms Lab manual, Department of CSE and IT, GMRIIT
2. <https://www.leetcode.com>

23CS308 JAVA Lab**0 0 3 1.5****Course Outcomes**

1. Make use of JAVA SDK environment to create - debug and run java programs
2. Create applications based on code reusability
3. Develop programs using threads
4. Develop and debug real time problems using exception handling
5. Design Graphical User Interface using AWT components
6. Design Graphical User Interface using Swing components

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	1	1	-	-	-	-	-	2	-	2	-	2
CO2	3	3	2	1	-	-	-	-	-	2	-	2	-	2
CO3	3	3	2	2	-	-	-	-	-	2	-	2	-	2
CO4	3	3	2	3	-	-	-	-	-	2	-	3	-	3
CO5	3	3	3	2	-	-	-	-	-	2	-	2	-	3
CO6	3	3	3	2	-	-	-	-	-	2	-	3	-	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Case Study: Permutations and Combinations Calculator

User Input:

- The program should prompt the user to enter the total number of elements (n) and the number of elements to be selected (r).
- Validate the input to ensure that both n and r are positive integers, and r is less than or equal to n.

Functional Description:

- Create a method **calculatePermutations** that takes two integers n and r as input and returns the number of permutations.

Formula $nPr = n! / (n - r)!$, where "!" denotes factorial.

- Create a method **calculateCombinations** that takes two integers n and r as input and returns the number of combinations.

Formula $nCr = n! / (r! * (n - r)!)$.

- Implement a separate method to calculate the factorial of a given integer.

Sample Output:

Enter the total number of elements (n): 5
 Enter the number of elements to be selected (r): 3
 Permutations (nPr): 60
 Combinations (nCr): 10

2. Conversion Utility that allows users to convert measurements between different units.

User Input:

- The program should prompt the user to enter positive integer value for conversion type.
- The program should prompt the user to enter the positive input (feet/ meters/ miles/ kilometers) based on user option.

Functional Description:

- utilize method overloading to handle conversions between various units, such as feet to meters, miles to kilometers, and vice versa.

formula: feet to meters - feet * 0.3048
 miles to kilometers - miles * 1.60934

Sample Output:

Measurement Conversion Utility
 1. Feet to Meters
 2. Meters to Feet
 3. Miles to Kilometers

- 4. Kilometers to Miles
- 5. Exit
- Enter your choice: 3
- Enter the distance in miles: 5
- 5 miles is approximately 8.046 kilometers.

3. Case Study: **BankAccount** Class with Constructor Overloading

Functional Description:

- Create a **BankAccount** class to represent a bank account. The class should have private attributes such as **accountNumber** (a unique identifier for the account), **accountHolderName**, and **balance** (representing the current account balance).
- The class should have the following constructors:
 - **BankAccount(String accountNumber, String accountHolderName)**: Create an account with a zero balance.
 - **BankAccount(String accountNumber, String accountHolderName, double initialBalance)**: Create an account with the specified initial balance.
- Implement methods to:
 - **deposit(double amount)**: Add the given amount to the account balance.
 - **withdraw(double amount)**: Subtract the given amount from the account balance if sufficient funds are available.

Sample Output:

Welcome to the Bank Account System
Creating a new account..
Enter the account holder's name: John Doe
Enter the initial balance: 500.0
Account created successfully.
Account Number: ACCT123456
Account Holder: John Doe
Balance: \$500.00
What would you like to do?
1. Deposit
2. Withdraw
3. Exit
Enter your choice: 1
Enter the amount to deposit: 250.0
\$250.00 deposited successfully.
Updated Balance: \$750.00

4. Implement inheritance concept for below case study:

Note: class **FictionBook** extends class **LibraryBook**, class **ClassicBook** and class **ScienceFictionBook** extends from **FictionBook**

- **LibraryBook**: Represents a general library book with attributes like title, author, and year, along with a method **displayBookInfo()** to display book details.
- **FictionBook**: Extends **LibraryBook** and adds an additional attribute genre.
- **ClassicBook**: Extends **FictionBook** and adds an additional attribute publisher.
- **ScienceFictionBook**: Extends **FictionBook** and adds an additional attribute edition

5. Case Study: Abstract Class for Finding Areas of Different Shapes

User Input:

- The program should prompt the user to enter positive integer value to calculate type of area.
- The program should prompt the user to enter the input based on user option.
 - **Circle**: Requires the radius as an input parameter
 - **Rectangle**: Requires the length and width as input parameters.
 - **Triangle**: Requires the base and height as input parameters.
 - **Square**: Requires the side length as an input parameter.

Functional Description:

- Create an abstract class **Shape** that will serve as the base class for different shapes. Include an abstract method **calculateArea()**

- Create concrete subclasses that extend the **Shape** class for different shapes like **Circle**, **Rectangle**, **Triangle** and **Square**.

Sample Output:

Select a shape:

1. Circle
2. Rectangle
3. Triangle
4. Square
5. Exit

Enter your choice: 1

Enter the radius of the circle: 5

The area of the selected shape is: 78.53981633974483

6. Implement Dynamic Method Dispatch in Java.
7. i. Create an **ArrayList** of integers to store a collection of numbers. Implement methods to add elements to the list, remove elements, update elements, and search for elements in the list.
ii. Create a Java program that accepts a string input from the user. Use the **StringTokenizer** class to tokenize the input string into separate tokens based on specified delimiters (e.g., space, comma, etc.).
8. Demonstrating Mutability Differences between **String**, **StringBuilder**, and **StringBuffer** in Java
 - Explain the Concept in 100 words.
 - Perform string manipulation operation concatenation on each class
 - Print the results of each class after modification operation
9. Demonstrate multiple inheritance-like behavior achieved through interface implementation.
10. Case Study: Java Program Illustrating Multiple Catch Clauses with Finally Block

Functional Description:

- Implement exception handling for possible exceptions that may occur during the division, such as **ArithmeticException** and **NumberFormatException**.
- Use multiple catch clauses to handle **ArithmeticException** and **NumberFormatException** separately.
- Use a **finally** block to execute code that should be performed regardless of whether an exception occurred or not

Sample Output:

Enter the dividend: 10

Enter the divisor: 0

Division by zero is not allowed.

Execution completed.

11. Create your own custom exception classes to handle specific situations or errors that are not covered by the built-in exception classes.

Functional Description:

- Create a custom exception class that extends the **Exception** class (or any other appropriate superclass, depending on your requirements).
- Define the custom exception class to represent a specific error situation, such as **InvalidAgeException**, which is thrown when an invalid age is provided.
- Use the custom exception class in a method to throw the exception when a certain condition is met, such as when the age is less than zero or exceeds a specific limit.

Constraints:

The program should prompt the user to enter age integer value. Here, age<0 or age>120

Sample Output:

Enter age:-5

Exception: Invalid age. Age must be between 0 and 120.

12. Creates three threads by extending the **Thread** class. Each thread will display a specific message at a regular interval. The messages to be displayed are as follows:

First thread: "**Good Morning**" every 1 second

Second thread: "**Hello**" every 2 seconds

Third thread: "**Welcome**" every 3 seconds

Note: implement the same by using **Runnable** interface.

13. Case Study: Java Program for Producer-Consumer Problem

User Input:

- The program should prompt the user to enter positive integer values for **bufferSize**
- The program should prompt the user to enter positive integer values to **produceCount** and **consumeCount**

Functional Description:

- Buffer Implementation:
 - Create a shared buffer with a limited size (e.g., an array or an ArrayList) to hold the produced items.
- Producer & Consumer Implementation:
 - Create a Producer class & Consumer class that implements the Runnable interface.
 - The Producer class should produce items and put them into the buffer.
 - The Consumer class should consume items from the buffer.
 - Implement synchronization to avoid race conditions when accessing the buffer.

Sample Output:

```
Enter Buffer Size:5
Enter Procedure Count:5
Enter Consumer Count:5
Produced: 0
Consumed: 0
Produced: 1
Consumed: 1
Produced: 2
Consumed: 2
Produced: 3
Consumed: 3
Produced: 4
Consumed: 4
```

14. Case Study: Java Program for a Basic Calculator using AWT

In this case study, we'll implement a Java program to create a basic calculator using AWT. The calculator will have a simple graphical user interface (GUI) with buttons for numbers, arithmetic operations, and a display to show the result of calculations.

AWT Implementation:

- Create a Java AWT to implement the calculator GUI.
- The AWT should have buttons for digits (0 to 9), arithmetic operations (addition, subtraction, multiplication, division), and an equal (=) button to perform calculations.

Display and Input:

- Implement a display area where the user can see the entered numbers and the result of calculations.
- Provide a way for users to input numbers and arithmetic operations using the GUI buttons.

Basic Calculations:

- Implement methods to handle basic arithmetic calculations (addition, subtraction, multiplication, division).
- Perform calculations based on the user's input and display the result in the GUI.

User Interface:

- Design a user-friendly GUI with appropriate labels, buttons, and display areas.
- Use layout managers to organize the components effectively.

15. Case Study: Java Program for Temperature Converter using AWT

In this case study, we'll implement a Java AWT to create a Temperature Converter. The AWT will allow users to convert temperatures between Celsius and Fahrenheit. The user will input a temperature value in one unit, and the AWT will display the converted temperature in the other unit.

AWT Implementation:

- Create a Java AWTpplet to implement the temperature converter GUI.

- The AWT should have input fields for the temperature value and buttons to select the source and target temperature units (Celsius or Fahrenheit).
- Use appropriate layout managers to organize the components effectively.

Conversion Logic:

- Implement methods to handle temperature conversions between Celsius and Fahrenheit.
- The temperature conversion formulas are:
 - Fahrenheit to Celsius: $C = (F - 32) * 5 / 9$
 - Celsius to Fahrenheit: $F = (C * 9 / 5) + 32$

User Interface:

- Design a user-friendly GUI with appropriate labels, input fields, and buttons.
- Display the converted temperature in the GUI after the conversion is performed.

16. Case Study: Java Swing Application for Job Application Form

In this case study, we'll implement a Java Swing application with a JFrame that contains fields for name, age, email, and qualifications. The application will validate the form data when the user clicks the "Submit" button. If all fields are filled, the data will be written to a file named "application_form.txt."

Swing Application:

- Create a Java Swing application with a JFrame to display the job application form.
- Design the form with labels for each field (name, age, email, qualifications) and corresponding input fields (text fields or other appropriate components).
- Add a "Submit" button to the form to allow users to submit their job application.

Data Validation:

- Implement validation for the form data to ensure that all fields are filled before submission.
- Display error messages for missing fields or invalid data.

Data Writing:

- Create a method to write the validated form data to a file named "application_form.txt."
- The file should be created in the current working directory.
- Use appropriate file handling techniques to write the data.

User Interaction:

- Allow users to input their name, age, email, and qualifications using the form fields.
- Trigger the form data validation when the user clicks the "Submit" button.
- Display appropriate messages to inform the user about the success or failure of form submission.

List of Augmented Experiments

1. New Patient Registry Management System
2. Restaurant Billing Management System
3. Library Management System
4. ATM Management System
5. Bus Ticket Booking Management System
6. Movie Ticket Booking Management System
7. Queuing Management System
8. Attendance Management System
9. Medical Store Billing Management System
10. Text Editor Projects in Java
11. Google Search Engine Filter
12. Electronic voting System
13. Day Planner
14. Library management System
15. Personal Finance Management System

Reading Material (s)

1. JAVA Lab manual, Department of CSE and IT, GMRT, Rajam

23ESX01 Employability Skills I**0 0 2 0****Course Outcomes**

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming.
3. Assess analytical and aptitude skills.
4. Develop algorithms for engineering applications.
5. Solve engineering problems using software.
6. Utilize simulation tools for testing

COs –POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	1	2	3	2				2	2	2	3		
CO2	3	2	3	2	3				2	2	2	3		
CO3	3	2	3	2	3				2	2	2	3		
CO4	3	2	3	2	2				3	3	3	3		
CO5	3	2	3	2	2				3	3	3	3		
CO6	2	1	2	3	2				3	3	3	3		

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit-I**Communication Skills****8 hours**

Communication Skills & Confidence: How Communication Skills affect Confidence? How to communicate effectively.(with Examples)

Listening: Listening? , Listening Vs Hearing, Possible reasons for why people do not Listen at times, Active Listening Vs Passive Listening, How Listening can affect our relationships? How Listening helps in Campus Placements also? (with Examples)

Goal Setting: SMART Technique to Goal Setting, Putting First things First, SWOT Analysis and Time Management

Attitude & Gratitude: Attitude Vs Skills Vs Knowledge, Attitude Vs Behaviour, How to develop Positive Attitude? Developing the attitude of Gratitude.

Public Speaking: JAM, J2M, Presentations by Students on General Topics.

Quantitative Aptitude**8 hours**

Number system, L.C.M and H.C.F, Problems on Ages, Averages, Time and work, Pipes and cisterns

Unit-II**Competitive Programming Phase – I****16 Hours****Module-1:**

Introduction: Importance of Competitive Programming, Conditional Statements, Loops, Nested Loops. Strings: Declaration of strings, Accessing strings elements, operations, String Matching Algorithms, Practice Problems - Codechef, Hackerrank, Codeforces, Leetcode, interviewbit.

Module-2:

Arrays: Basics on Arrays: Creating elements, converting a string into array of characters, converting a number into array of character, accessing array elements, 2D Arrays & Matrix, **Recursion:** Definition, examples and how recursion differs from iteration. Practice Problems - Codechef, Hackerrank, Codeforces, Leetcode, interviewbit.

References:

1. <https://leetcode.com>
2. <https://www.codechef.com>
3. <https://www.hackerearth.com>
4. <https://www.interviewbit.com>
5. <https://www.hackerrank.com>

4th Semester**23IT304 Database Management Systems****3 0 0 3****Course Outcomes**

1. Explain the fundamental concepts of database and Various data models
2. Illustrate the Relational Algebra and integrity constraints for Query execution
3. Apply the relational database to formulate the SQL Commands
4. Make use of Normalization to improve database design and schema refinement
5. Analyze the concept of transaction management, recovery and serializability in databases
6. Classify the concurrency control protocols, different types of data and Indexing techniques

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	1	1	-	-	-	-	-	-	-	-	2	-	2
CO2	3	2	3	-	-	-	-	-	-	2	-	2	-	2
CO3	3	3	3	-	-	-	-	-	-	2	-	2	-	2
CO4	3	3	3	-	-	-	-	-	-	2	-	2	-	3
CO5	3	2	3	-	-	-	-	-	-	2	-	2	-	3
CO6	2	1	2	-	-	-	-	-	-	2	-	2	-	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours****Introduction to DBMS and ERModel**

DBMS Vs. File System, instance and schema, Data abstraction, Data independence, database users and database administrator, Database system structure, Introduction to Data Models (E-R Model, Relational Model, Hierarchical Model, Network Model, Object Oriented Data Model), Database Design Process, Entities, Attributes, Entity Sets, Relationships, Relationship Sets, Additional features of ER Model.

Applications of DBMS, Object Relational Data Model

Unit II**12 Hours****Introduction to Relational Model and Basic SQLQueries**

Relational Algebra Operations: Selection, Projection, Rename, Set Operators, Joins, Division, Examples of Relational Algebra Queries, Relational Calculus: Tuple Relational Calculus. Integrity Constraints over Relations, Introduction to Views. SQL Queries: Basic Structure, Set Operations, Aggregate Functions, Null values, Sub Queries, Group By And Having Clauses, OuterJoins.

Domain Relational Calculus, Query Optimization

Unit III**12 Hours****Normalization and Transaction Management**

Introduction To Schema Refinement - Problems Caused By Redundancy - Decomposition - Problems Related To Decomposition - Functional Dependency - Closure of a Set of Fds - Attribute Closure - First - Second - Third Normal Forms - BCNF - Multi Valued Dependencies - Fourth Normal Form, Join Dependency, Fifth Normal Form. Transactions: Acid Properties of Transaction - Transaction States - Schedule: Serial Schedule - Concurrent Schedules - Anomalies Associated with Concurrent Schedules (RW - WR - and WW Conflicts) - Serializability - Conflict Serializability - and View Serializability.

EF Codd Rules, Domain Dependency

Unit IV**12 Hours****Locking, Recovery Systems, Indexing, Different Types of Data**

Introduction to Lock Management-Lock Based Concurrency Control: 2pl-Strict 2pl-Concurrency without Locking: Timestamp-Based Concurrency Control, Optimistic Concurrency Control. Introduction to Aries

- the Log - the Write-Ahead Log Protocol-Check Pointing Indexing: Types of Single-Level Ordered Indexes, Multilevel Indexes Different Types of Data: Structured, Semi-Structured and Unstructured Data
Heap File, Hash File Organizations

Total: 48 Hours

Textbook (s)

1. Elmasri&Navatha, Fundamentals of Database Systems, Pearson Education, 7th Edition, 2016
2. SilberschatzKorth, Database System Concepts, McGraw hill, 7th Edition, 2020

Reference (s)

1. SorayaSedkaoui, Data Analytics and Big Data, Wiley, 1st Edition, 2018.
2. PeterRob&CarlosCoronel, Database Systems design, Implementation and Management, 9th Edition, 2010.
3. Raghurama Krishnan & Johannes Gehrke, Database Management Systems, TATA McGraw-Hill, 3rd Edition, 2003
4. C.J.Date, An Introduction to Database Systems, Pearson Education, 8th Edition, 2006

Internal Assessment Pattern

Cognitive Level	Int. Test 1(%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. List any four application of DBMS
2. Define data model
3. List any four applications for triggers
4. Define functional dependency
5. List the 4 properties of Transaction

Understand

1. Explain E-R Model with suitable example
2. Explain the role of integrity constraints in database design
3. Illustrate the working principle of 'write a head log' protocol
4. Differentiate 3NF and 4NF
5. Explain Two Phase Locking Protocol

Apply

1. When multiple transactions are being executed by the operating system in a multiprogramming environment, there are possibilities that instructions of one transaction are interleaved with some other transaction. Apply the suitable concept to overcome the problem
2. Classify various normal forms according to their applicability
3. Give some real-world applications of Normalization
4. Illustrate the Commit and Rollback operations of Transaction Control
5. Give some real-world applications for Database indexing techniques

Analyze

1. Compare File processing system with DBMS
2. Analyze different locking protocol for concurrency control and serializability
3. Normalization will increase the complexity of the database design. Justify
4. Compare DDL and DML of SQL

5. Compare and Contrast Serializability and Recoverability

Evaluate

1. Is database redesign is necessary? explain
2. How can you evaluate the performance of two data models?
3. Evaluate the performance of query processor and list the corresponding metrics
4. How can you assess the throughput and delay for any DBMS?
5. How can you evaluate the impact of data models on the query processing?

Open Book Exam Questions

Question 1:

Anitha has a large CD collection. Her friends like to borrow her CD's, and she has to keep track of who has what. She maintains a list of friends, identified by unique FID's and a list of CD's, identified by CID's. With each friend are the name and telephone numbers which she can call to get the CD back. With each CD is actor name and title. Whenever a friend borrows a CD, She will enter that fact into her database along with the date borrowed. Whenever the CD gets returned, that fact, too, gets noted along with the date returned. Anitha wants to keep a complete history of her friends' borrowing habits so that she can ask favors of the heavy borrowers.

Draw an ER diagram to figure out the above situation and identify types of attributes and cardinality. Represent this database as a collection of 3NF relational tables.

Question 2:

The relational scheme $R(A,B,C,D,E,F)$ and set of functional dependencies $AB \rightarrow D$, $E \rightarrow C$, $AF \rightarrow B$. From this, find out all super keys for this relation, and which of these super keys form akey.

23IT403 Operating Systems**3 0 0 3****Course Outcomes**

1. Explain the different services provided by operating system at different level.
2. Analyze various CPU Scheduling Algorithms and synchronization techniques.
3. Identify deadlock prevention and avoidance measures.
4. Compare and contrast main memory and virtual memory.
5. Illustrate the functionality of file systems.
6. Evaluation of various disk scheduling algorithms.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2	3
CO3	3	3	-	-	-	-	-	-	-	-	-	2	2	3
CO4	3	3	-	-	-	-	-	-	-	-	-	2	2	2
CO5	2	2	-	-	-	-	-	-	-	-	-	2	2	2
CO6	2	2	-	-	-	-	-	-	-	-	-	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours****Operating-Systems Overview and Process Management**

Operating-System Overview: Computer-System Organization and Architecture, Operating-System Structure, Operating-System Operations & Services, System Calls & its types.

Threads: Multi Core Programming, Multithreading Models, Thread Scheduling algorithms.

Process Management: Process Concepts, Process Scheduling Criteria, Scheduling Algorithms and evaluation.

Thread issues, Multilevel Queue, Multilevel feedback Queue Scheduling.

Unit II**12 Hours****Inter Process Communication Mechanism**

Process Synchronization: Cooperative process, the Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Synchronization problems. Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance & Detection, Recovery from Deadlock.

Monitors, Synchronization Examples.

Unit III**12 Hours****Memory Management**

Main Memory: Contiguous Memory allocation, Swapping, Segmentation, Paging, Segmented paging, Multilevel paging. Virtual Memory Management: Demand Paging, Page Replacement algorithms, Allocation of Frames.

Structure of page table, Thrashing, Memory-Mapped Files.

Unit IV**12 Hours****File System Interface & I/O Systems**

Mass-Storage Structure: Disk structure, Disk Scheduling, Disk management, Raid Structure.

File System: Access Methods, Directory Structures, Allocation Methods, Free-Space Management. I/O Systems: I/O hardware Application of I/O Interface, Kernel I/O Sub-System.

File Sharing, File System Recovery, Transforming I/O Requests to Hardware Operation.

Total: 48 Hours**Textbook (s)**

1. Operating System Concepts, Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 9th Edition, Wiley,

2016.

2. Operating Systems, Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, 3rd Edition, Pearson Prentice Hall, 2004.

Reference (s)

1. Operating Systems: Internals and Design Principles, William Stallings, 7th Edition, Pearson Prentice Hall, 2013.
2. Operating systems: A Concept based Approach, D. M. Dhamdhere, 2nd Edition, TMH, 2006.
3. Operating System: A Design Approach, Crowley, 1st Edition, TMH, 2001.
4. Modern Operating Systems, Andrew S Tanenbaum, 3rd Edition, PHI, 2009.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	20	20	--
Understand	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. List any four operating systems
2. Define operating system
3. List any four operating system services

Understand

1. Explain System calls
2. Explain the role memory management in operating system
3. Illustrate the working principle critical section problem

Apply

1. When multiple transactions are being executed by the operating system in a multiprogramming environment, there are possibilities that instructions of one transaction are interleaved with some other transaction. Apply the suitable concept to overcome the problem
2. Give an example of a scenario that might benefit from a file system supporting an append-only access write.

Analyze

1. Context switching between two threads of execution within the operating system is usually performed by a small assembly language function. In general terms, what does this small function do internally?
2. Compare CPU scheduling algorithms
3. Analyze the general strategy behind deadlock prevention, and give an example of a practical deadlock prevention method.

Evaluate

1. Assuming the operating system detects the system is deadlocked, what can the operating system do to recover from deadlock?
2. Describe how to implement a lock using semaphores

Open Book Exam Questions

1. A file to be shared among different processes, each of which has a unique number. The file can be accessed simultaneously by several processes, subject to the following constraint: the sum of all unique numbers associated with all processes currently accessing the file must be less than n. Write a monitor to co-ordinate the access to the file. You may want to write start_access and end_access monitor procedures.
2. Consider a paging system with the page table stored in memory:

- a. If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?
- b. If we add associative registers, and 75% of all page-table references are found in the associative registers, what is the effective memory reference time?

23CS403 Computer Organization and Architecture**3 0 0 3****Course Outcomes**

1. Interpret the functional architecture of computing systems.
2. Summarizethetypesofinstructionanditsmicrooperationwithaddressingmodes
3. Identify various arithmetic operations on fixed, floating point numbers and its representation.
4. Illustrate the concepts of control unit design and I/O processor.
5. Discuss the memory hierarchy concepts.
6. Describe concept of parallelism and types of hazard.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO6	3	2	2	-	-	-	-	-	-	-	-	1	3	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**13 Hours****Overview & Micro operation**

Components of a computer system – Performance measures - Classifying Instruction Set Architecture-Representing instructions -Micro operation – Logical operations – Shift operations - instruction codes - Computer Registers instruction –memory Reference instruction –Input-Output Reference instruction - Instruction cycle -Addressing and addressing modes.

Trends in Technology-Arithmetic micro-operations

Unit II**11 Hours****Arithmetic Operations**

ALU - Addition and subtraction with Signed Magnitude Data - Hardware Implementation – Multiplication – Hardware Implementation for Signed Magnitude Data – Division - Hardware Implementation for Signed Magnitude Data – Divide Overflow - Floating Point operations – Parallelism and Computer Arithmetic: Sub word Parallelism.

BCD Adder-BCD Subtraction

UNIT III**11 Hours****Control Unit and Memory Systems**

Basic MIPS implementation – Building data path – Control Implementation scheme – Memory hierarchy – Cache basics – Measuring and improving cache performance - Virtual memory- Input/output system-programmed I/O-DMA and Interrupts-I/O processors

Stack organization-RISC Vs CISC Architecture

Unit IV**13 Hours****Parallelism**

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Multicore processors- Pipelining – Arithmetic pipeline –Instruction pipeline -Pipelined data path and control – Handling Data hazards & Control hazards – Exceptions.

Vector processing –single processor Vs parallel processor

Total: 48 Hours**Text Book(s):**

1. David A. Patterson and John L. Hennessey, "Computer organization and design: The hardware/software interface", Morgan Kaufman / Elsevier, Fifth edition, 2014.
2. M. Morris Mano, "Computer System Architecture", 3rd edition, Pearson/PHI, 2002.

Reference(s):

1. V. Carl Hamacher, Zvonko G. Varanescic and Safat G. Zaky, "Computer Organization", 6th edition, McGraw-Hill Inc, 2012.
2. William Stallings "Computer Organization and Architecture, Seventh Edition, Pearson Education, 2007.
3. Andrew S Tanenbaum "Structured Computer Organization", 5th edition, Pearson/PHI, 2007

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	40	--	--
Understand	40	50	--
Apply	20	50	80
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is micro operation?
2. Show the Register Reference Instruction format.
3. Define PC and MAR.
4. What are the two types of data presentation?
5. Define Associative Memory

Understand

1. Identify the basic functional units of the system
2. Explain about logic micro operations and its applications with examples
3. Differentiate RISC and CISC architectures in terms of their instruction set and addressing modes.
4. Compare hardwired control unit is differing from micro programmed control unit designs
5. Demonstrate control memory

Apply

1. Starting from an initial value of R=11011101, determine the sequence of binary values in R after a logical shift-left, followed by a logical shift-right and a circular shift-right.
2. Analyze the contents of Register A that holds 8 bit binary 11011001 and Determine the B- operand and the logic micro operation to be performed in order to change the value in A to: (i) 01101101 (ii) 11111101 State the differences between register stack and memory stack.
3. Perform the arithmetic operations (+70) + (+80) and (-70) + (-80) with binary numbers in signed-2's complement representation. Use eight bits to accommodate each number together with its sign. Show that overflow occurs in both cases, that the last two carries are unequal, and that there is a sign reversal.
4. Show the hardware to be used for the addition and subtraction of two decimal numbers with negative numbers in signed-10's complement representation. Indicate how an overflow is detected. Derive the flowchart algorithm and try a few numbers to convince yourself that the algorithm produces correct results.
5. The procedure for aligning mantissas during addition or subtraction of floating-point numbers can be stated as follows: Subtract the smaller exponent from the larger and shift right the mantissa having the smaller exponent a number of places equal to the difference between the exponents. The exponent of the sum (or difference) is equal to the larger exponents. Without using a magnitude comparator, assuming biased exponents, and taking into account that only the AC can be shifted, derive an algorithm in flowchart form for aligning the mantissas and placing the larger exponent in the AC.

Open book Examination

Apply

1. Smith and Goodman found that for a given small size, a direct-mapped instruction cache consistently outperformed a fully associative instruction cache using LRU replacement.
 - a. Explain how this would be possible (*Hint: You can't explain this with the three C's model because it "ignores" replacement policy*)
 - b. Explain where replacement policy fits into the three C's model, and explain why this means that misses caused by a replacement policy are "ignored"- or, more precisely, cannot in general be definitively classified by the three C's model.
 - c. Are there any replacement policies for the fully associative cache that would outperform the direct-mapped cache? Ignore the policy of "do what a direct-mapped cache would do".
 - d. Use a cache simulator to see if Smith and Goodman's results hold for memory reference traces that you have access to. If they do not hold, why not?
2. John takes two numbers in sign magnitude representation (the two numbers are same with different signs), The 1's complement of one number is 6. The difference between 1's complement of these two numbers is 32. Find the numbers. And also find the product of these two numbers using the result of 2's complement value of these two numbers.

Analyze

1. A two-word instruction is stored in memory at an address designated by the symbol W. The address field of the instruction (stored at $W + 1$) is designated by the symbol Y. The operand used during the execution of the instruction is stored at an address symbolized by Z. An index register contains the value X. State how Z is calculated from the other addresses if the addressing mode of the instruction is
 - a. direct
 - b. indirect
 - c. relative
 - d. indexed.
2. An 8-bit computer has a 16-bit address bus. The first 15 lines of the address are used to select a bank of 32K bytes of memory. The high-order bit of the address is used to select a register which receives the contents of the data bus. Explain how this configuration can be used to extend the memory capacity of the system to eight banks of 32K bytes each, for a total of 256K bytes of memory.

23MA404 - Probability and Statistics using Python**3 0 2 4****Course Outcomes**

1. List the basic data structures of Python and various libraries of Python.
2. Illustrate basic probability axioms and apply Bayes' theorem related to engineering problems.
3. Differentiate between various distributions of random variables on given data.
4. Examine given dataset based on descriptive statistics.
5. Compare the null or alternative hypotheses using the suitable test statistic.
6. Choose appropriate curve fitting and correlation methods for a given data

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	3	-	1	-	-	-	-	-	2	-	2	-	-
CO2	3	2	-	3	-	-	-	-	-	3	-	2	-	-
CO3	3	2	-	3	-	-	-	-	-	3	-	1	-	-
CO4	3	1	-	3	-	-	-	-	-	3	-	3	-	-
CO5	3	1	-	2	-	-	-	-	-	3	-	1	-	-
CO6	3	1	-	3	-	-	-	-	-	3	-	3	-	-

3-Strongly linked | 2-Moderately linked | 1-Weaklylinked

Unit I**12+8 Hours****Fundamental of Python Programming**

Strings, Files, Lists, Dictionaries, Tuples. **Introduction to NumPy:** Creating Numpy Arrays, Numpy Data Objects, dtype, Numerical Operations. Numpy Arrays: Concatenating, Flatten, reshape, adding Dimensions, Vector Stacking, Pandas DataFrame, Accessing and Changing values of DataFrames, Pandas Pivot, groupby **Introduction to Pandas:** Reading and Writing Data in Pandas, Multi-level Indexing, Data Visualization in Pandas

*Objects and Classes***Practical Components**

1. Experiments on Basic experiments on fundamentals on python
2. Exploratory Data Analysis using NumPy
3. Exploratory Data Analysis using Pandas
4. Exploratory Data Analysis using Matplotlib

Unit II**12+6 Hours****Random Variables and Probability Distributions**

Introduction to Probability: Events, Axioms of Probability and Probabilities of events; Conditional Probability, Bayes Theorem. Discrete and Continuous random variables; Expectation and Variance, Distribution of a Random Variables: **Discrete and Continuous Distributions-** Bernoulli, Binomial, Poison and Normal Distributions (without proofs); Central Limit Theorem (without proof).

*Gaussian distribution***Practical Components**

1. Simulation of random experiments and plot the empirical probability of each event, alongside the theoretical probability.
2. Python script to find conditional probability of a given event.
3. Simulation of various probability distributions

Unit III**12+10 Hours****Sampling Theory and Testing of Hypothesis**

Sampling: Population and sample, parameter and statistic, standard error. Parameter estimations, Confidence Intervals, Unknown Standard Deviation. **Hypothesis Testing:** Null and alternative hypothesis, level of significance, Type I and Type II errors, one tail and two-tail tests. Hypothesis testing concerning one mean and proportions, two means –Proportions and their differences using Z-test, Student's t-test, F-test, Chi-square test.

One-way ANOVA

Practical Components

1. Python Modules for Descriptive Statistics
2. Write a python program to perform z-test, t- test for testing the Null hypothesis for single mean
3. Write a python program to perform z-test, t- test for testing the Null hypothesis for difference of means
4. Write a python program to explore problems in F-test.
5. Write a python program to perform chi square for determine whether there is a significant association between the two variables

Unit IV

12+8 Hours

Curve Fitting, Correlation & Regression

Curve Fitting: Introduction-fitting a straight line-second degree curve-exponential curve by method of least squares. **Correlation:** Simple correlation, Karl Pearson's Correlation coefficient and Spearman's rank correlation. Simple regression, multiple regression.

Covariance

Practical Components

1. Develop a straight line curve to fit some real world observations
2. Develop an exponential curve to fit some real world observations
3. Explore problems in Correlation with sample data
4. Explore problems in Regression with sample data

Total: 48+32 Hours

Text Books:

1. Probability & Statistics by T.K.V.Iyengar&B.Krishna Gandhi & Others, S.Chand (2016) 6th edition.
2. E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye, (2012), Probability and Statistics for Engineers and Scientists, 9th Edition, Pearson Education, ISBN: 978-8-131-71552-9.
3. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, O'Reilly Media, Inc.

Reference Books:

1. Michael Baron, Probability and Statistics For Computer Scientists, 2nd Edition, CRC Press
2. Sheldon M. Ross, (2011), Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Academic Foundation, ISBN: 978-8-190-93568-5.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	10	10	--
Understand	50	30	--
Apply	40	60	--
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

SAMPLE QUESTION (S)

Remember

1. Define variable in python.
2. List any two differences between built-in and user defined functions.
3. List any two python packages used mathematics.

Understand

1. Explain use of probability and statistics in real world.
2. Illustrate about random variables in python.

Apply

1. Find different real time applications which use Markov process
2. Implement a queuing theory to handle multiple processes.

23CS405 Web Coding and Development**3 0 0 3****Course Outcomes**

1. Design static web pages using HTML tags and CSS.
2. Describe the basic and advanced concepts of Java Scripts to design dynamic web pages.
3. Develop portable and dynamic web pages.
4. Demonstrate PHP server-side scripting language to develop business logic.
5. Make use of database connectivity to communicate database server from web server.
6. Develop Dynamic Web Pages using Flask.

COs-POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	-	-	3
CO2	3	3	3	-	3	-	-	2	-	-	-	-	-	3
CO3	2	2	3	-	2	-	-	2	-	-	-	-	-	3
CO4	2	2	3	-	2	-	-	2	-	-	-	-	-	3
CO5	2	2	1	-	3	-	-	2	-	-	-	-	-	3
CO6	2	3	3	-	3	-	-	2	-	-	-	-	-	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 hours****HTML Common tags:** Lists, Tables, images, Forms, Links and Navigation.**CSS:** Introduction, CSS Properties, Selectors, Combinators, Controlling Fonts, Forms, Pseudo classes, Navigation Bar, Layouts, The Box Model**Bootstrap**Responsive Design, Layouts, Grids, Media Queries, **Components-** Forms, Drop Downs, Cards, Input Groups, Collapse, List Groups, Navbar, Popovers, Flex Box.*Introduction to HTML5, XML, CSS3***Unit II****12 hours****Java Script:** Variables & Scope, Data types, Control Structures, Array Methods, Functions, Events, Validations, Objects, Document Object Model (DOM), Browser Object Model (BOM)**Advanced JavaScript:** Arrow functions, Template Literals, Array Destructuring, Object Destructuring, Classes and Modules – ES6 imports and exports*Transpilation, Iterators and Generators***Unit III****12 hours****PHP**

Introduction, Model View Architecture (MVC), Creating PHP script, Running PHP script, Introduction to PHP, Arrays, Functions, sending parameters in URL, working with Forms.

Working with Database: Running SQL Queries, connecting with Databases, Uploading Files, PHP Sessions, Redirecting, Routing, Connecting PHP with JavaScript and Authentication.*PHP Cookies, PHP Exception Handling, Introduction to PHP laravel***Unit IV****12 hours****Flask**

Introduction to Flask, Virtual Environment, features of flask, url building, routing, Templates and Jinja Code, Rendering Templates, Static files, Building Forms, Sending Form data to Templates, Template Inheritance (header, footer, etc), Session Tracking, Connecting database(SQLite), Retrieving database values to templates, File uploading, Sending Mails, Deployment of website.

*wsgi file, csrf token, http methods.***Total: 48 Hours****Text Book(s)**

1. Programming the World Wide Web, 8th edition Robert W. Sebesta, Pearson.
2. Web Coding Development All In One for Dummies, Paul McFedries, Wiley.
3. Bootstrap: Responsive Web Development, 1st Edition, Jake Spurlock foreword by davewiner, O'Reilly publications.

- Advanced Java Script Speed up web development with powerful and benefits of Java Script, Zachary Shute, Packt Publishers.

Reference(s):

- Web programming with HTML, XHTML and CSS, 2e, Jon Duckett, Wiley India
- Web programming Bai, Michael Ekedahl, CENAGE Learning, India edition.
- An Introduction to Web Design + Programming, Paul S.Wang, India Edition
- Flask Web Development 2e Miquel Grinberg O'Reilly publications.

Internal Assessment Pattern:

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test/OBE (%)
Remember	25	15	--
Understand	30	15	20
Apply	25	25	40
Analyze	20	25	20
Evaluate	--	--	--
Create	--	20	20
Total (%)	100	100	100

Sample Question(s)

Remember

- Define and write about HTML.
- What's the purpose of JavaScript.
- List the ways to include CSS in Web Pages

Understand

- What is the use of cascading style sheet? Explain different style sheets used in HTML.
- Explain string object with suitable example.
- Illustrate how work java script events.
- Describe procedure for how to connect PHP to MYSQL.

Apply

- Write an HTML program to display your class timetable.
- Write a java script to find reverse of a given number using functions.
- at one of the inserted record is invalid. So, write a PHP program to update the table by deleting the invalid record. [Design a responsive registration page using bootstrap].
- Insert an image into a web page. Write a script which displays a message when the mouse is over the image. The co-ordinates of the mouse should be displayed if click is attempted on the image.
- A person X has created the table (emp) and inserted the data in the table. After the completion of insertion, he found the Assume database table name is emp (empno, ename, dept, age).

Analyze

- Analyze how URL routing works in Flask and its role in handling user requests.
- Differentiate CSS and Bootstrap.

23IT308 Database Management Systems Lab**0 0 3 1.5****Course Outcomes**

1. Demonstrate ER Modelling concepts to design the Database
2. Apply integrity constraints on a database
3. Apply different DDL, DML, DCL, TCL commands in creation and manipulation of Database
4. Implement subqueries to make the complex queries more readable and apply joins to combine different relations to get required data from database
5. Implementation of SQL conversion, number and string functions
6. Experiment with triggers, cursors and functions to maintain referential integrity of data

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	3	2	-	-	-	2	-	2	-	2	-	3
CO2	3	2	2	3	-	-	-	2	-	2	-	2	-	2
CO3	3	2	2	2	-	-	-	2	-	2	-	2	-	3
CO4	3	2	3	2	-	-	-	2	-	2	-	2	-	3
CO5	3	2	2	3	-	-	-	2	-	2	-	2	-	3
CO6	3	2	2	2	-	-	-	2	-	2	-	2	-	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments**Experiment 1****Application: 1**

"Established in 1977, "Roadway Travels" has been actively operating for decades, providing connectivity across various destinations in India through a fleet of several buses. Headquartered in Hyderabad, the company now aims to modernize its operations in the following key areas:

1. Reservation System:

Managing reservations is the responsibility of the booking office. Customers can reserve their seats up to 60 days in advance, utilizing either cash or credit payment methods. In instances where tickets are unavailable, customers receive wait-listed tickets, which can be confirmed once cancellations occur.

2. Ticketing:

The booking office handles ticketing processes, including sales and issuance. Both cash and credit payments are accepted for this purpose.

3. Cancellation and Modification:

Cancellation services are also facilitated at the booking office. Applicable cancellation charges will be levied as per company policy. Furthermore, modifications to reservations can be processed within this domain. Notably, wait-listed tickets that remain unconfirmed are eligible for full refunds."

The Following are the entities:

Bus (BusNo, Source, Destination, coachtype)

Reservation (PNRNo, BusNo, NoofSeats, JourneyDt, ContactNo, Address)

Ticket (TicketNo, BusNo, JourneyDt, Source, Destination, Dept_Time, Age, Sex)

Passenger (TicketNo, PNRNo, Name, ContactNo, Age, Sex)

Cancellation (PNRNo, JourneyDt, SeatNo, ContactNo)

Application: 2

Online Learning Platform: An online learning platform requires an ER model to handle courses, students, instructors, and enrollments. Courses have titles, descriptions, and durations. Instructors have names, expertise, and contact details. Students have profiles with names, email addresses, and student IDs. Enrollments link students to courses, including enrollment dates.

Entities and Attributes:

Course (Course ID (Primary Key), Title, Description, Duration (in weeks or hours)Level (Beginner, Intermediate, Advanced), Category (e.g., Programming, Mathematics, Language), Price, Language,

Thumbnail Image URL,)

Instructor (Instructor_ID (Primary Key), Name, Bio, ContactInfo (Email, Phone), Expertise (Areas of specialization), ProfilePictureURL)

Student (Student_ID (Primary Key), FirstName, LastName, Email, DOB, Address, Contact)

Enrollment (Enrollment_ID (Primary Key), Course_ID (Foreign Key referencing Course), Student_ID (Foreign Key referencing Student), EnrollmentDate, Status (Enrolled, Completed, Dropped, etc.))

Lesson (Lesson_ID (Primary Key), Course_ID (Foreign Key referencing Course), Title Order (Sequence within the course), Duration (in minutes or hours), Content (Text, Video URL, PDF URL, etc.))

Quiz (Quiz_ID (Primary Key), Course_ID (Foreign Key referencing Course), Title, Number of Questions, Passing Score)

Question (Question_ID (Primary Key), Quiz_ID (Foreign Key referencing Quiz), Question Text, Question Type (Multiple Choice, True/False, Short Answer, etc.))

Answer (Answer_ID (Primary Key), Question_ID (Foreign Key referencing Question), AnswerText, Correct_Answer_Indicator)

Application: 3

Music Streaming Service: A music streaming service needs an ER model to organize its content and user interactions. The system should handle songs, albums, artists, playlists, and users. Songs have titles, durations, and release years. Albums include album names, release dates, and cover art. Artists have names, genres, and biographies. Users have profiles with names, email addresses, and subscription details. Playlists contain songs and are created by users.

Application: 4

Company Database: The company is organized into departments. Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations. A department controls several projects, each of which has a unique name, a unique number, and a single location. We store each employee's name, social security number, address, salary, sex, and birthdate. An employee is assigned to one department but may work on several projects, which are not necessarily controlled by the same department. We keep track of the number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee. We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's name, sex, birthdate, and relationship to the employee.

Entities are:

Company Database:

EMPLOYEE (SSN, EName, Address, Sex, Bdate, Salary, SuperSSN, DNo)

DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)

DLOCATION (DNo, DLoc)

PROJECT (PNo, PName, PLocation, DNo)

WORKS_ON (SSN, PNo, Hours)

DEPENDENT (Essn, Dependent_name, Sex, Bdate, Relationship)

Apply ER Model for the above applications and identify the relations present in each application represent them in ER diagram.& Convert ER model to Relational Model.

Note: Students need to form a group minimum of 3 students and maximum of 5, and should design at least two applications into ER model by using EdrawMax software and convert them into relational model

Experiment 2

Creating users, roles and grant privileges to users and relations.

Experiment 3

Create and alter tables for Company Database in SQL using Integrity Constraints.

Integrity Constraints are CHECK, NOT_NULL, DEFAULT, UNIQUE, PRIMARY KEY, FOREIGN KEY.

Use atleast one constraint in one relation to understand the usage of constraints on database.

Schema:

CREATE TABLE employee (Fname varchar (15) NOT NULL, Minit varchar(1), Lname varchar(15) NOT NULL, SSN varchar(9) NOT NULL, Bdate date, Address varchar(30), Sex varchar(1), Salary float,

```
Super_ssn varchar(9), Dno int NOT NULL, PRIMARY KEY (ssn), FOREIGN KEY (Super_ssn) REFERENCES employee(ssn));
```

```
CREATE TABLE department (Dnamevarchar(15) NOT NULL, Dnumber int NOT NULL, Mgr_ssn varchar(9) NOT NULL, Mgr_start_date date, PRIMARY KEY (Dnumber), UNIQUE(Dname), FOREIGN KEY (Mgr_ssn) REFERENCES employee(ssn));
```

```
CREATE TABLE dept_locations (Dnumber int NOT NULL, Dlocationvarchar(15), PRIMARY KEY (Dnumber, Dlocation), FOREIGN KEY (Dnumber) REFERENCES department (Dnumber));
```

```
CREATE TABLE project (Pnamevarchar(15) NOT NULL, Pnumber int NOT NULL, Plocation varchar(15), Dnum int NOT NULL, PRIMARY KEY (Pnumber), UNIQUE (Pname), FOREIGN KEY (Dnum) REFERENCES department (Dnumber));
```

```
CREATE TABLE works_on (Essnvarchar(9) NOT NULL, Pno int NOT NULL, Hours float NOT NULL, PRIMARY KEY (Essn, Pno), FOREIGN KEY (Essn) REFERENCES employee(ssn), FOREIGN KEY (Pno) REFERENCES project(Pnumber));
```

```
CREATE TABLE dependent (Essnvarchar(9) NOT NULL, Dependent_name varchar(15) NOT NULL, Sex varchar(1), Bdate date, Relationship varchar(8), PRIMARY KEY (Essn, Dependent_name), FOREIGN KEY (Essn) REFERENCES employee(ssn));
```

Experiment 4

Execute basic SQL queries on Employee Database

To Create a database called Employee which consists of EMP, Dept, Salgrade, Project, Works_on and Dependent tables as relations in the database use Data Definition Language command (Create, Alter).

Run sql queries on database using DML commands like Insert, Update, Delete and for retrieval of data from database use Select statement.

Employee Database:

EMP (Empno, Ename, Job, Mgr, Hiredate, sal, comm, deptno)

DEPT (Deptno, Dname, Location)

SALGRADE(Grade, Losal, Hisal)

PROJECT (Pno, Pname, Plocation, Deptno)

WORKS_ON(Empno, Pno, Hours)

DEPENDENTS(EMPNO, DependentName, Sex, Bdate, Relation)

4.1 Insertion:

Insert rows into table by using datatypes like varchar, int, date, float etc.,

Syn: INSERT INTO employee (Fname, Minit, Lname, SSN, Bdate, Address, Sex, Salary, Super_ssn, Dno) values ('James', 'E', 'Borg', 888665555, '10-NOV-1937', '430 Stone, Houston, TX', 'M', 55000, NULL, 1);

4.2 Retrieval (Set operations)

Syn: Select Name from EMP Union Select Salary from EMP;

4.3 Updating

Update rows by changing the values in a row using update command syntax.

4.4 Deletion

Delete an entire row or multiple rows from the table using this command

Experiment 5

Implement the SQL operations on Employee Database created in Experiment 4.

Operations are: In, Any, All, Between, Like, Exists, Group by, Order by, having.

Employee Database:

EMP (Empno, Ename, Job, Mgr, Hiredate, sal, comm, deptno)

DEPT (Deptno, Dname, Location)

SALGRADE (Grade, Losal, Hisal)

PROJECT (Pno, Pname, Plocation, Deptno)

WORKS_ON (Empno, Pno, Hours)

DEPENDENTS (EMPNO, DependentName, Sex, Bdate, Relation)

Experiment 6

Implementing the concepts of Rollback – commit, checkpoints, and Views.

Rollback – commit, checkpoints:

Create Teacher table with the following fields(Name, DeptNo, Date of joining, DeptName, Location, Salary)

1. Insert five records
2. Give Increment of 25% salary for Mathematics Department .
3. Perform Rollback command
4. Give Increment of 15% salary for Commerce Department
5. Perform commit command.

Views:

To create different views, use the Employee Database

1. Create a view to display Hiredate of all employees.
2. Create a view to display no of working hours of all employees with Plocation.

Experiment 7

Apply different types of joins available in SQL on company database created in Experiment 4.

Types of Joins:

- Inner Join
- Outer Join
- Left Join
- Right Join

Experiment 8

Apply subqueries and nested queries on company database (refer to experiment 4).

Experiment 9

Implement built in functions in oracle (Numeric, Aggregate functions) on Dual table(provided by Oracle) and Employee database.

Numeric Functions: ABS, CEIL, FLOOR, SQRT etc.,

Aggregate Functions: MIN, MAX, SUM, COUNT, AVG

Experiment 10

Implement String handling and Conversion functions on Dual table (provided by Oracle) and Employee database.

String Functions: Lowercase, Uppercase, Initcap, Rtrim, Ltrim, Lpad, Rpad etc.,

Conversion Functions: TO_CHAR(), TO_DATE(), TO_NUMBER().

Experiment 11

Sql Practice links from online platforms:

Employee Bonus	https://leetcode.com/problems/employee-bonus/
Big Countries	https://leetcode.com/problems/big-countries/
Employees Earning more than their managers	https://leetcode.com/problems/employees-earning-more-than-their-managers/
Managers with at least 5 direct reports	https://leetcode.com/problems/managers-with-at-least-5-direct-reports/
Second Highest Salary	https://leetcode.com/problems/second-highest-salary/
Count Salary Categories	https://leetcode.com/problems/count-salary-categories/

Experiment 12

Triangle	https://www.hackerrank.com/challenges/what-type-of-triangle/problem?isFullScreen=true
Average Population of each country in a continent	https://www.hackerrank.com/challenges/average-population-of-continent/problem?isFullScreen=true
Top Earners	https://www.hackerrank.com/challenges/earnings-of-employees/problem?isFullScreen=true
Occupations	https://www.hackerrank.com/challenges/occupations/problem?isFullScreen=true
New Company	https://www.hackerrank.com/challenges/the-company/problem?isFullScreen=true

15Days of Learning SQL

<https://www.hackerrank.com/challenges/15-days-of-learning-sql/problem?isFullScreen=true>

Experiment 13

Implement PL/SQL operations on Employee Database to retrieve one row as output.

Experiment 14

Implementing functions, stored procedures on company database using PL/SQL

Experiment 15

Implement cursors on Employee database using PL/SQL to retrieve multiple rows as output.

Experiment 16

Creating triggers using PL/SQL

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. Prof Arnab Bhattacharya IIT Kanpur, SQL Introduction <https://nptel.ac.in/courses/106104135/10>
2. Prof Arnab Bhattacharya IIT Kanpur SQL: Updates, Joins, Views, and Triggers
3. <https://nptel.ac.in/courses/106104135/11>

List of Augmented Experiments

1. Inventory control management System
2. College Management System
3. Hospital management System
4. Library management System
5. Payroll management System
6. Health care organization Management System
7. Restaurant Management System
8. Blood Donation Management System
9. Art Gallery Management System
10. Hotel Management System
11. School Management System
12. Salary Management System
13. Wholesale Management System
14. Time Table Management System
15. Website Management

Reading Material (s)

1. Database Management Systems Lab Manual, Department of CSE, GMRIT,Rajam

23CS407 Web Coding and Development Lab**0 0 3 1.5****Course Outcomes**

1. Design static web pages using HTML and CSS.
2. Design responsive web pages using Bootstrap for visually appealing web pages.
3. Create JavaScript functions for user authentication, form validation, dynamic content generation, and data visualization.
4. Develop business logic using PHP scripts.
5. Build database connectivity to facilitate communication between the Web Server and the Database Server.
6. Develop Web Applications using Flask framework.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	2	-	-	1	-	2	-	-	-	3
CO2	2	3	3	3	2	-	-	3	-	2	-	-	-	3
CO3	2	2	2	3	2	-	-	1	-	2	-	-	-	3
CO4	2	2	3	3	2	-	-	3	-	2	-	-	-	3
CO5	2	2	3	3	3	-	-	2	-	2	-	-	-	3
CO6	2	2	2	3	2	-	-	2	-	2	-	-	-	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Design the following static web pages required for Online Examination System web site.
 - a. Home Page
 - b. Login Page: a. Student Login Page b. Admin Login Page
 - c. Registration page
 - d. Test Page
 - e. Results Page.
2. Apply different font styles, font families, font colors, animations, and other formatting styles to the above static web pages.
3. Apply CSS Box model to design above static web pages
4. Make the static pages Responsive and attractive using Bootstrap components (**Mobile View)
5. Write a JavaScript function that validates the student's login credentials. If the username and password are correct, redirect them to the test page; otherwise, show an error message.
6. Implement a form validation function for the registration page. Ensure that the password and confirm password fields match and that the email is in a valid format.
7. Write a JavaScript program that dynamically generates a set of multiple-choice questions and their answer choices from an array of question objects. Allow the user to select an answer and submit the test
8.
 - a. Create a JavaScript function that calculates the user's test score based on their answers and displays it on the results page.
 - b. Implement a chart or graph using a JavaScript library (e.g., Chart.js) to visualize the user's performance on the test, showing the number of correct and incorrect answers.
9. Create a PHP script that takes user registration data (e.g., username, email, password) from the registration form and inserts it into a database table for storing user information.
10. Develop a PHP script that validates the entered login credentials (username and password) against the database records. If valid, allow the user to log in.

11. Write a PHP script that receives the user's test answers from the test page and stores them in a database table along with the user's ID and timestamp.
12. Create a PHP script that retrieves the user's test results from the database and displays them on the results page. Include the user's score and a list of questions answered correctly and incorrectly.
13. Write a Flask application that establishes a connection to a SQLite database. Define a User model with fields like username, email, and password.
14. a. Create a Flask route for user registration. When a user submits the registration form, insert their information into the database.
b. Implement Flask routes for student and admin login pages. Validate the entered login credentials against the database records.
15. Write a Flask route that retrieves a set of test questions from the database and displays them on the test page.
16. a. Develop a Flask route that receives the user's test answers and stores them in the database along with the user's ID and timestamp.
b. Create a Flask route that retrieves the user's test results from the database and displays them on the results page.

List of Augmented Projects

1. WebCrawlers
2. Online Hospital Management
3. Online Shopping Project
4. Web based Appointment Systems
5. Scrapbook
6. Online Job Recruitment System
7. Attendance management system
8. Online Banking system
9. Online Exam
10. Railway Reservation system
11. Leave Application Management System
12. Address Book
13. Movie Rental Systems
14. Online Auction System
15. Student Information system

Reading Material (s)

1. Web Technologies Lab manual–Department of CSE & IT-GMRIT Rajam

23ESX01 Employability Skills I**0 0 2 2****Course Outcomes**

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming.
3. Assess analytical and aptitude skills.
4. Develop algorithms for engineering applications.
5. Solve engineering problems using software.
6. Utilize simulation tools for testing

COs –POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	1	2	3	2				2	2	2	3		
CO2	3	2	3	2	3				2	2	2	3		
CO3	3	2	3	2	3				2	2	2	3		
CO4	3	2	3	2	2				3	3	3	3		
CO5	3	2	3	2	2				3	3	3	3		
CO6	2	1	2	3	2				3	3	3	3		

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Unit-I**Communication Skills****8 hours**

Building Confidence: Fear? Steps to Overcoming the Fear of Public Speaking? Self Esteem: Definition? Types of Self Esteem, Causes of Low Self Esteem, Merits of Positive Self Esteem and Steps to build a positive Self Esteem.

Group Discussions (Practice): GD? GD Vs Debate, Overview of a GD , Skills assessed in a GD, Dos & Don'ts, & Conducting practice sessions (Simple Topics).

Motivational Talk: Team Work: Team Vs Group? Stages in Team Building, Mistakes to avoid and Lessons to Learn (Through Stories or Can be a Case Specific)

Quantitative Aptitude**8 hours**

Percentages, Profit and loss, Mixtures and Allegations, Simple Interest, Compound Interest

Unit-II**Competitive Programming Phase – II****16 Hours****Module-1:**

Fundamental mathematical concepts: Basic Mathematics, Number Theory, Geometry - Bit manipulation - Two-pointer technique.

Practice Problems: Codechef, Hackerrank, Codeforces, Leetcode, interviewbit

Module-2:

Data Structures: Searching - Linked List - Stack – Queue – Graph Traversal Methods - Hashing Techniques.

Practice Problems: Codechef, Hackerrank, Codeforces, Leetcode, interviewbit

References:

1. <https://leetcode.com>
2. <https://www.codechef.com>
3. <https://www.hackerearth.com>
4. <https://www.interviewbit.com>
5. <https://www.hackerrank.com>

5th Semester**23EC502 Microprocessors and Microcontrollers****3 0 2 4****Course Outcomes**

1. Assess the architecture and instructions of 8086 microprocessor
2. Demonstrate the application of addressing modes
3. Execute assembly language programs based on 8086 microprocessor
4. Assess the architecture and instructions of 8051 microcontroller
5. Execute assembly language programs based on 8051 microcontroller
6. Implement the interfacing of peripherals with 8051 microcontroller

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	-	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	2	2	3	-	-	-	-	-	-	-	3	-
CO6	3	2	3	2	3	-	-	-	-	-	-	-	3	-

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Unit I**14+8 Hours**

Introduction to microcomputer, evolution of processors and semiconductor memories (RAM, ROM, EPROM, EEPROM), Architecture of 8086 microprocessor, Register organization of 8086, Pipelining concept, Memory segmentation, Addressing Modes.

Instruction Set and Programming: Instruction set of 8086 microprocessor: Data transfer instructions, Arithmetic instructions, Logical Instructions, String instructions, Stack related instructions, Branching instructions, Assembler directives.

Data transfer instructions of 8085 microprocessor, Architecture of 8085 microprocessor

Practical Components

1. Data transfer program using different addressing modes in assembly language programming.
2. Perform arithmetic operations on 8 bit and 16 bit numbers in assembly language programming.
3. Data transfer program using string instruction in assembly language programming.
4. Program for data conversion in assembly language programming.

Unit II**10+6 Hours****8086 Operational Modes and Memory Interfacing**

Minimum and Maximum mode operations of 8086 with timing diagrams, Procedures and macros, Stack Structure of 8086, Static RAM Interfacing, Interfacing of 8255 Programmable Peripheral Interface with 8086 microprocessor.

Dynamic RAM, Direct memory access

Practical Components

1. Write assembly language program using procedure.
2. Write assembly language program using macro.
3. Program to reject negative numbers from a series of bytes.

Unit III**12+8 Hours****8051 Microcontroller**

Comparison between microprocessor and microcontroller, 8051 family microcontroller, RAM architecture of 8051, Integrated Development Environment (IDE), Pin description of 8051 microcontroller, Machine cycle. Addressing Modes, Instruction set of 8051: Data transfer instructions, Arithmetic instructions, Logical Instructions, Stack related instructions, Branching instructions. Programming and Applications of Timers, Interrupts, Universal Asynchronous Receiver Transmitter (UART).

External memory interfacing with 8051 microcontroller, various constituents of hex file

Practical Components

1. Perform Arithmetic operations on 8bit numbers in assembly language programming using 8051 microcontroller.
2. Program to toggle the LED.
3. Programming and interfacing of traffic light logic.
4. Program to generate square wave using interrupts.

Unit IV

12+10 Hours

Interfacing of 8051 microcontroller with External Peripherals

Interfacing with 8051 microcontroller with: Keypad matrix, LCD, Seven segment displays, L293D Motor driver, Stepper motor, Analog to Digital Converter (804), Digital to Analog Converter (808).

Interfacing of temperature sensor (LM 35) with 8051, interfacing of relay with 8051

Practical Components

1. Programming and interfacing of the key pad matrix.
2. Programming and interfacing of seven-segment display.
3. Programming and interfacing of the LCD.
4. Programming and interfacing of the relay.
5. Programming and interfacing of the dc/Stepper motor.

Total: 48+32 Hours

Textbook (s)

1. A.K. Ray & K. M Bhurchandi, Advanced Microprocessors & peripherals, Tata McGraw-Hill, 3rd Edition, 2012
2. Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, The 8051 Micro controller and Embedded systems: using assembles and C, Pearson, 2nd Edition,2007

Reference (s)

1. D.V.Hall, Microprocessor and Interfacing, Tata McGraw Hill Publishing Company, 2nd Edition 2006
2. N. Sentil Kumar, M Sarvanan, S Jeevananthan, Microprocessors and Microcontrollers, Oxford University Press, 1st Edition, 2010
3. Kenneth J Ayala, The 8051 Microcontroller Architecture, Programming and Applications, Thomson Publishers, 3rd Edition, 2004

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Examination (%)
Remember	25	25	--
Understand	35	35	--
Apply	40	40	100
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. List out any four sixteen-bit registers of 8086 microprocessor which can't split into two eight bit registers.
2. State the advantages of memory segmentation.
3. State the significance of Reset pin of 8051 microcontroller.
4. List four differences between 8051 family of microcontroller.

Understand

1. Calculate the physical address generated by the 8086 microprocessor to fetch the code if CS = 2A40H & IP = AAAAH.
2. Explain the function of BIU and EU of 8086 microprocessor.
3. Explain the consequences of execution of MOV IP, #14H instruction of 8051 microcontroller.
4. Explain the structure of internal RAM of 8051 microcontroller.
5. Explain the significance of each bit of TMOD register of 8051 microcontroller.

Apply

1. Write a program for 8051 microcontroller in assembly language to generate a square wave of 10KHz from pin P2.1. Assuming frequency of crystal attached to the microcontroller is 12MHz.
2. Develop a program in assembly language for 8051 microcontroller to add five eight bit numbers.
3. Interface a seven-segment display with 8051 microcontroller and develop a program in assembly language to display even numbers from 0 to 9.
4. Interface a LCD with 8051 microcontroller and develop a program in assembly language to display a message in 1st row of LCD.

23CS502 Artificial Intelligence and Machine Learning**3 0 0 3****Course Outcomes**

1. Understand the scope of Artificial Intelligence in the real world
2. Demonstrate various machine learning algorithms and its preliminaries
3. Understand and apply Classification and Regression machine learning algorithms
4. Demonstrate and resolve complex clusters using dimensionality reduction
5. Understand the principles of Ensemble Learning Techniques
6. Illustrate the basic Concepts of Neural Networks and its Algorithms.

CO-PO Mapping:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	-	2	2
CO3	2	2	2	3	-	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	2
CO5	2	2	2	3	-	-	-	-	-	-	-	-	3	2
CO6	3	2	2	2	-	-	-	-	-	-	-	-	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit -I:**12 Hours****Artificial Intelligence**

Introduction, Problem as a State Space Search- Chess Problem, Water jug Problem, Heuristic Search Techniques- Generate and Test, Hill Climbing, Best First Search Techniques- OR Graphs, A* Algorithm, Problem Reduction- AND-OR Graphs, AO* algorithm, Constraint Satisfaction Problem, Propositional Logic, Predicate Logic, Resolution, Applications of AI.

AI Agents, AI Types, AI Tasks, Expert system

Unit -II:**12 Hours****Supervised Learning**

Introduction to Supervised Learning, Types of Machine Learning, Machine Learning Process, Performance Metrics, Classification Techniques- Naïve Bayes Classifier, K-Nearest Neighbours, Decision Tree Classification, Regression- Linear Regression and Logistic Regression, Regularization Techniques, Gradient Descent.

Bayes Theorem, Random Forests, Feature Scaling, Applications of ML

Unit -III:**12 Hours****Unsupervised Learning**

Clustering Techniques- K- Means Clustering, K-Medoids clustering, Mean-Shift Clustering and Hierarchical Clustering. Dimensionality Reduction – Principle Component Analysis, Independent Component Analysis and Linear Discriminant Analysis. Ensemble Learning Methods- Bagging, Boosting, Stacking and Voting.

Association Rule Learning, Measure of Quality Clustering, Applications, Anomaly detection

Unit -IV:**12 Hours****Artificial Neural Networks**

Introduction to Neural Network, Benefits of Neural Networks, Human Brain vs Artificial Neural Networks, Types of Neural Networks, Activation Functions, Stochastic Model of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures (Single-Layer, Multi-Layer, Deep Networks), Knowledge Representation, Learning and Optimization in Neural Networks.

Bias, Mean, Variance, Co-Variance

Total: 48 Hours**Text Book (s)**

1. E. Rich K. Knight and B.Nair – Artificial Intelligence– Third Edition – Tata McGraw Hill, 2017
2. Stephen Marsland- Machine Learning – An Algorithmic Perspective – Second Edition – Chap Man & Hall CRC Press, 2015

3. Simon Haykin, "Neural Networks - A comprehensive foundation", Pearson Education, 2003.

Reference (s)

1. Russel Norvig, Artificial Intelligence A modern Approach, 3rd Edition, Pearson Education 2010
2. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
3. Simon Haykin, " Neural networks and Learning Machines", Prentice Hall, 2008

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam(%)
Remember	25	20	-
Understand	35	40	30
Apply	40	40	40
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. Define Artificial intelligence.
2. What is Confusion Matrix?
3. List out the Regularization techniques.

Understand

1. What is Machine Learning?
2. How KNN is different from K- means Clustering?
3. What are the benefits of neural networks?

Apply

1. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
2. Apply k-Nearest Neighbour algorithm to classify the iris data set and print both correct and wrong predictions in it.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm.

Analyze

1. Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw the relevant graphs
2. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program

Open Book Question(s)

1. The issue of the possibility of self-improvement of the system of artificial intelligence, which gained autonomy, got out of human control and by downloading data from the Internet it is becoming an increasingly powerful and threatening system for humans since the 2090s in science fiction literature and film. With each subsequent year, the technology of artificial intelligence is developed and improved.
 - a) Justify the detailed steps involved for getting the above scenario w.r.t. human brain and computer vision.
 - b) Is it possible now or in the future to create an artificial intelligence that will draw knowledge directly from the analysis of Internet resources and learn this knowledge?
2. A large room is filled with mousetraps, arranged in a grid. Each mousetrap is loaded with two ping-pong balls, carefully placed so that when the mousetrap goes off they will be flung, land on other

mousetraps and set them off. The walls of the room are sticky, so any balls that hit the walls of the room are effectively absorbed. Every mousetrap that gets hit sends the two ping-pong balls in the same way: their movement is determined by a X and Y displacement relative to the launching mousetrap. You then decide to launch a single ping-pong ball into the room. It hits a mousetrap, setting it off, and launching its two balls. These two balls then set off two more mousetraps, and now four balls fly off... When the dust settles, many of the mousetraps have been set off, but some have been missed by all the flying balls.

- a) Identify the attributes and the mousetraps which are involved in this process
- b) Justify and predict the common set offs in the process and identify which learning suits the above scenario.

23CS503 Computer Networks (Integrated)**3 0 2 4****Course Outcomes:**

1. Illustrate the basic concepts of Data Communication Systems and Computer Networks.
2. Classify various wired and wireless transmission media used in data communication networks.
3. Demonstrate various techniques for error detection and correction to identify and resolve errors during data transmission.
4. Illustrate subnetting and routing mechanisms in network design.
5. Demonstrate the services of the transport layer and explain TCP and UDP protocols.
6. Summarize the internal functionalities of main protocols such as HTTP, SNMP, DNS, and Email.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	2	1	-	2	-	-	-	-	2	1	-
CO2	3	2	-	2	1	-	2	-	-	-	-	2	2	-
CO3	2	3	-	2	2	-	2	-	-	-	-	2	1	-
CO4	3	3	-	3	3	-	2	-	-	-	-	2	1	-
CO5	2	3	-	3	3	-	2	-	-	-	-	2	2	-
CO6	3	1	-	3	2	-	2	-	-	-	-	2	2	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT – I**12 + 8 hours****Introduction to Data Communications:** Components, Data Representation, Data flow

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet..

Physical Layer: Transmission media: Guided media- twisted pairs, coaxial cable, fiberoptics, unguided media-Wireless transmission, Switching Techniques: Circuit Switching-Packet Switching-Message Switching.*Taxonomy of networking devices***Practical Components:**

1. Familiarization with Networking Components and devices: LAN Adapters - Hubs – Switches - Routers etc.
2. Familiarization with Transmission media and Tools: Co-axial cable - UTP Cable - Crimping Tool - Connectors etc.
3. Preparing the UTP cable for cross and direct connections using crimping tool.
4. a) To configure the IP address for a computer connected to LAN and to configure network parameters of a web browser for the same computer.
b) Configuration of TCP/IP Protocols in Windows

UNIT – II**12 + 6 hours****Design Issues:** Framing-error detection and correction-CRC**Elementary Data link Protocols:** Stop and wait-Sliding, Window protocols: Go-back-n-Selective Repeat, **Medium Access sub layer:** Channel allocation methods, Multiple Access protocols: ALOHA-CSMA-IEEE Standard 802.3 and Ethernet*Data Link Control Protocols: HDLC-SLIP-PPP***Practical Components:**

1. Implement the data link layer framing methods:
 - a) Character stuffing method
 - b) Bit Stuffing method
2. Implement on a data set of characters the two CRC polynomials: CRC 12 - CRC 16
3. Develop a simple data link layer that performs the flow control using
 - a) The sliding window protocol,
 - b) Go-Back-N Protocol.

UNIT – III**12 + 8 hours**

Network Layer: Design issues, Routing algorithms: shortest path routing, distance vector routing, Flooding, Hierarchical routing, Broadcast, Multicast, Congestion Control Algorithms - Approaches to Congestion Control, Quality of Service-leaky bucket algorithm, token bucket algorithm, The Network layer in the internet-IPv4 Protocol, IP Addresses, Subnetting.

Internet control protocols

Practical Components:

1. Implement Dijkstra's algorithm to compute the Shortest path through a graph.
2. Take an example subnet graph with weights indicating delay between nodes. Now Obtain Routing table at each node using distance vector routing algorithm.
3. Take an example subnet of hosts. Obtain broadcast tree for it
4. Write a program for congestion control using Leaky bucket algorithm.

UNIT – IV

12 + 10 hours

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols. Application Layer – Domain name system, SNMP, Electronic Mail, World Wide Web, HTTP

Proxy Servers, Data compression

Practical Components:

1. a) Installing of internal modem and connecting to Internet.
b) To configure WiFi for your PC.
2. Wireshark
a) Packet Capture Using Wire shark
b) Starting Wire shark
c) Viewing Captured Traffic
d) Analysis and Statistics & Filters.
3. Do the following using NS3 Simulator
a) NS3 Simulator-Introduction and installation
b) Simulate to Find the Number of Packets Dropped
c) Simulate to Find the Number of Packets Dropped by TCP/UDP
d) Simulate to Find the Number of Packets Dropped due to Congestion
e) Simulate to Compare Data Rate & Throughput.
f) Simulate to Plot Congestion for Different Source/Destination
g) Simulate to Determine the Performance with respect to Transmission of Packets
4. Write a program for how to connect and transfer data between two nodes with each other.
5. Study and build a sample network topology to configure it for dynamic routing protocol using NS3

Total: 48+32 hours

Textbook (s)

1. Andrew S Tanenbaum, Computer Networks, 5th Edition, Pearson Education /PHI, 2013
2. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, Tata McGraw Hill Higher Education, 2013
3. Reference (s)
4. William Stallings, Data and Computer Communications, 8th Edition, Pearson Prentice Hall, 2007
5. W.A. Shay, Thomson, Understanding communications and Networks, 3rd Edition, Cengage Learning, 2005

Internal Assessment Pattern

Cognitive Level	Internal Test 1 (%)	Internal Test 2 (%)
Remember	25	20
Understand	40	40
Apply	35	40
Analyze	-	-
Evaluate	-	-
Create	--	--
Total (%)	100	100

Sample Questions

Remember

1. List the applications of Computer Networks
2. Write two differences between OSI and TCP/IP models.
3. State 5 key assumptions in Dynamic channel allocation?
4. State the purpose of DNS.
5. Define congestion.

Understand

1. Illustrate OSI Reference model.
2. Explain various design issues of data link layer
3. What are the responsibilities of Data Link layer and explain Pure Aloha and Slotted Aloha protocols.
4. Describe Distance Vector routing algorithm with example and explain count to infinity problem 5. Represent the Manchester encoding for the bit stream: 0001110101.

Apply

1. What is the check summed frame transmitted if the message is 1101011011 and the generator polynomial is $x^4 + x + 1$ using CRC
2. Can you think of any circumstances under which an open-loop protocol, (e.g., a Hamming code) might be preferable to the feedback-type protocols?
3. Assuming that all routers and hosts are working properly and that all software in both is free of all errors, is there any chance, however small, that a packet will be delivered to the wrong destination?
4. The following data fragment occurs in the middle of a data stream for which the byte-stuffing algorithm described in the text is used: A B ESC C ESC FLAG FLAG D. What is the output after stuffing?
5. The following character encoding is used in a data link protocol: A: 01000111; B: 11100011; FLAG: 01111110; ESC: 11100000 Show the bit sequence transmitted (in binary) for the four-character frame: A B ESC FLAG when each of the following framing methods are used:
 - (a) Character count.
 - (b) Flag bytes with byte stuffing. (
 - c) Starting and ending flag bytes, with bit stuffing.

23CS504 Theory of Computation**3 0 0 3****Course Outcomes**

1. Define State machines, languages and computations
2. Design a state machine with and without outputs
3. Compare regular grammars and regular languages
4. Relate Context free languages and Context free grammars
5. Design Pushdown automata for Context free languages
6. Illustrate decidable and un-decidable problems

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	2	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	2	3	-
CO3	3	2	3	-	-	-	-	-	-	-	-	2	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO5	3	2	3	-	-	-	-	-	-	-	-	2	2	-
CO6	3	3	2	-	-	-	-	-	-	-	-	2	2	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**13 Hours**

Finite Automata: Introduction to formal languages- language operations- Finite automata model- Deterministic Finite Automata – Nondeterministic Finite automata - Recognition of a language by an Automaton - Equivalence of DFA and NFA - Finite Automata with Null-Closure - Minimization of Finite Automata - Equivalence of FAs - Mealy and Moore Machine, Equivalence of Mealy and Moore machines.

Mathematical induction, strong principle, Complementation of Finite automata, Compound Automata

Unit II**11 Hours**

Regular Languages: Regular Sets-Regular expressions- Equivalence of Finite automata and regular expressions –Pumping Lemma for Regular Languages - Closure Properties of Regular sets. Regular Grammars: Right linear grammar- Left linear grammar- Equivalence of RLG and finite automata- Equivalence of LLG and finite automata.

Myhill-Nerode theorem –applications of regular expressions

Unit III**13 Hours**

Context free language- Closure Properties of Context free languages, pumping lemma for context free languages- Context-free grammar-simplification of Context free Grammar-Normal forms: Chomsky Normal form and Greibach Normal form.

Pushdown Automata: PDA Model-Design-Acceptance by empty stack and final state- Non-deterministic PDA. Context free grammar to Pushdown automata conversion.

Context Sensitive Languages, Linear bounded automata

Unit IV**11 Hours**

Turing Machine: Chomsky classification of languages- Turing Machine Model - Design of TM- Turing Machines variants–Undecidable languages - properties of Recursive and Recursively Enumerable Languages -Post Correspondence Problem - Halting Problem - Polynomial Reducibility, P – NP, NP – Complete and NP – Hard problems

Computable Functions - Constant Functions, Recursive Functions

Total 48 Hours**Text Books:**

1. J. E. Hopcroft and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson/Addison Wesley, 2007
2. Mishra & Chandra Sekharan, Theory of Computer Science& Automata Language and Computation, 3rd Edition, Prentice Hall of India, 2007

Reference books:

1. P. Linz, Introduction to Formal Language and Computation, 2nd Edition, Narosa, 2006.
2. H. R. Lewis & C. H. Papadimitriou, Elements of the Theory of Computation, Prentice Hall of India, 2nd Edition - 2006.

Internal Assessment Pattern

Cognitive Level	Internal Test 1 (%)	Internal Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	20	--
Apply	30	40	60
Analyze	20	20	40
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Write the analytical representation of NFA.
2. Define context free grammar.
3. State Rice's theorem

Understand

1. Compare Mealy and Moore machine
2. Explain the closure properties of regular languages
3. Illustrate the Chomsky classification of languages.

Apply

1. Design pushdown automata for $L = \{anbn/n \geq 1\}$.
2. Construct Turing machine for palindrome strings over $\Sigma = \{a, b\}$

Analyse

1. How does a Mealy machine different from Moore machine?
2. Does PCP with 2 lists $X = \{10, 110, 11\}$ $Y = \{1, 01, 0\}$ has a solution? Justify your answer.

Open Book Exam Questions

1. Suppose r_1 and r_2 are regular expressions over the same alphabet Σ . We say $r_1 = r_2$ to denote equality of the languages represented by r_1 and r_2 . In other words, every string in the language represented by r_1 is also included in the language represented by r_2 and vice versa. For each of the following pairs of regular expressions over $\Sigma = \{0, 1\}$, either prove that they represent the same language, or give a string that is present in the language of one but not in the language of the other. In the latter case, you must also describe why your solution string is in the language of oneregular expression, but not in that of the other.
 - (a) $r_1 = 1 * (1 + 0) * 0 *$ and $r_2 = (0 * 1 *) *$
 - (b) $r_1 = ((0 + 1) * 0) * 0$ and $r_2 = (0 + 1) * 0 * 0$
 - (c) $r_1 = (0 + 1) * 01(0 + 1) *$ and $r_2 = 1 * (0 + 1) * 0(0 + 1) * 1$
2. When we say that a TM M accepts a language L by halting, we mean that if M is started with a word w on its tape, it halts if and only if $w \in L$. In class, we have seen how every binary string can be thought of as encoding a deterministic Turing machine (DTM) that accepts by halting. Recall also that with the encoding studied in class, every DTM can be encoded as a binary string with no two consecutive 0's. Similarly, every binary string can be thought of as an input string on a given (possibly different) alphabet. We will use $[[w]]_{TM}$ to denote the Turing machine encoded by $w \in (0 + 1)^*$. Similarly, we will use $[[w]]_{\Sigma}$ to denote the input string encoded by $w \in (0 + 1)^*$. Let L_1 and L_2 be as defined below:
 - $L_1 = \{w \mid w \in (0 + 1)^+ \text{ and there is at least one input string on which } [[w]]_{TM} \text{ doesn't halt}\}.$
 - $L_2 = \{w100w2 \mid w1, w2 \in (0 + 1)^*, w1 \text{ has no two consecutive zeros, and } [[w1]]_{TM} \text{ does not halt on } [[w2]]_{\Sigma}\}.$

Which of the following statements are true? Justify your answer.

- (a) If L_1 is recursively enumerable, then L_2 is recursive.
- (b) L_1 is co-recursively enumerable

(c) The language $L_2 = \{ww^R \mid w \in L_1\}$ is recursive. Here, w^R means the reverse of the word w .

23CS507 Artificial Intelligence and Machine Learning Lab**0 0 3 1.5****Course Outcomes:**

1. Construct rule-based systems for solving real-world problems.
2. Demonstrate the function of data repositories and pre-processing tools.
3. Apply and evaluate classification techniques for solving classification problems.
4. Build regression models to accurately predict outcomes.
5. Apply clustering techniques to group data and analyze the outcomes.
6. Simplify complex data using dimensionality reduction.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	2	-	-	-	-	-	-	3	3	3
CO2	2	-	-	2	3	-	-	-	-	-	-	2	3	3
CO3	3	2	-	3	3	-	-	-	-	-	-	2	3	3
CO4	2	2	-	2	3	-	-	-	-	-	-	2	2	2
CO5	3	2	-	3	2	-	-	-	-	-	-	2	2	2
CO6	3	2	-	3	3	-	-	-	-	-	-	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments:**Expert System**

1. Develop a Rule Based system (Consider any Problem from the Annexure any Real Time)

Data Pre-Processing and Data Pre-Processing Tools

2. Importing Datasets, Missing Data, Feature Encoding, Handling Outliers
3. Splitting Datasets to Training Dataset and Test Dataset, Feature Scaling, Data Sampling

Classification

4. K-Nearest Neighbor(K-NN) Classifier
5. Support Vector Machine Classification
6. Naïve Bayes Classifier
7. Decision Tree Classification

Regression

8. Simple Linear Regression
9. Multiple Linear Regressions
10. Polynomial Regression
11. Logistic Regression

Clustering

12. Association Rule Learning
13. K Means Clustering
14. Hierarchical Clustering

Dimensionality Reduction

15. Principal Component Analysis
16. Linear Discriminate Analysis

Text Book (s)

1. Raschka, Sebastian and Mirjalili, Vahid, Python Machine Learning, 3rd Edition, Packt Publishing., 2020
2. Stephen Marsland- Machine Learning – An Algorithmic Perspective – Second Edition – Chap Man & Hall CRC Press, 2015

Reference (s)

1. Tom M. Mitchell, –Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Machine Learning A-Z: Hands-On Python, Udemy.

Annexure:

1. Banking System
2. Weather System
3. Medical System
4. Gaming System
5. Dressing System
6. Disease Diagnose or Prediction System

Augmented Experiments:

1. Rule Based Expert System: Design, Suiting and Shirting for an event/ occasion
2. Gaming: Chess, Water Jug Problem, 8 Queens Problem
3. Real Time: Traffic Lights
4. Real Time: Banking Transactions (Only Debit and Credit)
5. Mathematical Approach for Theorem Proving
6. Financial Approach for Loans via Cash / Vehicle / Gold
7. Medical Expert Systems
8. Disease Classification Strategies
9. Disease Prediction Strategies
10. Work on a Real Dataset.

23TPX01 Term Paper**0 0 3 1.5****Course Outcomes**

At the end of the course, students will be able to

1. Interpret the literature to link the earlier research with the contemporary technologies
2. Communicate effectively as an individual to present ideas clearly and coherently
3. Review the research findings and its correlation to the latest applications
4. Prepare documents and present the concepts clearly and coherently
5. Inculcate the spirit of enquiry for self-learning
6. Identify interdisciplinary oriented topics

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	2	3	-	3	2	3	-	3	2	2
CO2	2	2	-	3	3	3	-	2	3	3	-	3	2	2
CO3	3	3	-	3	2	3	-	3	2	3	-	3	2	2
CO4	3	3	-	3	2	3	-	3	3	3	-	3	2	2
CO5	2	2	-	3	3	3	-	2	2	3	-	3	2	2
CO6	3	2	-	3	1	3	-	3	3	3	-	3	2	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Term Paper: The Term Paper is a self-study report and shall be carried out either during 5th or 6th semester in choice with Mini Project. Every student will take up this term paper individually and submit a report. The scope of the term paper could be an exhaustive literature review choosing any engineering concept with reference to standard research papers or an extension of the concept of earlier course work in consultation with the term paper supervisor. The report will be evaluated by a committee as nominated by HoD with the approval of CoE

23ESX02 Employability Skills II**0 0 2 0****Course Outcomes**

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming.
3. Assess analytical and aptitude skills.
4. Develop algorithms for engineering applications.
5. Solve engineering problems using software.
6. Utilize simulation tools for testing

COs –POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	1	1	1	1	1	-	-	-	2	3	3	3	-	-
CO2	1	1	3	1	1	-	-	-	2	3	3	3	-	-
CO3	1	1	3	1	1	-	-	-	2	2	3	3	-	-
CO4	2	2	3	2	2	-	-	-	3	3	2	3	-	-
CO5	3	2	3	2	2	-	-	-	3	2	2	3	-	-
CO6	2	2	2	2	3	-	-	-	3	2	3	3	-	-

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Soft Skills:

Sl No.	5th Semester (Topic & Content)	No. of Periods
1.	Introduction to Campus Placements: Stages of Campus Placement, Skills assessed in Campus Placements & How to get ready?	01
2.	Motivational Talk on Positive Thinking: Beliefs, Thoughts, Actions, Habits & Results (Success)	01
3.	Resume Preparation: Resume? Templates? Mistakes to be avoided in a Resume, Steps to be followed in preparing it.(with examples)	02
4.	Group Discussions (Recap): GD? Stages of a GD, Skills assessed in a GD, Blunders to be avoided, How to excel in a GD? (through Practice Sessions)	02
5.	Psychometric Tests: Definition, Types of Psychometric Tests: Numerical Computation, Data Interpretation, Verbal Comprehension, Verbal Critical Reasoning and Personality Questionnaires	01
6.	Exercises related to Communication: Story Writing, TAT etc	01
Total Periods		08

Quantitative Aptitude:

Sl No.	Semester-V (Topic)	No. of Periods
1.	Square & Cube roots	01
2.	Partnership	01
3.	Partnership	01
4.	Logarithms	01
5.	Progressions	01
6.	Mensuration	01
7.	Mensuration	01
8.	Data Sufficiency	01
Total Periods		08

Domain Specific: (Data Structures and Algorithms (DSA)-Phase-1)

16 Hours

Module-1: Analysis of Algorithm, Mathematics & Bit Manipulation

Asymptotic Analysis - Time and Space Complexity - Bitwise Operators (Bitwise AND, OR, XOR, Left/Right Shift). Arrays - Operations - Insertion, Deletion - Problems: Largest Element, Leaders in Array, Max Subarray Sum. Searching - Linear and Binary Search - Two Pointer Approach. Sliding Window Technique - Sorting - Overview of Sorting Algorithms - Bubble, Selection, Insertion, Merge, Quick Sort, Heap Sort and its applications (e.g., Top K Elements). Pattern Searching: Naive Pattern Search, Rabin-Karp Algorithm.

Module-2: Strings, Backtracking & Trees

Advanced Pattern Searching - Knuth-Morris-Pratt (KMP) Algorithm. String Problems: Palindrome Check, Reverse Words in a String, Anagram Search. Backtracking - Concept of Backtracking and Recursion, Common Problems: N-Queens, Sudoku Solver, Subset Sum, Permutations. Binary Tree: Basics, Traversals: Inorder, Preorder, Postorder, Level Order, Problems: Height, Diameter, Lowest Common Ancestor (LCA), Serialize and Deserialize Binary Tree. BST Operations: Search, Insert, Delete. Advanced BSTs: Self-balancing BSTs: AVL Tree, Red-Black Tree (Introductory level), Problems: Kth Smallest, Vertical Sum, Floor in BST.

References:

1. <https://leetcode.com>
2. <https://www.geeksforgeeks.org/>
3. <https://www.codechef.com>
4. <https://www.hackerearth.com>
5. <https://www.interviewbit.com>
6. <https://www.hackerrank.com>

23SIX01 Summer Internship I**0 0 0 1****Course Outcomes**

At the end of the course, students will be able to

1. Demonstrate the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s
2. Solve real life challenges in the workplace by analyzing work environment and conditions, and selecting appropriate skill sets acquired from the course
3. Articulate career options by considering opportunities in company, sector, industry, professional and educational advancement
4. Communicate and collaborate effectively and appropriately with different professionals in the work environment through written and oral means
5. Demonstrate the ability to harness resources by examining challenges and considering opportunities
6. Demonstrate appreciation and respect for diverse groups of professionals by engaging harmoniously with different company stakeholders

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	1	2	1	2	3	1	3	3	3	3	3	3	3
C02	3	3	3	3	2	2	1	3	3	1	1	3	3	1
C03	3	2	3	2	2	1	1	3	2	3	3	2	3	3
C04	3	3	3	3	3	3	2	3	3	3	3	3	3	3
C05	3	3	3	3	3	3	3	3	3	3	3	3	3	3
C06	3	3	3	3	3	3	3	2	3	3	3	3	3	3

Summer Internship: As a part of curriculum in all branches of Engineering, it is mandatory for all students to undergo summer internship Programme at industries (core or allied) / R & D organization to get practical insight of their subject domain during summer break after the 4th semester. This summer internship Programme shall be availed to a maximum duration of 4 weeks and the assessment shall be carried out with both internal and external experts leading to “Satisfactory” and “Non-Satisfactory Performance”, and it will not be accounted for the calculation of CGPA.

6th Semester**23CS601 Compiler Design****3 0 0 3****Course Outcomes**

1. Explain different translators and acquire knowledge of compiler & its Phases.
2. Identify formal grammars for specifying the syntax and Semantics of programming languages.
3. Construct parse table for a given grammar.
4. Examine the intermediate code for a given program.
5. Illustrate the symbol table management and storage organization.
6. Develop code optimization techniques to improve the performance of a program.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	2	3	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	1	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	1	1	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	1	-
CO6	3	2	3	-	-	-	-	-	-	-	-	2	2	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours**

Overview of Language Processing-Compiler-Assembler-Interpreters-Linkers & Loaders-Phases of a Compiler-Lexical Analysis-Role of Lexical Analysis-Token-Patterns and Lexemes-Lexical Errors-Regular definitions for the Language constructs- Transition diagrams for recognition of Tokens-Reserved Words and Identifiers.

*Input buffering, LEX tool***Unit II****12Hours**

Syntax Analysis-Top-down Parsing-First and Follow-Recursive predictive parsing- Non-Recursive Predictive Parsing-LL(1) Grammar-Bottom-up parsing-ShiftReduce Parsing-Model of an LR Parser-Construction of SLR(1) Tables-Construction of CLR(1)-LALR(1)-Parsing tables

*Handling Ambiguous grammars- Dangling ELSE ambiguity***Unit III****12 Hours**

Semantic Analysis - SDT: Synthesized and Inherited Attributes-Intermediate Code-Three Address Code-Quadruples-Triples-Indirect Triples-Abstract Syntax Trees-DAG for Expressions-Symbol Table management-Runtime Environment:Storage Organization-Storage Allocation strategies

*Data structures used in symbol table, Three address code for control statements***Unit IV****12 Hours**

Machine Independent Code Optimization-Common Sub-expression Elimination-Constant Folding-Copy Propagation-Dead Code Elimination-Strength Reduction-Loop Optimization-Basic Blocks-Flow Graph-DAG for basic blocks-Machine Dependent Code Optimization:Peephole Optimization-Register Allocation-Instruction Scheduling

*Code generation algorithm – optimization among basic blocks***Total: 48 Hours**

Text Books:-

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques, and Tools, 2nd Edition, Pearson, 2007.
2. V. Raghavan, Principles of Compiler Design, 2nd Edition, TMH, 2011.

Reference Books:-

1. Nandini Prasad, Principles of Compiler Design, 2nd Edition, Elsevier, 2012.
2. Yunlin Su, Song Y. Yan, Principles of Compilers: A New Approach to Compilers Including the Algebraic Methods, Springer, 2011.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	30	20	60
Analyze	10	20	40
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define Lexeme.
2. What is Bottom-up parsing?
3. What is inherited attribute?
4. What is constant folding?

Understand

1. Explain the phases of compiler.
2. Explain about various intermediate code representations.
3. Illustrate the machine independent code optimization techniques with an example for each.

Apply

1. Calculate the first and follow functions for the given grammar-
 $S \rightarrow (L) / a$
 $L \rightarrow SL'$
 $L' \rightarrow ,SL' / \epsilon$
2. Construct CLR(1) parsing table for the following grammar
 $S' \rightarrow S$
 $S \rightarrow C C$
 $C \rightarrow cC$
 $C \rightarrow d$

Analyse

1. Compare and contrast different storage organization strategies.
2. How does machine dependent code optimization is different from machine independent code optimization?

Open book Questions

1. Construct the basic block and flow graph for the following C fragments

```

a=3;
    b=4;
    for(i=0;i<n;i++)
    {
        a=a*b+5;
        a=a-4;
    }
    c=a+b*3;

```
2. Write the recursive C function to generate Fibonacci sequence. Represent the activation record for each recursive call in case of Fibonacci (8).

23CS602 Cryptography and Network Security**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Describe the fundamentals of Cryptography, encryption and decryption algorithms.
2. Make use of the symmetric and public key cryptographic algorithms.
3. Explain Cryptographic Hash Functions and Digital Signatures.
4. Discuss the design and functioning of Secure Communication Protocols.
5. Identify different web and network security threats.
6. Summarize Secure Data Handling Mechanisms.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	-	2	-	3	-	-	-	2	-	-
CO2	3	2	2	-	-	2	-	3	-	-	-	2	-	-
CO3	3	2	2	-	-	2	-	3	-	-	-	2	-	-
CO4	3	1	2	-	-	2	-	2	-	-	-	2	-	-
CO5	3	1	2	-	-	2	-	3	-	-	-	2	-	-
CO6	3	1	2	-	-	2	-	2	-	-	-	2	-	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours**

Introduction: Security Attacks, Security Goals, Computer criminals, Methods of Defence, Security Services, Security Mechanisms. **Basics of Cryptography:** Symmetric Cipher Model, Substitution Techniques, Transportation, Techniques, Other Cipher Properties- Confusion, Diffusion, Block and Stream Ciphers. Block Cipher Design Principles and Modes of Operations, **Symmetric Key Cryptosystems:** Principles of Private Key System, Data Encryption Standard (DES), Strength of DES, Triple DES, International Data Encryption algorithm(IDEA), Advanced Encryption Standard (AES) *Blowfish, CAST-128.*

Unit II**12 Hours**

Public Key Cryptography: Principles of Public Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange. **Cryptographic Hash Functions:** Principles of Cryptographic Hash functions, Applications of Cryptographic Hash Functions, Secure Hash Algorithm (SHA-512), Message Authentication Codes, Message Authentication Requirements and Functions, HMAC, Digital Signatures, Elgamal Digital Signature Schemes
Digital Signature Standards

Unit III**12 Hours**

Authentication Applications: Kerberos, Key Management and Distribution, X.509 Directory Authentication service, Public Key Infrastructure, **Electronic Mail Security:** Pretty Good Privacy, S/MIME. **IP Security:** Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange
Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security, *HTTPS, Electronic Payment*

Unit IV**12 Hours**

Locking, Recovery Systems, Indexing, Different Types of Data

IDS and Firewalls: Intruders, Intrusion Detection, Password Management, Firewalls-Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted Systems. **Non-cryptographic protocol Vulnerabilities:** DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities- Phishing, Buffer Overflow.

Format String Attacks, SQL InjectionCybercrime and Computer Crime, Intellectual Property.

Total: 48 Hours

Textbook (s)

1. William Stallings, "Cryptography And Network Security – Principles and Practices", 7th edition, Pearson Education Limited 2017.
2. AtulKahate, "Cryptography and Network Security", 2nd edition Tata McGraw-Hill, 2003.
3. Behourz A Forouzan, Cryptography and Network Security, 2nd edition, Tata McGraw-Hill 2011

Reference (s)

1. Matt Bishop, "Computer Security art and science ", Second Edition, Pearson Education, 2002
2. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007
3. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
4. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006
5. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, First Edition, 2006.
6. OWASP top ten security vulnerabilities: <http://xml.coverpages.org/OWASPTopTen.pdf>

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Mention any two security attacks
2. List any two goals of security
3. Define Hash function

Understand

1. Differentiate between asymmetric and symmetric key cryptography
2. How do we achieve authentication?
3. Differentiate between the two applications of hash function.

Apply

1. How do we apply PGP to the Email Security?
2. Implement firewall using iptables command.
3. Can message encryption itself provide measure of authentication?

Open Book Exam Questions

Question 1:

A man named Jones wanted to chat with his girlfriend Goldie. But he can see that all his family is around him and even his girlfriend is also with her parents. So, he thought to send a secret message to his girlfriend. They usually love to meet in the "Central Park". Now jones wants to send a message to Goldie as "Hi Goldie. How are you? Because you are with your parents, and I am with my parents we cannot speak with each other. But I want to meet you at our favourite place central park tomorrow after your class". Help jones to convert the message to unreadable format using the key of their favourite place. Also suggest him how would jones tell Goldie that the letter is originated from jones only.

Question 2:

You have decided to start a startup after graduation. But you alone cannot be doing this, so you have to ask help from your friends. Suggest what techniques you require and which sort of people you would select so that your company will be a huge success. Explain the techniques clearly to your friends and tell them what they have to do in detail.

23CS603 Software Engineering**3 0 0 3****Course Outcomes**

1. Explain the need of Software Life Cycle Models
2. Build end-user requirements into system and software requirements,
3. Summarize the system models of software engineering
4. Identify and apply appropriate software architectures and patterns to carry out high level design
5. Choose various testing techniques during software development
6. Categorize Risk management and Software quality for software products

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	2	-	2	-	-	2	-	-	2	-	3	-
CO2	3	2	3	-	2	-	-	2	-	-	3	-	3	-
CO3	3	2	3	-	3	-	-	-	-	-	3	-	3	-
CO4	3	2	3	-	2	-	-	2	-	-	3	-	3	-
CO5	3	2	3	-	2	-	-	1	-	-	3	-	3	-
CO6	3	2	2	-	2	-	-	1	-	-	3	-	3	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT – I**12 Hours**

Introduction to Software Engineering and SDLC, Software Myths, CMMI, Process models: Linear Sequential model, Prototyping model, Evolutionary models: Spiral model, Agile developmental methodologies-Scrum & XP

Incremental model, software development: Product based and application based

Unit II**12 Hours**

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification.

Software Requirements Engineering Process, Feasibility studies, Requirements elicitation and analysis, requirements validation.

System models: Context models, behavioral models, data models, object models.

Structure of Software Requirements Document, Structured analysis methods

Unit III**12 Hours**

Design concepts, data design, software architecture, Architectural styles and patterns, User interface design - Golden rules, User interface analysis and design and steps. Conceptual model of UML, basic structural modeling, Static and Dynamic UML diagrams: class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, etc.,

Data Acquisition System - Monitoring and Control System

Unit IV**12 Hours**

Testing strategies and Risk Management: Testing levels: Unit testing, integration testing, system testing – alpha and beta testing, Testing Types: black box and white box testing techniques, Cyclomatic Complexity, debugging, Risk management - Risk types, strategies, estimation and Planning. Software Quality - Quality assurance and its techniques

Software measurement, metrics for software quality

Total: 48 Hours**Textbook (s)**

1. Roger S. Pressman, Software Engineering, A practitioner's Approach, 8th Edition, McGraw-Hill International Edition, 2015
2. I. Sommerville, Software Engineering, 7th Edition, Pearson education, 2004.
3. Rajib Mal, Fundamentals of software Engineering, 4th Edition, Eastern Economy Edition, 2014.

Reference(s)

1. K. K. Aggarwal and Yogesh Singh, Software engineering, 3rd Edition, New Age International Publication, 2008

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define software engineering.
2. List different types software myths.

Understand

1. Describe software architecture styles and patterns .
2. Illustrate golden rules for user interface design.

Apply

1. Applying the process of requirement analysis, discuss how the requirements can be collected for a project.
2. Applying debugging strategy find an error from a code?

Analyze

1. Compare and Contrast software life cycle models.
2. Analyze risk types in the risk management.

Open Book Exam Questions

Assume that 10 errors have been introduced in the requirements model and that each error will be amplified by a factor of 2:1 into design and an addition 20 design errors are introduced and then amplified 1.5:1 into code where an additional 30 errors are introduced. Assume further that all unit testing will find 30 percent of all errors, integration will find 30 percent of the remaining errors, and validation tests will find 50 percent of the remaining errors. No reviews are conducted. How many errors will be released to the field.

23CS606 Case Tools Lab**0 0 3 1.5****Course Outcomes**

1. Apply basics of Unified Modeling Language (UML) to illustrate its importance in software engineering and system design
2. Design various use cases to showcase the functional requirements of the system.
3. Construct UML diagrams for static and dynamic views of the system
4. Infer various case studies and design the model
5. Construct the code from the model for the given application
6. Demonstrate and deploy the solutions for various real time problems.

COs-POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	2	3	1	-	-	-	2	2	2	-	2	-
CO2	2	3	2	2	2	-	-	-	2	3	2	-	2	-
CO3	2	3	3	3	3	-	-	-	2	3	2	-	2	-
CO4	2	-	3	2	3	-	-	-	2	3	2	-	3	-
CO5	2	-	2	2	3	-	-	-	2	2	2	-	3	-
CO6	2	3	2	2	2	-	-	-	2	-	2	-	3	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments:

Case studies given below should be Modeled using Rational Rose tool in different views i.e. Use case diagram, Class diagram, Sequence Diagram, Collaboration Diagram, State Diagram, Activity Diagram, Component Diagram, Deployment Diagram and Forward and Reverse Engineering.

CASE STUDY 1:**LIBRARY MANAGEMENT SYSTEM:**

This case study on the library management system gives us the complete information about the library and the daily transactions done in a Library. We need to maintain the record of new s and retrieve the details of books available in the library which mainly focuses on basic operations in a library like adding new member, new books, and up new information, searching books and members and facility to borrow and return books.

CASE STUDY 2:**A HOSPITAL MANAGEMENT SYSTEM:**

Entry in the hospital management system is done through system users. Master form for users is used to create user profile. Whole system is display in user's selected language. For example if user knows Germany then whole hospital management system is display in German language after login. Above all modules are related to patient. So when patient is admit then patient information is enter from patient entry form like patient name, patient initial, patient sex, patient birth date, blood group, patient ID.

CASE STUDY 3:**AUTOMATED TELLER MACHINE (ATM)**

Software is designed for supporting a computerized ATM banking network. All the process involved in the bank is computerized these days. All the accounts maintained in the bank and also the transactions effected, including ATM transactions are to be processed by the computers in the bank. An ATM accepts a relevant cash card, interacts with user, communicates with the central system to carry out the transaction, dispenses cash, and prints receipts. The system to be designed and implemented must include appropriate record keeping and security provisions. The system must handle concurrent access to the same account.

CASE STUDY 4:**DESIGN A STUDENT REGISTRATION SYSTEM :**

Each student has access to his or her course and grade information only and must be authenticated prior to viewing or updating the information. A course instructor will use the system to view the list of courses he or she is assigned for a given semester or has taught previously, view the list of students registered for the course(s) he or she is teaching and record final grades for each student in the course(s). TA

assignments will also be viewable through this system. Instructors must also be authenticated prior to viewing or updating any information.

CASE STUDY 5:

MULTITHREADED AIRPORT SIMULATION:

Everyday number of airplanes lands and takes off from airport. It is the responsibility of the Air Traffic Control (ATC) to regulate these planes. The aim of this simulation is to reconstruct the events occurring during landing or take off. Whenever plane enters the RADAR space, RADAR signals the ATC about the plane. Then the pilot sends the plane details. ATC checks the runway and decides priority. ATC signals the pilot whose plane is having highest priority to land/take off. Then the pilot performs the corresponding command.

CASE STUDY 6:

POINT OF SALE:

Shops are the integral part of any civilization. They are present in every culture since ages. This application emphasizes on the transaction going on between the customer and shop keeper during sale of product. The customer approaches the shop keeper/ sales boy and places his order. The shop keeper forwards the order to sales boy who fetches the required goods from inventory. Then the shop keeper calculates bill and issues to the customer. The customer on paying the bill takes goods from the shop keeper. In turn, shop keeper fetches goods from supplier.

List of Augmented Experiments

1. Create a UML model for Passport automation system.
2. Create a UML model for Book bank
3. Create a UML model for Exam Registration
4. Create a UML model for Stock maintenance system.
5. Create a UML model for Online course reservation system
6. Create a UML model for E-ticketing
7. Create a UML model for Credit card processing
8. Create a UML model for e-book management system
9. Create a UML model for Recruitment system
10. Create a UML model for Quiz system

Reading Material (s)

1. Case tools Lab manual, Department of CSE, GMRIT, Rajam

23MPX01 Mini Project**0 0 3 1.5****Course Outcomes**

1. Identify a contemporary engineering application to serve the society at large
2. Use engineering concepts and computational tools to get the desired solution
3. Justify the assembled/fabricated/developed products intended
4. Organize documents and present the project report articulating the applications of the concepts and ideas coherently
5. Demonstrate ethical and professional attributes during the project implementation
6. Execute the project in a collaborative environment

COs – POs Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3	3	2	3	2	3	2	2	2	2	3	3	3	3
C02	3	3	3	2	3	3	3	3	2	3	3	3	3	3
C03	2	3	3	3	3	3	3	2	2	2	3	3	3	3
C04	2	2	3	3	3	3	3	3	3	3	3	3	3	3
C05	3	3	2	2	3	3	3	3	3	2	3	3	3	3
C06	3	3	2	2	3	3	3	3	3	3	3	3	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Mini Project: The curriculum offers Mini Projects in two different forms viz: (i) Mini Project as a mandatory component in all lab courses (ii) 2 credit Mini Project during 5th or 6th semester. With respect to second one (ii) student will take mini project batch wise and the batches will be divided as similar to lab courses. The report will be evaluated by a committee as nominated by CoE constituted with internal & external panels

23ESX02 Employability Skills II**0 0 2 2****Course Outcomes**

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming.
3. Assess analytical and aptitude skills.
4. Develop algorithms for engineering applications.
5. Solve engineering problems using software.
6. Utilize simulation tools for testing

COs –POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	1	1	1	1	1	-	-	-	2	3	3	3	-	-
CO2	1	1	3	1	1	-	-	-	2	3	3	3	-	-
CO3	1	1	3	1	1	-	-	-	2	2	3	3	-	-
CO4	2	2	3	2	2	-	-	-	3	3	2	3	-	-
CO5	3	2	3	2	2	-	-	-	3	2	2	3	-	-
CO6	2	2	2	2	3	-	-	-	3	2	3	3	-	-

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Soft Skills:

Sl No.	Topic & Content	No. of Periods
1.	Resume (Recap): Resume? Templates? Mistakes to be avoided in a Resume and Steps to be followed in preparing it.	01
2.	Group Discussions (Recap) & Practice: GD? Stages of a GD, Skills assessed in a GD, Blunders to be avoided, How to excel in a GD? Practice sessions and sharing Feedback. (Screening sample Videos)	01
3.	Interview Skills: Interview? Types of Interviews, Dos & Don'ts, Skills assessed in an Interview, Mistakes to be avoided, How to equip oneself to excel? How to handle the Typical Interview Questions? (with Examples)	03
4.	Mock Interviews: Practice sessions with Feedback.	02
5.	Exercises related to Communication: Email Writing, Voice Versant, etc.	01
Total Periods		08

Quantitative Aptitude:

Sl. No.	Topic	No. of Periods
1.	Time and Distance	01
2.	Time and Distance	01
3.	Problems on Trains	01
4.	Problems on Trains	01
5.	Blood relations	01
6.	Ratio and Proportions	01
7.	Calendars	01
8.	Clocks	01
Total Periods		08

Domain Specific: (Data Structures and Algorithms (DSA)-Phase-2)**16 Hours****Module-1: Advanced Algorithms**

Graph Algorithms - Graph Basics, Representation, BFS and DFS, Prims and Dijkstra, Problems: Bridges, Cycle in Directed Graph. Advanced Graph Algorithms: Kruskal's, Bellman-Ford, Problems: SCCs, Count

Islands. Greedy Algorithms - Greedy Concepts, Problems: Activity Selection, Job Sequencing, Sort K-Sorted Arrays. Dynamic Programming- DP Intro, vs Greedy, Memorization, Tabulation, Problems: Coin Change, LCS, Subset Sum.

Module 2 - Database Management Systems (DBMS)

Introduction to DB- Relational Algebra & SQL- DDL, DML, DCL commands- SQL Clauses: GROUP BY, HAVING, ORDER BY, SQL Joins: Inner, Left, Right, Full- Subqueries and Operators: EXISTS, IN, ANY, ALL, Aggregate Functions : COUNT, SUM, AVG - Views and Indexes- Normalization & Functional Dependencies: Normal Forms: 1NF, 2NF, 3NF, and BCNF.

References:

1. <https://leetcode.com>
2. <https://www.geeksforgeeks.org>
3. <https://www.codechef.com>
4. <https://www.hackerearth.com>
5. <https://www.interviewbit.com>
6. <https://www.hackerrank.com>

23ATX-- AUDIT COURSE**0 0 0 0****Course Outcomes**

At the end of the Audit Course the students will be able to

1. Interpret the meaning of values and select their goals by self- Investigation based on personal values.
2. Interpret the major events and issues related to a period in Indian history.
3. Assess the benefits and limitations of science and its application in technological developments towards human welfare
4. Check the awareness regarding basic human rights and to uphold the dignity of every individual.
5. Assess the individual and group behaviour and understand the implications of organizational behaviour on the process of management.
6. Determine the appropriateness of various leadership styles and conflict management strategies used in organizations.

COs –POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	-	-	-	-	-	2	2	3	1	2	-	2	-	-
CO2	-	-	-	-	-	3	2	1	1	1	-	1	-	-
CO3	-	-	-	-	-	2	3	1	1	1	-	2	-	-
CO4	-	-	-	-	-	3	2	3	1	2	-	2	-	-
CO5	-	-	-	-	-	2	2	1	3	2	-	1	-	-
CO6	-	-	-	-	-	2	2	3	1	2	-	2	-	-

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Audit Courses: Audit courses are among the compulsory courses and do not carry any credits. All the students shall register for one Audit courses in the beginning of 3rd semester. List of the courses will be notified at the beginning of the third semester for all students and the student has to choose one audit course under self-study mode at the beginning of third semester. All the students (regular and lateral entry students) shall complete the audit course similar to other regular courses and the results will be indicated with “Satisfactory” or “Not Satisfactory” performance.

List of Professional Electives**23CS004 Principles of Programming Languages****3 0 0 3****Course Outcomes**

1. Explain the concepts of programming languages.
2. Describe syntax and semantics of programming languages.
3. Explain data types, and basic statements of programming languages.
4. Illustrate the concept of subprogram.
5. Demonstrate the concepts of ADT and OOP.
6. Summarize the concept of exception handling and event handling.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	3	-
CO3	3	1	3	1	-	-	-	-	-	-	-	-	3	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	2	3	-	-	-	-	-	-	-	-	3	-
CO6	3	2	2	3	-	-	-	-	-	-	-	-	3	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Preliminary Concepts****11+4 Hours**

Reasons for studying concepts of programming languages, programming domains, language evaluation criteria, influences on language design, language categories, language design trade-offs, implementation methods, programming environments, Evolution of Major Programming Languages.

Syntax and Semantics: General problem of describing syntax, formal methods of describing syntax, attribute grammars, describing the meanings of programs.

Unit II**Data types, Expressions and Statements, Control Structure****11+4 Hours**

Names, Bindings, and Scopes: Introduction, names, variables, concept of binding, scope, scope and lifetime, referencing environments, named constants

Data types: Introduction, primitive, character, string types, user defined ordinal types, array, associative arrays, record, tuple types, list types, union types, pointer and reference types, type checking, strong typing, type equivalence

Expressions and Statements: Arithmetic expressions, overloaded operators, type conversions, relational and Boolean expressions, short-circuit evaluation, assignment statements, mixed-mode assignment

Control Structures: introduction, selection statements, iterative statements, unconditional branching, guarded commands.

Unit III**Subprograms****11+4 Hours**

Subprograms: Fundamentals of subprograms, design issues for subprograms, local referencing environments, parameter passing methods, parameters that are subprograms, calling subprograms indirectly, overloaded subprograms, generic subprograms, design issues for functions, user defined overloaded operators, closures, co routines

Implementing subprograms: General semantics of calls and returns, implementing simple subprograms, implementing subprograms with stack-dynamic local variables, nested subprograms, blocks, implementing dynamic scoping.

Unit IV**ADT, OOP, Exception and Event Handling****12 + 3 Hours**

Abstract Data types: The concept of abstraction, introductions to data abstraction, design issues, language examples, parameterized ADT, encapsulation constructs, naming encapsulations

Object Oriented Programming: Design issues for OOP, OOP in Smalltalk, C++, Java, Ada 95, C#, Implementation of Object-Oriented constructs.

Exception Handling and Event Handling: Introduction, exception handling in Ada, C++, Java, introduction to event handling, event handling with Java and C#.

Total: 45+15 Hours

Textbook (s)

1. Robert W. Sebesta, "Concepts of Programming Languages", Tenth Edition, Addison Wesley, 2012.
2. Programming Languages, Principles & Paradigms, 2ed, Allen B Tucker, Robert E Noonan, TMH

Reference (s)

1. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, MIT Press, 2009.
2. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Prentice Hall, 2008.
3. Richard A. O'Keefe, "The craft of Prolog", MIT Press, 2009.
4. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	50	50	--
Apply	--	10	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define programming language?
2. Define named constants?
3. Define subprogram?

Understand

1. Explain numeric types?
2. Summarize grammars for simple assignment statements.
3. Discuss language evaluation criteria and the characteristics that affect them.

Apply

1. Identity the exceptions occurred in C++ and Ada.
2. Construct BNF notation for following:
 - a. For loop
 - b. If-else condition
 - c. Structure definition
3. Solve the given grammar is ambiguous or not.


```

<assign> -><id>=<expr>
<id>->A|B|C
<expr>-><expr>+<expr>
|<expr>*<expr>
|(<expr>)
|<id>
```

23CS005 Mobile Computing**3 0 0 3****Course Outcomes**

1. Explain the basic concepts and fundamentals of mobile computing and telecommunication systems along with various standards.
2. Illustrate the techniques, protocols related to GSM and GPRS architecture to perform requirements analysis.
3. Explain major components of Mobile IP to improve the service qualities of a network
4. Compare various ad hoc routing protocols to examine the performance of network
5. Explain the architecture of Wireless Sensor Network and WLAN design issues and limitations.
6. Outline the basic knowledge in developing smart phone applications using various platforms, toolkits, APIs and third party libraries

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	-	3	-	-	-	-	2	-	2	-	2	-	2
CO2	2	-	2	-	-	-	-	2	-	2	-	2	-	3
CO3	2	-	1	-	-	-	-	2	-	2	-	2	-	3
CO4	2	-	2	-	-	-	-	2	-	2	-	2	-	3
CO5	2	-	2	-	-	-	-	2	-	3	-	2	-	3
CO6	2	-	2	-	-	-	-	2	-	3	-	2	-	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction to Mobile Communications****12+4 Hours**

Overview: Mobile Communication and Mobile Computing – Architecture; Generations of Telecommunications – 1G, 2G, 3G, 4G and 5G; Wireless Technologies – WPAN, WLAN, WMAN; Wireless Medium Access Control (MAC) – Overview, SDMA, TDMA, FDMA, CDMA;
 2G Technologies: GSM – Services, Architecture, Radio Interface, Protocol Stack, Localization, Call Handling, Handover, Security; 2.5G – GPRS and 3G – EDGE.

*Networking: Communication Modes, Basic Network Designs, Cellular Infrastructures***Unit II****Mobile Network Layer and Transport Layer****11+4 Hours**

Mobile Network Layer: Mobile IP Overview, IP Packet delivery, Agent discovery and advertisement, Registration, Tunneling and Encapsulation, Optimizations, Security, and Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer – Motivation, Traditional TCP, Classical TCP Approaches: Indirect TCP, Snooping TCP, Mobile TCP, Transaction-oriented TCP; Optimizations, TCP for 2.5G/3G.

*Multi Task gadget: wide area mobile data - air link standards for data - wireless application environment***Unit III****Mobile Ad-hoc Network (MANET)****11+3 Hours**

Introduction to Mobile ad-hoc networks, Characteristics and features, Applications, Limitations; Routing protocols – Design Issues, Routing algorithms: Proactive (DSDV & OLSR) and Reactive (DSR & AODV), Security in ad hoc networks; Wireless LAN – IEEE 802.11 – System Architecture, Protocol Layers.
 Wireless Sensor Network (WSN): Introduction, Architecture, Applications, Properties and Security.

*Satellite systems: history - applications - basics - broadcast systems***Unit IV****Mobile Platforms and Applications****11+4 Hours**

Mobile OS: Overview on Mobile Device Operation Systems (Android, iOS, Black Berry) – Architecture, App development Kit; Introduction to Network Simulators: Characteristics, Applications, Limitations, Types

of Simulators: Wireless Application Protocol (WAP): Introduction, Architecture, Applications.
Application layer Protocols – FTP, SMTP, HTTP, DNS; Windows 10.

Total: 45+15 Hours

Textbook (s)

1. Raj Kamal, Mobile Computing, Oxford press, Third Edition, 2018
2. Jochen Schiller, Mobile Communications, Pearson Education, Second Edition, 2020

Reference (s)

1. Asoke K Talukder, Hasan Ahmad and RoopaYavagal, Mobile Computing, Second Edition, McGraw Hill, 2010
2. Prasant Kumar Pattnail and Rajib Mall, Fundamentals of Mobile Computing, Second Edition, PHI Learning Pvt. Ltd., 2015
3. Frank Adelstein, et al., Fundamentals of Mobile and Pervasive Computing, McGraw Hill, 2005
4. http://www.isi.edu/nsnam/ns/doc/ns_doc.pdf (NS2 manual)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	25	10
Understand	25	15	20
Apply	25	20	30
Analyze	20	20	30
Evaluate	--	10	10
Create	--	10	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define Mobile Computing
2. List the applications of mobile computing
3. List the limitations of mobile computing
4. Define Mobile Adhoc Network
5. List the MANET routing issues

Understand

1. Explain mobile computing with architecture
2. Explain TDMA and FDMA with neat diagrams
3. Illustrate the different services provided by the GSM, Explain with system architecture
4. Explain IP Packet delivery with diagram
5. Describe DSSM (Direct Sequence Spread Spectrum)

Apply

4. Illustrate Registration process achieved in mobile network layer
5. Discuss the feature of tunneling and encapsulation
6. Illustrate the function of Dynamic Host Configuration Protocol (DHCP)
7. Discuss about security in Ad-hoc network
8. Illustrate the properties of MANETS

Analyze

1. Compare Snooping TCP and Indirect TCP
2. Analyze the performance of Dynamic Source Routing protocol
3. Compare about iOS and Blackberry Operating Systems

4. Compare NS2 and NS3 simulators
5. Explain about Android Operating System with architecture

Evaluate

1. Evaluate the performance of Wireless Datagram protocol
2. Evaluate the performance of DSDV
3. Evaluate the performance of DSR
4. How Traditional TCP is different from I-TCP
5. How localization and Call handling is performed

Open Book Exam Questions

Q1. Describe the functions of the MS and SIM. Why does GSM separate the MS and SIM? How and where is user-related data represented/stored in the GSM system? How is user data protected from unauthorized access, especially over the air interface? How could the position of an MS (not only the current BTS) be localized? Think of the MS reports regarding signal quality.

Q2. Describe the Concept of GPRS. Using the best delay class in GPRS and a data rate of 115.2 kbit/s – how many bytes are in transit before a first acknowledgement from the receiver could reach the sender (neglect further delays in the fixed network and receiver system)? Now think of typical web transfer with 10 Kbyte average transmission size – how would a standard TCP behave on top of GPRS (see chapters 9 and 10)? Think of congestion avoidance and its relation to the round-trip time. What changes are needed?

23CS006 Distributed Operating Systems**3 0 0 3****Course Outcomes**

1. Summarize the fundamental concepts of Distributed Operating Systems.
2. Illustrate the Concepts of Message passing system and Remote Procedure Calls.
3. Design and Implementation of Distributed Shared Memory and Structures.
4. Utilize the Synchronization and Distributed File Systems.
5. Make use of Resource Management and Process Management Concepts.
6. Outline the concept of Naming and Security in Distributed Operating Systems.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	2	-	-	-	-	-	-	-	-	1	1	2
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO6	3	1	2	-	-	-	-	-	-	-	-	1	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction and Communication in Distributed System****12+3****Hours**

Introduction: Design Issues - Distributed Computing Environment - Message Passing - Features of Good Message Passing System-Issues in IPC by Message Passing-Synchronization- Buffering
 Remote Procedure Calls: The RPC Model - Transparency of RPC- Implementing RPC Mechanism - Stub Generation - RPC Messages - Marshaling Arguments and Results - Server Management - Parameter-Passing Semantics- Call Semantics

*Communication Protocols for RPCs - Complicated RPCs - Client-Server Binding-Case Study: Sun RPC***Unit II****Distributed Shared Memory and Synchronization****11+4****Hours**

Distributed Shared Memory: General Architecture of DSM Systems- Design and Implementation Issues of DSM – Granularity - Structure of Shared Memory Space
 Synchronization: Clock Synchronization - Event Ordering - Mutual Exclusion –Deadlocks- Election Algorithms

*Consistency Models-Replacement Strategy - Thrashing***Unit III****Resource Management and Distributed FileSystems****11+4****Hours**

Resource Management: Features of a Good Global Scheduling Algorithm - Task Assignment Approach – Load Balancing Approach – Load Sharing Approach
 Distributed File Systems: Introduction -Desirable Features of a Good Distributed File System - File Models – File Accessing Models – File Sharing Semantics – File Caching Schemes - File Replication

*Process Management - Process Migration- Threads- Case Study: DCE Distributed File Service***Unit IV****Naming and Security****11 + 4****Hours**

Naming: Desirable Features of a Good Naming System - Fundamental Terminologies and Concepts - System-Oriented Names - Object-Locating Mechanisms - Human-Oriented Names - Name Caches
 Security: Potential Attacks to Computer Systems - Cryptography – Authentication

Access Control - Digital Signatures - Design Principles- Case Study: DCE Directory Service

Total: 45+15 Hours

Textbook (s)

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2009
2. Andrew S Tannebaum, "Distributed Operating Systems", Pearson Education, 2007

Reference (s)

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012
2. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007
3. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
4. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. List any four advantages of Distributed operating systems
2. Define distributed operating systems.
3. List any five reasons why to build distributed operating System.
4. What are the features of good distributed file systems?
5. List the features of a Good Naming System

Understand

1. Explain the design issues of distributed operating systems.
2. Explain the role of Naming in distributed operating systems
3. Summarize the internal and external synchronization of Physical clocks
4. Differentiate Resource Management and Process Management
5. Explain in detail about security and authentication.

Apply

1. Construct the different protocols of RPC.
2. Identify the File shearing Semantics and file caching Schemes.
3. Develop the Bully and Ring Algorithm
4. Develop the scenario how might the clocks in two computers that are linked by a local network be synchronized without reference to an external time source
5. Utilize the various deadlock prevention techniques with suitable example?

Analyze

1. Analyze the Concept of exception handling in RPC.
2. Examine the Concept of Thread.
3. Compare Fault tolerance and Thrashing.
4. Classify the deadlock avoidance techniques.
5. Simplify an algorithm using multicast and logical clocks for mutual exclusion.

Open Book Exam Questions

Question 1:

A distributed system has DSM facility. The process-scheduling mechanism of this system selects another process to run when a fault occurs for the currently running process, and the CPU is utilized while the block is being fetched. Two system engineers arguing about how to better utilize the CPUs of this system have the following opinions:

(a) The first one says that if a large number of processes are scheduled for execution at a node, the available memory space of the node can be distributed among these processes so that almost always there will be a ready process to run when a page fault occurs. Thus, CPU utilization can be kept high.

(b) The second one says that if only a few processes are scheduled for execution at a node, the available memory space of the node can be allocated to each of the few processes, and each process will produce fewer page faults. Thus, CPU utilization can be kept high. Whose argument is correct? Give reasons for your answer.

Question 2:

The password mechanism is used in a distributed system to authenticate users at login time. State the most suitable locations (according to you) for storing the login program and the password file in the following cases:

(a) The distributed system is based on the workstation-server model with each workstation having a small hard disk of about 20 megabytes capacity.

(b) The distributed system is based on the workstation-server model. Some of the workstations are diskless and others have a small hard disk of about 20 megabytes capacity.

(c) The distributed system is based on the processor-pool model.

23CS007 Cloud Computing Essentials**3 0 2 4****Course Outcomes**

1. Interpret the architecture and infrastructure models of cloud computing, strengths, and limitations of cloud computing.
2. Explain the virtualization concepts of machines and data centers.
3. Infer the design concepts of cloud ready applications
4. Compare different cloud centre's implementation
5. Discuss the concepts of cloud scaling and disaster recovery
6. Analyze the performance, scalability, and availability of the underlying cloud technologies and software

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	3	-	-	3	2	3	1	-	-	-	-	-
CO2	2	-	3	-	-	1	1	2	3	-	-	-	-	-
CO3	3	-	2	-	-	2	3	1	2	-	-	-	-	-
CO4	4	-	2	-	-	1	3	3	1	-	-	-	-	-
CO5	5	-	2	-	-	1	3	1	2	-	-	-	-	-
CO6	6	-	2	-	-	3	3	3	3	-	-	-	-	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+6 Hours**

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

Communication between Distributed Objects- Object Model, Distributed Object Model.

Practical Components:

1. Study of Cloud Computing & Architecture.
2. Install KVM/VMware Workstation for creating a virtual environment on windows platform. Concept: Virtualization
3. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.

Unit II**12+8 Hours****Introduction to Cloud Computing**

Overview of Computing Paradigm: Recent Trends in Computing, Evolution of Cloud Computing. Introduction to Cloud Computing: Cloud Computing (NIST Model), Properties, Characteristics & Disadvantages, Role of Open Standards. Cloud Computing Architecture: Cloud Computing Stack, Service Models (XaaS), Deployment Models. Infrastructure as a Service (IaaS): Introduction to IaaS, Resource Virtualization. Platform as a Service (PaaS): Introduction to PaaS, Cloud Platform and Management. Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS.

Companies in the Cloud Today, Amazon Web Services, Google services, IBM Cloud, Windows Azure, Tata Cloud, Salesforce.com

Practical Components:

1. Install Google App Engine. Create hello world app and other simple web applications using python/java.
2. Use GAE launcher to launch the web applications.
3. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
4. Signup an AWS Free Tier Account and Explore Management Console and configure AWS CLI

Unit III**12+10 Hours****Virtualization & Design**

Virtualization, Virtual machine, Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource

Management, Data centre, Virtualization for Data-Centre Automation. Service Levels for Cloud Applications Ready for the cloud: Web Application Design, Machine Image Design, Privacy Design, Database Management.

various hypervisors like VMware, KVM, oracle VM, HTTPS, Electronic Payment

Practical Components:

1. Working on to transfer the files from one virtual machine to another virtual machine.
2. Working on to launch virtual machine using trystack (Online Openstack Demo Version)
3. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves). Hadoop file management: Adding files and directories, Retrieving files, Deleting files
4. Run Wordcount application using Hadoop single node cluster.
5. Move files between regular Linux file-system and HDFS using put and get commands

Unit IV

Cloud Service Providers

12 + 8 Hours

EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue, service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud.

Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft, Aneka Platform

Practical Components:

1. Working and installation of Microsoft Azure
2. Working with Mangrasoft Aneka Software
3. Installation and Configuration of Justcloud
4. Working with AWS services in AWS CloudShell

Total: 48+32 Hours

Textbook (s)

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication
2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
4. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Reference (s)

1. Michael Miller, Cloud Computing-Web Based Applications that change the way you work and collaborate online, 1st Edition, Pearson Education, Publishing, 2011
2. Kai Hwang, Geoffrey C Fox and Jack J. Dongarra, Distributed & Cloud Computing from Parallel Processing to the Internet of Things, 1st Edition, MK Publishing, 2010
3. David S. Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, 1st Edition, Addison-Wesley, 2009
4. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, 2011.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	30	30
Understand	40	40
Apply	30	30

Analyze	--	--
Evaluate	--	--
Create	--	--
Total (%)	100	100

SAMPLE QUESTION (S)

Remember

1. Define Cloud Computing.
2. List types of virtualizations.
3. Define proactivescaling.
4. What is CIATriad?

Understand

1. Explain different cloud Infrastructure models.
2. Explain different levels of virtualization.
3. Explain about cloud Network security in detail.
4. Explain about Recovery Point Objective.
5. With neat diagram explain the functioning of Xen Architecture.
6. List and explain various cloud service providers risks.

Analyze

1. Compare cloud center and service infrastructure.
2. Analyze different cloud services provided by Amazon

23CS008 Internet of Things**3 0 2 4****Course Outcomes:**

1. Illustrate IoT framework, architecture and design principles of M2M Communication
2. Outline the design principles of Web and Internet Connectivity and its protocols
3. Summarize MAC and IP addressing in IoT, 6LowPAN and LoRaWAN protocols
4. Identify the suitable sensor technology for data collection and how to store and use it for Computing
5. Develop business models in IoT by identifying vulnerabilities and attacks involving in IoT
6. Inspect an application using IoT technology

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	-	2	3	-	-	3	-	-	-	-	-	1	-
CO2	2	-	2	2	-	-	2	-	-	-	-	-	2	-
CO3	2	-	1	1	-	-	2	-	-	-	-	-	2	-
CO4	2	-	3	2	-	-	2	-	-	-	-	-	3	-
CO5	2	-	2	2	-	-	3	-	-	-	-	-	2	-
CO6	2	-	3	3	-	-	3	-	-	-	-	-	3	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT I**12+8Hours**

Overview of IoT: Overview of Wireless Sensor Networks, Overview of Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication.

Design Principles: IoT/M2M Systems Layers and Design Standardization, Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway

Examples of IoT, Ease of Designing and Affordability

Practical Components:

1. Study of IoT development boards
2. Study of the fundamentals of Arduino and Raspberry Pi
3. Basic experiments using Arduino like LED

UNIT II**12 +8Hours**

Design Principles for Web Connectivity: Introduction, Web Communication Protocols: Constrained Applications Protocol (CoAP), Lightweight Machine-to-Machine Communication; Message Communication Protocols: Message Queue Telemetry Transport (MQTT);

Internet Connectivity Principles: Introduction, Internet Connectivity, Internet-Based Communication, IP Addressing in the IoT, Media Access Control, Introduction to 6LowPAN and LoRaWAN

Application Layer Protocols: HTTP, HTTPS, FTP and Telnet

Practical Components:

1. Implement LED Fading using Arduino
2. Study of Ubimote, BLE Mote and WiFi mote and the installation of required compiler in Linux
3. Embedded Programming a. Toggling LEDs b. Transmitting a string through UART c. Controlling LEDs blinking pattern through UART

UNIT III**12 +8Hours**

Sensor Technology: Sensing the Real World using Analog and Digital Sensors, Industrial IoT, Automotive IoT, Actuator, RFID Technology – Principles, Architecture, Applications & Components, Web of Things of RFIDs. **Data Collection, Storage and Computing:** Introduction, Cloud computing Paradigm for Data Collection, Storage and Computing, Everything as a Service and Cloud Service Models for IoT

Sensor Data Communication Protocol: Serial Bus – USB, CAN

Practical Components:

1. Study of Sensors that are attached with development boards
2. Implement a program in Arduino to raise Buzzer sound based on distance of the object identified by Ultrasonic Sensor
3. Embedded Programming a. Echo each character typed on serial terminal. b. Digital IO configuration. c. Timer based LED Toggle

UNIT IV

12+8 Hours

Business Models and Processes using IoT: Introduction, Business Models, Business Scenarios in IoT.

IoT Privacy, Security and Vulnerabilities Solutions: Security and Privacy Requirements, Threat Analysis, IoT Layered Attacker Model, Access Control and Secure Message Communication, Security Models

Case Studies: Smart Home, Smart City, Precision Agriculture

IoT Hardware: Raspberry pi, Arduino

Practical Components:

1. Point to point communication of two Ubimotes over the radio frequency
2. Reading Temperature, Light Intensity and Relative Humidity value from the sensor using BLE Mote
3. Reading Temperature, Light Intensity and Relative Humidity value from the sensors using Wi-Fi Mote

Total: 48+32 Hours

Textbook:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles". TMH Publications, 2017.
2. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014

Reference:

1. Ovidiu Vermesan & Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers Series in Communications, 2017.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	25	25	-
Understand	30	30	40
Apply	20	20	30
Analyze	25	20	30
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Write the major significance of Internet of Things.
2. State the crucial requirement of IoT in terms of application and its supporting natures.
3. List the dominant technologies behind IoT development.
4. Identify two major differences between Internet of Everything and Industrial IoT.
5. Write about the data-center based cloud tools that use to run the machine learning algorithm internally.
6. Recognizes an alternative approach that results in better adaptivity in case of network fluctuations and increased latency.
7. Identify the on-demand processing and storage capabilities that is used to analyze the data generated by IoT objects in batch or stream format.

Understand

1. Identify the evolutionary terms of Internet of Things (IoT) that use to interact and live with the physical objects.
2. Illustrate the reference architecture of IoT that unifies the smart objects and human beings to provide the ubiquitous communication
3. Illustrate the service-oriented architecture of IoT that ensures the interoperability among the heterogeneous devices
4. Illustrate the API-Oriented Architecture of IoT that use SOAP and Remote Method Invocation (RMI) as a means for describing, discovering, and calling services
5. Discuss the resource capacity, selecting and provisioning the resources that greatly impact Quality of Service (QoS) of the IoT applications
6. Classify the taxonomy of resource management activities of IoT.
7. Report the standard requirement of real time analytics to fulfill the demand of real-time stream processing engine.

Apply

1. Interpret a study analysis on open-source prototyping platform for the industrial IoT.
2. Implement a suitable OPENIoT Architecture for IoT/Cloud Convergence that provides an abstract presentation of the functional elements of architecture.
3. Sketch W3C SSN-XG ontology and how to semantically enable real time sensor feeds.
4. Execute the two-tier data dissemination model for large-scale wireless sensor network.
5. Demonstrate SPARQL query caching in order to improve the performance of semantic web applications.
6. Illustrations a technique to cluster semantically similar QA pairs for retrieving an answer for a newly given query without asking the QA engine on the cloud side.

Analyze

1. Comparative analysis on real-time analytics in Cloud-IoT and fog computing.
2. Compare the communication efficiencies for the following protocols such as AMPQ, CoAP, DDS, MQTT, UPnP and XMPP in terms of Transport Layer Protocols.
3. Differentiate the major significances of nesC, keil C and Dynamic C.
4. Relate a set of minimal features to be fulfilled by the programming frameworks for IoT.
5. Comparative analysis on IoT programming approaches

Evaluate

1. Select an example that utilizes the device-collaboration framework for the proactive suggestion application
2. Appraise a semantic QA cache that implement the device/cloud collaboration framework to compute the probability of the on-device semantic QA cache to answer a given query correctly. Select a suitable example that use automatically tagging recognized images to display the additional information such as social sentiment in order to achieve similar performance improvement for speech-recognition application with DL through device/cloud collaboration framework
3. Critique on fog-computing assisted distributed analytics system that uses a set of fall-detection algorithms, including algorithms based on acceleration measurements and time-series analysis methods, as well as filtering techniques to facilitate the fall-detection process.
4. Defend the augmented reality applications in terms of Game based on Fog Computing and Linked Data

7th Semester

23IT010 Social Network Analysis (Elective V)

3 0 0 3

Course Outcomes

1. Acquire Knowledge to analyze Social Networks
2. Model, Aggregate and Represent Knowledge for Semantic Web
3. Use Extraction and Mining tools for Social Networks
4. Apply Reality Mining to Predict Human Behaviors for Social Communities
5. Apply various Algorithms for Evolution and Opinion Mining in Social Networks
6. Write algorithms and systems for expert location in social networks

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	2	-	-	-	-	3	-	-	-	-	2	-	2
CO2	2	2	-	-	-	-	3	-	-	-	-	2	-	3
CO3	2	1	-	-	-	-	3	-	-	-	-	2	-	3
CO4	2	1	-	-	-	-	2	-	-	-	-	2	-	3
CO5	2	2	-	-	-	-	3	-	-	-	-	2	-	3
CO6	2	2	-	-	-	-	2	-	-	-	-	2	-	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus

Unit I

11 Hours

Introduction

Introduction to Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Statistical Properties of Social Networks, Network analysis, Development of Social Network Analysis-Key concepts and measures in network analysis, Discussion networks-Blogs and online communities-Web-based networks

Case Studies of Social Network sites like Facebook-Twitter-Linkedin etc.

Unit II

13 Hours

Evolution

Evolution in Social Networks- Framework, Tracing Smoothly Evolving Communities, Models and Algorithms for Social Influence Analysis, Influence Related Statistics, Social Similarity and Influence, Influence Maximization in Viral Marketing, Link Prediction in Social Networks, Feature based Link Prediction

Neurons & Social Actor-Advanced techniques in Link Prediction

Unit III

12 Hours

Mining Communities and Opinion Mining

Applications of Community Mining Algorithms, Node Classification in Social Networks

Opinion Extraction-Sentiment Classification and Clustering, Temporal Sentiment Analysis-Irony Detection in Opinion Mining-Wish Analysis-Product Review Mining-Review Classification

Tracking Sentiments towards Topics over Time

Unit IV

12 Hours

Modelling and Visualization

Visualizing Online Social Networks, A Taxonomy of Visualizations, Graph Representation-Centrality-Clustering-Node-Edge Diagrams-Visualizing Social Networks with Matrix-Based Representations-Node-Link Diagrams, Hybrid Representations, Modelling and Aggregating Social Network Data, Random Walks and their Applications, Ontological representation of Social Individuals and Relationships.

Use of Hadoop and MapReduce-Gephi

Total: 48 Hours

Textbook (s)

1. Charu C. Aggarwal, Social Network Data Analytics, Springer, 2011

2. Peter Mika, Social Networks and the Semantic Web, Springer, 1st Edition, 2007.

Reference (s)

1. Borko Furht, Handbook of Social Network Technologies and Applications, Springer, 1st Edition, 2010.
2. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking, Techniques and applications, Springer, 1st Edition, 2011.
3. Giles, Mark Smith, John Yen, Advances in Social Network Mining and Analysis, Springer, 2010.
4. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, Computational Social Network Analysis: Trends, Tools and Research Advances, Springer, 2009.

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Comprehensive Test1 (%)
Remember	35	20	-
Understand	35	30	-
Apply	20	40	70
Analyze	10	10	20
Evaluate	--	-	10
Create	--	-	-
Total (%)	100	100	100

Sample Question (S)

Remember

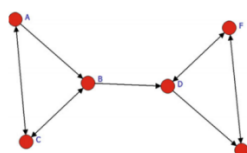
1. What are the limitations of current web?
2. List the statistical properties of social networks
3. Define social similarity.
4. What are the two different measures in influence related statistics

Understand

1. Explain about development of semantic web in research.
2. Demonstrate web based networks.
3. Illustrate the ways of visualizing social networks with matrix based representation and node – link diagram.
4. Explain core methods of community detection and mining.
5. Explain algorithms and systems for expert location in social networks.
6. Outline the models and algorithms for social influence analysis.

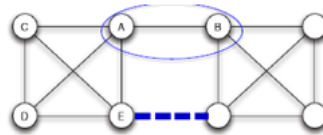
Apply

1. Make use of the following graph to solve Degree Centrality, Between-ness Centrality and Cliques.



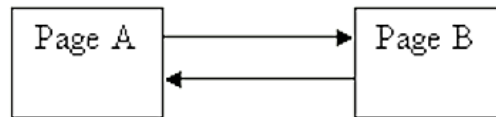
2. Solve Path, Length and Distance between nodes (i.e., Density measures) using SNA Data Processing Tools.
3. Make use of the above graph to solve network density and cut points.
4. Develop random graphs using Erdos Reini Model
5. Solve Weak Ties, Traidic closure for the following graph.

¹Comprehensive test should contain only questions related to Higher Order Thinking (HOT) Skills Pertaining to this course

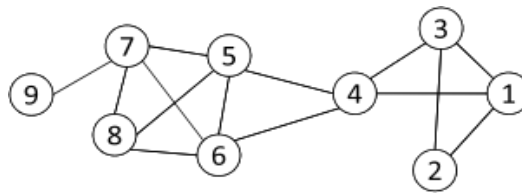


Analyse

1. Compute PageRank for the following figure.



2. Discover Spectral Clustering steps for the following graph.



3. Examine the ways to visualize community's hubs and node centrality measures using sna package.
4. Analyze positive, moderate and negative feeds using sentiment analysis on twitter data.

Open Book Exam Questions

1. Visualization of team data in Gephi-What should be my considerations?
2. How do we calculate data processing time using cloud analyst?

Course Outcomes

1. Explain the need of optimization of engineering systems.
2. Formulate and solve linear programming problems.
3. Solve the problems on network models such as transportation and assignment.
4. Analyze the complexity of solutions to an optimization problem.
5. Apply unconstrained optimization and constrained non-linear programming
6. Illustrate about dynamic programming and modern optimization techniques.

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	-	-	-	-	-	-	2	-	-
CO2	3	2	1	-	1	-	-	-	-	-	-	2	-	-
CO3	3	3	2	-	2	-	-	-	-	-	-	2	-	-
CO4	3	2	1	-	1	-	-	-	-	-	-	2	-	-
CO5	3	1	3	-	3	-	-	-	-	-	-	2	-	-
CO6	3	3	2	-	2	-	-	-	-	-	-	2	-	-

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I**12 Hours****Introduction to Optimization & Classical Optimization Techniques:**

Engineering Applications of Optimization, Statement of Optimization Problem.

Classical Optimization Techniques: Single variable optimization, multivariable optimization with no constraints, multivariable optimization with equality constraints, multivariable optimization with inequality constraints, convex programming problem.

Optimization techniques, Engineering Optimization Literature.

Unit II**12 Hours****Linear Programming & Transportation Problems:**

Applications of 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 – simplex algorithm.

Introduction to Transportation problems, various methods of Transportation problem, Variations in Transportation problem,

Two phases of simplex method

Unit III**12 Hours****Assignment Problems & Unconstrained Nonlinear Programming:**

Introduction to Assignment problems, variations in Assignment problems. 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.

Introduction, Random Search Methods, Grid Search method, Univariate method, Powell's Method, Simplex Method, Gradient of a Function, Steepest descent method. Newton's Method.

Marquardt Method, Quasi-Newton Methods

Unit IV**12 Hours****Dynamic Programming & Modern methods of Optimization:**

Multistage decision process, Concept of suboptimization and principle of optimality, computational procedure in dynamic programming, Examples of calculus and tabular method of solutions.

Modern methods of optimization: Genetic Algorithms, particle swarm optimization and Ant colony optimization.

Simulated Annealing, neural network-based optimization

Total: 48 Hours

Textbook (s)

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice, Wiley, 4th edition, 2009.

Reference (s)

1. Deb K. - Optimization for Engineering Design Algorithms and Examples, PHI - 2000
2. George Bernard Dantzig, MukundNarainThapa, Linear programming, Springer series in operations research 3rd edition, 2003.
3. H.A. Taha, Operations Research: An Introduction, 8th Edition, Pearson/Prentice Hall, 2007.
4. Kalyanmoy Deb, Optimization for Engineering Design-Algorithms and Examples, PHI Learning Pvt. Ltd., New Delhi, 2005.
5. Arora J, Introduction to Optimization Design, Elsevier Academic Press, New Delhi, 2004
6. Saravanan R, Manufacturing Optimization through Intelligent Techniques, Taylor & Francis (CRC Press), 2006
7. Hardley G., Linear Programming, Narosa Book Distributors Private Ltd., 2002

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	30	30	--
Understand	30	30	30
Apply	40	40	50
Analyze	--	--	20
Evaluate	--	--	---
Create	--	--	--
Total (%)	100	100	100

Understand

1. Explain about soft computing?
2. Classify supervised learning and unsupervised learning?
3. Summarise the difference between conventional control system and Fuzzy control

Apply

1. Demonstrate the application of Fuzzy logic in Industrial manufacturing?
2. Show the differences between Traditional Algorithms and Genetic Algorithm
3. A genetic algorithm is to be used to evolve a binary string of length n containing only 1s. The initial population is a randomly generated set of binary strings of length n. Give a suitable fitness function for this problem.

Analyze

1. If the population size in a genetic algorithm is restricted to 1, what search algorithm does it correspond to? Justify your answer.
2. Consider two fuzzy sets X and Y with the following membership functions: $X = \{(x_1/0.4, (x_2/0.7), (x_3/0.8), (x_4/1)\}$ $Y = \{(x_1/0.3), (x_2/0.6), (x_3/0.5), (x_4/0.9)\}$ Resolve: $X \cup Y, X \cap Y, X - Y, X + Y, X * Y$

Open Book Examination Question

Evaluate

1. Suppose a genetic algorithm uses chromosomes of the form $x = abcdefgh$ with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as: $f(x) = (a + b) - (c + d) + (e + f) - (g + h)$ and let the initial population consist of four individuals with the following chromosomes: $x_1 = 6\ 5\ 4\ 1\ 3\ 5\ 3\ 2$ $x_2 = 8\ 7\ 1\ 2\ 6\ 6\ 0\ 1$ $x_3 = 2\ 3\ 9\ 2\ 1\ 2\ 8\ 5$ $x_4 = 4\ 1\ 8\ 5\ 2\ 0\ 9\ 4$. Evaluate the fitness of each individual, showing all your workings, and arrange the min order with the fittest first and the least fit last.

2. Suggest a suitable evolutionary computing technique for finding optimized Economic Load Dispatch. Support your answer by providing detailed analysis

3. Consider four travel packages offered by Thomas Cook, Club Mahindra, World around, and Himalaya Travels. We want to choose one. Their costs are INR 100,000, INR 200,000, INR150,000 and INR 175,000. Their travel time in hours are 150, 200, 100, and 125 respectively. They are viewed as interesting with degrees 0.4, 0.3, 0.6, 0.5. Define your own fuzzy set of acceptable travel times. Then determine the fuzzy set of interesting travel packages whose cost and travel times are acceptable and use this set to choose one of your own packages

23CS012 Wireless Adhoc Network (Elective-V)

3 0 0 3

Course Outcomes

1. Explain the various challenging issues of wireless Adhoc networks.
2. Apply the MAC protocols using reservation and scheduling mechanisms.
3. Apply the routing protocols and transport layer protocol using various TCS mechanisms in wireless Adhoc networks.
4. Explain the issues of MAC and network layer solution to provide quality of service.
5. Explain the significances of various battery management schemes for wireless Adhoc networks.
6. Analyze the security requirements and secure routing in wireless Adhoc networks.

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	2	1	-	-	2	-	-	-	-
CO2	3	3	2	-	-	1	2	-	-	1	-	-	-	-
CO3	3	3	3	-	-	2	3	-	-	1	-	-	-	-
CO4	3	3	2	-	-	2	1	-	-	2	-	-	-	-
CO5	3	3	2	-	-	1	1	-	-	2	-	-	-	-
CO6	3	2	3	-	-	3	3	-	-	2	-	-	-	-

3–Stronglylinked|2–Moderatelylinked|1–Weaklylinked

UNIT I

12 Hours

Wireless AdHoc Networks: Introduction, Properties, applications, limitations, Issues in AdHoc Wireless Networks, Ad Hoc Wireless Internet. **MAC Protocols:** Introduction, Issues in Designing a MAC protocol for AdHoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MACProtocols, Contention-Based Protocols, Contention-Based Protocols with reservation Mechanisms.

Contention–Based MAC Protocols with Scheduling Mechanisms

UNIT II

12 Hours

RoutingProtocols:Introduction,IssuesinDesigningaRoutingProtocolforAdHocWirelessNetworks,Classifi cation of Routing Protocols, Proactive/ Table–Driven Routing Protocols, Reactive/ On–Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power – Aware Routing Protocols. **TransportLayer:** Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCPOverAdHoc Wireless Networks.

OtherTransportLayerProtocolforAd HocWirelessNetworks.

UNIT III

12 Hours

QualityofService:Introduction,IssuesandChallengesinProvidingQoSInAdHocWirelessNetworks,Classific ation of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad HocWirelessNetworks.**EnergyManagement:**Introduction,NeedforEnergyManagementinAdHocWireless Networks,ClassificationofAdHocWirelessNetworks,BatteryManagementSchemes,TransmissionPowerMa nagementSchemes.

System Power Management Schemes.

UNIT IV

12 Hours

Security Protocols: Network Security Requirements, Issues and Challenges in Security

Provisioning,Network Security Attacks, Key Management, Secure Routingin AdHoc Wireless Networks.

WirelessSensorNetworks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, Location Discovery.

Quality of a Sensor Network, Evolving Standards, Other Issues

Total: 48 Hours

Textbook(s)

1. AdHoc Wireless Networks: Architectures and Protocols-C.Siva Ram Murthy and B.S.Manoj,2004,PHI.
2. WirelessAd-hocandSensorNetworks:Protocols,PerformanceandControl-JagannathanSarangapani,CRCPress

Reference(s)

1. WirelessSensorNetworks-C.S.Raghavendra,KrishnaM.Sivalingam,2004,Springer.
2. Ad-HocMobileWirelessNetworks:Protocols&Systems,C.K.Toh,Firsted.PearsonEducation

SAMPLEQUESTION(S)

Internal Assessment Pattern

Cognitive Level	Int.Test1 (%)	Int.Test2 (%)	OBE(%)
Remember	40	50	20
Understand	35	30	20
Apply	25	20	60
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total(%)	100	100	100

Remember

1. Find out the major significance of cellular wireless networks and Adhoc wireless networks.
2. List few latest application systems of Adhoc wireless networks.
3. Identify the challenging issues in Adhoc network configuration and maintenance.
4. Show the proactive steps to solve the hidden terminal problem.
5. List the transmission impediments of wireless channel.
6. List the issues that affect the design, deployment, and performance of adhoc wireless system.
7. List the benefits when deployment of a commercial adhoc wireless network compared to wired network.
8. Write the advantages of hybrid wireless networks.
9. Define Scalability.
10. Write the design goals of MAC protocol for ad-hoc networks.
11. Describe the issues of MAC protocol for adhoc networks in brief.
12. Show the classifications of MAC protocol.
13. Identify the effects of exposed terminal problem in wireless networks.
14. Relate the advantages of directional antennas of MMAC over MACAW.
15. Name the mechanisms used in MAC layer.

Understand

1. Summarize the issues that affect the deployment and performance of adhoc wireless system.
2. Outline the benefits when deployment of a commercial adhoc wireless networks compared to wired network.
3. Compare Ad-hoc Networks and Wireless LAN.
4. Compare the efficiency of the packet queuing mechanism adopted in MACA and MACAW.
5. Relate contention-based protocols with reservation mechanisms and contention-based protocols with scheduling mechanisms by means of packet delivery, reception, and acknowledgment ratio.
6. Describe the design strategies of MACAW protocol.
7. Illustrate various steps involved in five-phase reservation protocol with its frame format.
8. Compare the differences of Adhoc on-demand Distance vector routing protocol (AODV) and dynamic sequence routing protocol (DSRP).
9. Identify any four reasons that lead to the quick power drain of nodes in mobile adhoc network.
10. Explain the sensor network architecture with a suitable illustration.

Apply

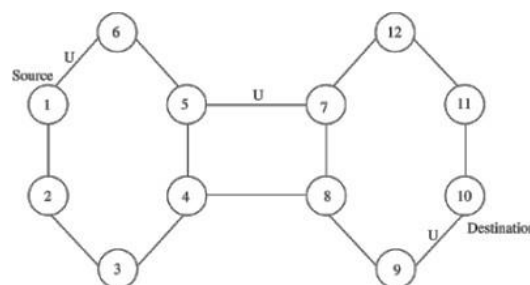
1. Calculate the maximum achievable data rate over a 9 KHz channel whose signal-to-noise ratio is 20 dB.
2. Think of four scenarios where wireless networks can replace wired networks in order to improve the efficiency of people at their workplace. Briefly describe how in each case a wireless network will fit the role better than a wired network.
3. Determine the transfer time of a 22 KB file with a mobile data network: (a) with a transmission rate of 10 Kbps and (b) repeat the same for 802.11 WLAN operating at 2 Mbps. (c) What is the length of the file that WLAN can carry in the time that mobile data service carried a 20 KB file? (d) What do you infer from the answers to the above questions?
4. Assume that in one slot in Bluetooth, 256 bits of payload could be transmitted. How many slots are needed if the payload size is (a) 512 bits, (b) 728 bits, and (c) 1,024 bits. Assume that the non-payload portions do not change.
5. With reference to the discussion on scatternets, illustrate the trade-off of synchronization and bandwidth using a timing diagram. (Hint: Consider the case when a Bluetooth device acts as a master in one piconet and as a slave in another.)

Analyze

1. Discuss the deployment scenarios for various HIPERLAN standards in the ETSI BRAN system.
2. Compare the EY-NPMA and the CSMA/CA mechanisms.
3. In serial communications, the baud rate of transmission is specified. Legacy applications on Bluetooth devices specify the baud rate. In the case of old serial communications, the data rate is the specified baud rate, but in the case of Bluetooth serial communications, it is not so. Why?
4. Identify and elaborate some of the important issues in pricing for multi-hop wireless communication.
5. Channel quality estimation can be done both at the sender and the receiver. Which is more advantageous? Why?
6. Compare an adhoc network and a cellular network with respect to bandwidth usage and cost-effectiveness.
7. Compare the pros and cons of using scheduling-based MAC protocols over reservation-based MAC protocols.

Evaluate

1. Consider the topology given in below to simulate DSR, SSA, and ABR protocols for path establishment from node 1 to node 10, find the paths found and the ratio of the number of *Route Request* packets sent in the network. (Links labeled "U" refer to unstable ones.)



2. Justify whether the LCC algorithm (when run consistently with node degrees or node IDs) gives a deterministic result? If so, prove the above fact. Otherwise, give a counter-example.
3. Critique on how content-based multicasting (CBM) could be advantageous or disadvantageous as far as the bandwidth utilization of the network is concerned.
4. Discuss how network security requirements vary in the following application scenarios of ad hoc wireless networks:
 - A. Home Network
 - B. Classroom Network

C. Military Network

D. Emergency Search and Rescue Network

5. Discuss how security provisioning in ad hoc wireless networks differs from that in infrastructure-based networks.?

Course Outcomes

1. Explain green IT with its different dimensions and strategies.
2. Analyze green devices and hardware along with its green software methodologies.
3. Examine the green IT standards for enhancing environmental sustainability.
4. Analyze the various green enterprise activities, functions and their role with IT.
5. Identify the various laws, standards and protocols for regulating green IT.
6. Identify the various key sustainability and green IT trends.

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	2	-	-	3	3	-	-	-	-	-	-	-
CO2	3	3	3	-	-	3	3	-	-	-	-	-	-	-
CO3	3	3	3	-	-	3	3	-	-	-	-	-	-	-
CO4	3	3	3	-	-	3	3	-	-	-	-	-	-	-
CO5	3	2	2	-	-	3	3	-	-	-	-	-	-	-
CO6	3	2	2	-	-	3	2	-	-	-	-	-	-	-

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12 Hours****Fundamentals**

Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Greening IT, Applying IT for enhancing Environmental Sustainability, Green IT Standards and Eco-Labeling of IT.

Enterprise Green IT strategy, Green IT: Burden or Opportunity?

Unit II**12 Hours****Green Devices and Hardware with Green Software**

Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques, Evaluating and measuring software Impact to platform power.

Research the sustainability of paper use in an organization.

Unit III**12 Hours****Green Enterprises and the Role of IT**

Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues, Enablers and making the case for IT and Green Enterprise.

Analyze an organization's IT sustainability.

Unit IV**12 Hours****Managing and Regulating Green IT**

Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social media.

Laws, Standards and Protocols :Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies.

Green building standards, Green data centers, Social movements and Greenpeace.

Total: 48 Hours**Textbook (s)**

1. Harnessing Green IT Principles and Practices, San Murugesan, G.R. Gangadharan, Wiley Publication, ISBN:9788126539680,2012.

Reference (s)

1. Foundation of Green IT, Marty Poniatowski, Prentice Hall Publication, ISBN:9780137043750,2009.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	30	--
Apply	30	30	50
Analyze			50
Evaluate			--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. Define Green IT
2. Define Green Software

Understand

1. Explain the Life Cycle of a Green device or hardware.
2. Illustrate the concept of process re-engineering in a simple way from a green perspective.

Apply

1. Identify the several key standards for process and product of Green IT.
2. Apply ERP system with modules and relationships in any recent trend.

Analyze

1. Analyze and give recommendations on how green strategies can be implemented in Homes to make a greener world. Explain about the same in your perspective.
2. Classify the major categories of information systems within an organization? Provide examples of greening enterprise activities at each level.

Evaluate

1. Recommend with a case study to depict the ways in which a green enterprise transformation (GET) can be applied for a service organization. For the selected service organization, briefly explain the following:
 - i) the practical aspects of a preliminary green IT audit.
 - ii) the green business objectives.
 - iii) a high-level SWOT analysis from a GET perspective.
2. Choose the UML diagrams to present the following models of green information systems:
 - i) use case diagram for "emissions benchmark maintenance".
 - ii) state machine diagram for "class-emission report".

Open Book Exam Questions

1. What is the meaning of Green Computing, gather statistics, or develop a list of ways to practice green computing; now expand the discussion to determine if Green Computing is possible, if it can make a difference, or if it is a marketing term used by large organizations in today's environmentally friendly society.
2. "Green computing or green IT is the study and practice of environmentally sustainable computing or IT"
 - i. In your own words, explain the term Green IT.
 - ii. Summarise the challenges in making Green IT a reality. Consider environmental factors such as political, economic, social, technological, legal and ecological in your answer.
 - iii. Cite 2 examples of success stories on Green IT. Evaluate if the same effort is achievable in your origin country.

Course Outcomes

1. Explain the concepts and issues of Software Project Management
2. Illustrate various Software Architectures
3. Classify Software Risks and Risk Management Strategies
4. Design effective software development model to meet organizational needs
5. Experiment with appropriate methodologies to develop a project schedule
6. Experiment with appropriate techniques to assess ongoing project performance

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	2
CO2	3	2	2	-	-	-	-	-	-	-	2	2	-	3
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	3
CO4	3	2	3	-	-	-	-	-	-	-	2	2	-	3
CO5	3	2	3	-	-	-	-	-	-	-	3	2	-	3
CO6	3	2	3	-	-	-	-	-	-	-	3	2	-	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours**

Conventional Software Management: The Waterfall Model, Conventional Software Management Performance. **Transition:** The principles of conventional software Engineering, Principles of Modern software management, transitioning to an iterative process.

Evolution of Software Economics: Software Economics, Software Cost Estimation. **Improving Software Economics:** Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections.
Software Development Phases, Procedural vs Object Oriented Paradigm.

Unit II**12 Hours**

Life Cycle Phases: Engineering and Production Stages, Inception, Elaboration, Construction, Transition Phases.

Artifacts of Software Process: The Artifact Sets, Types of Artifacts.

Software Architectures: A Management Perspective and Technical Perspective,

Workflows of the process: Software Process Workflows, Iteration Workflows.

Off-the-Shelf Components, Requirement Specification Document, Methods of Specification.

Unit III**12 Hours**

Checkpoints of the Process: Major Milestones, Minor Milestones, Periodic Status Assessments.

Iterative Process Planning: Work breakdown Structures, Planning Guidelines, Cost and Schedule Estimating process, Iteration Planning Process.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, Evolution of Organizations.

Process Automation: Automation Building Blocks, The Project Environment.

CASE Tools for Requirements Specification, Planning and Estimation, Pragmatic Planning.

Unit IV**12 Hours**

Project control and Process Instrumentation: The Seven Core Metrics, Management Indicators, Quality Indicators, Life Cycle Expectations, Pragmatic Software Metrics, Metrics Automation, Tailoring the Process.

Future Software Project Management: Modern Project Profiles, Next Generation Software Economics, The COCOMO Cost Estimation Model: Basic COCOMO

Bugs of testing, Bug tracking tools

Total: 48 Hours

Textbook (s)

1. Walker Royce, "Software Project Management – A Unified Framework", 1st Edition, Pearson Education, 2005.
2. Pankaj Jalote, "Software Project Management in Practice", 1st Edition, Pearson Education, 2002.

Reference (s)

1. Bob Hughes, "Mike Cotterell, Rajib Mall, Software Project Management", 5th Edition, McGraw-Hill Higher Education, 2011.
2. Joel Henry, "Software Project Management", 1st Edition, Pearson Education, 2004.
3. Norman E. Fenton, Shari Lawrence Pfleeger, "Software Metrics: A Rigorous and Practical Approach", 1st Edition, PWS Publishing Company, 1997.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	30	--
Understand	40	40	--
Apply	20	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define Software Process
2. List the phases of Software Development.
3. What is an Artifact?
4. What is Process Automation?

Understand

1. Explain various formal methods of specification.
2. Explain COCOMO II Model.
3. Explain Critical Path Methods to schedule a software project.

Apply

1. Identify the amount of Information need to present in a page.
2. Organize the different Software tool specification methods.
3. Assume that the size of an organic type software product has been estimated to be 32,000 lines of source code. Assume that the average salary of software engineers be Rest. 15,000/- per month. Determine the effort required to develop the software product and the nominal development time.

Open Book Questions

1. Calculate the effort and development time for the model related to your mini-project which was developed in previous semester using COCOMO basic cost estimation model. (Take your mini-project size in KLOC)[Apply]
2. Analyze your mini-project with respect to changes using Type 0, Type 1, Type 2, Type 3 & Type 4 categories. [Apply]

Course Outcomes

1. Identify an appropriate soft computing technique to build an Intelligent Machine
2. Explain supervised learning methods for neural network models for pattern classification and regression problems
3. Demonstrate the use of various Associative Memory Networks
4. Describe unsupervised learning methods for neural network models for storing and pattern classification
5. Determine the solutions of modeled networks using soft computing approaches for a given problem
6. Explain fuzzy logic and Genetic Algorithm to handle uncertainty

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	2	-	2
CO2	2	3	2	2	-	-	-	-	-	-	-	2	-	2
CO3	2	2	3	3	-	-	-	-	-	-	-	2	-	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	-	2
CO6	3	2	3	3	-	-	-	-	-	-	-	2	-	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I**12 Hours**

Basic elements of Soft Computing: Difference between Hard Computing & Soft Computing - Introduction to Neural Networks - Fuzzy Logic - Genetic Algorithms - Hybrid Systems.

Artificial Neural Networks: Introduction to Artificial Neural Networks - Evolution of Neural Networks - Basic Models of Neural Networks - McCulloch-Pitts Neuron - Hebb Network.

Basics of Artificial Intelligence and Computational Intelligence.

Unit II**12 Hours**

Supervised Learning Network: Artificial Neural Networks: Introduction - Perceptron Networks - Back Propagation Network. Radial Basis Function Network.

Associative Memory Networks: Auto-associative Memory Network - Hetero auto-associative Memory Network - Bidirectional Associative Memory (BAM) - Hopfield Networks.

Functional Link Neural Network.

Unit III**12 Hours**

Unsupervised Learning Network: Introduction - Fixed Weight Competitive Nets -Kohonen Self-Organizing Feature Maps - Learning Vector Quantization - Counter Propagation Networks – Basic Concepts on Adaptive Resonance Theory Networks (ART-1 & ART-2).

Support Vector Machines and their applications for Classification.

Unit IV**12 Hours**

Introduction to Fuzzy Sets: Difference between Classical Sets & Fuzzy Sets – Properties.

Classical Relations and Fuzzy Relations: Cartesian product of Relations - Classical Relations - Fuzzy Relations

Membership Functions: Features of Membership Functions -Fuzzification - and Defuzzification

Genetic Algorithm: Basic Concepts on Genetic Operators.

Concepts on Fuzzy Controller and its applications - a Simple Application of Genetic Algorithm for function Optimization.

Total: 48 Hours**Textbook (s)**

1. S. N. Sivanandam, S N Deepa, Principles of Soft Computing, 2nd Edition, Wiley India, 2007
2. V. Kecman, Learning and Soft Computing, Pearson Education, India, 2006

Reference(s)

1. J-S R Jung, C-T Sun and E. Mizutani, Neuro Fuzzy and Soft Computing, Pearson Education, India, 2015
2. G. J. Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic, Prentice Hall, USA, 1995
3. D. E. Goldberg, Genetic Algorithms: Search, Optimization and Machine Learning, Addison Wesley, N.Y, 1989
4. S. Haykins, Neural networks: a comprehensive foundation Pearson Education, India, 2002
5. A. P. Engelbrecht, Computational Intelligence: An Introduction, John Wiley & Sons, 2007.
6. X. Yu and M. Gen, Introduction to Evolutionary Algorithms, Springer Verlag, 2010.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE# (%)
Remember	25	15	--
Understand	35	15	--
Apply	20	20	40
Analyze	20	30	40
Evaluate	--	20	20
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define Chromosome
2. List two methods in which the information flows in a nervous system
3. List five unsupervised learning algorithms
4. List the difference between classical logic and fuzzy logic
5. List the computational units of ART

Understand

1. Explain the components of Soft Computing
2. Explain the role of activation function in exhibiting the output from a neuron
3. Construct the 5 node pattern {0,1,1,0,1} by Hopfield network and explain the procedure for recalling and storing
4. Explain Adaptive Resonance Theory and its type
5. Explain CPN and illustrate the steps involved in training algorithm of full CPN

Apply

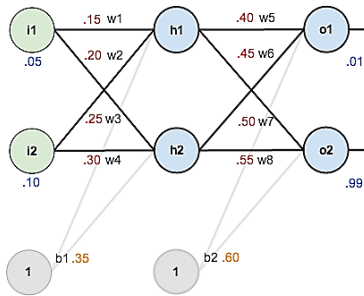
1. Construct a ANN circuit which makes the flow of data using multilayered and multilevel networks
2. Apply clusters of various datasets maintained by learning approach considering live example
3. Draw the neat architecture of hamming network and trace the inhibitory and excitatory neurons by considering an inconsistent vector
4. Find the Max-min and Max Product composition of the fuzzy relation matrices $R=\{0.6,0.3,0.2,0.9\}_{(2 \times 2)}$ $S=\{1,0.5,0.3,0.8,0.4,0.7\}_{(2 \times 3)}$
5. Find the cardinality for the matrices $R=\{1,4,6,7\}_{(2 \times 2)}$ $S=\{5,2,3,7\}_{(2 \times 2)}$

Analyze

1. Differentiate between learning and training algorithms considering multilayer perceptron network and trace the different types of networks obtained.
2. Differentiate between Counter Propagation Network and Adaptive Resonance Theory

Evaluate

1. Evaluate using Back Propagation algorithm for the below map considering weights , inputs and outputs



2. Evaluate the instance, that the 2 dimensional input vector X is presented to the three-neuron Kohonen network, $x = [0.52 \ 0.12]$. The initial weight vectors, W_j are given by

$$W_1 = [0.27, 0.81]$$

$$W_2 = [0.42, 0.70]$$

$$W_3 = [0.43, 0.21]$$

in a form of 2×1 matrix. Find the winning neuron using the Euclidean distance and apply kernel self-organization map. State the differences between register machines and stack machine?

23SIX02 Summer Internship II

0 0 0 1.5

Course Outcomes

1. Demonstrate communication skills to meet the requirement of industry
2. Develop logical thinking and analytical skills to thrive in competitive examinations
3. Use mathematical concepts to solve technical quizzes
4. Develop technical skills to work out real time problems
5. Develop algorithms for different applications
6. Solve industry defined problems using appropriate programming skills

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	2	1	2	1	2	3	1	3	3	3	1	3	3	1
C02	3	3	3	3	2	2	1	3	3	1	1	3	3	2
C03	3	2	3	2	2	1	1	3	2	3	1	2	3	1
C04	3	3	3	3	3	3	2	3	3	3	1	3	3	2
C05	3	3	3	3	3	3	3	3	3	3	2	3	3	2
C06	3	3	3	3	3	3	3	2	3	3	3	3	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Course Outcomes

1. Identify a contemporary engineering application to serve the society at large
2. Use engineering concepts and computational tools to get the desired solution
3. Justify the assembled/fabricated/developed products intended.
4. Organize documents and present the project report articulating the applications of the concepts and ideas coherently
5. Demonstrate ethical and professional attributes during the project implementation.
6. Execute the project in a collaborative environment.

CO-PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PO ₆	PO ₇	PO ₈	PO ₉	PO ₁₀	PO ₁₁	PO ₁₂	PSO ₁	PSO ₂
C01	3	3	2	3	2	3	3	2	3	3	3	3	3	3
C02	3	3	3	3	3	3	2	3	3	3	3	3	3	3
C03	3	3	3	3	2	3	2	3	2	3	3	2	3	3
C04	3	3	3	3	2	2	3	3	2	3	3	2	3	3
C05	3	3	3	3	3	3	3	3	3	3	3	3	3	3
C06	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

8th Semester

23CS017 Fundamentals of Social Networks Analysis (Elective VIII)

3 0 0 3

Course Outcomes

1. Explain the fundamental principles of social networking
2. Identify the architectures and challenges in building social networks
3. Interpret the capabilities and limitations of the existing network analysis methods
4. Model the knowledge to analyze real-world networks
5. Demonstrates the knowledge of basic mathematical models used in the analysis of social networks
6. Illustrate human behaviour in social web and related communities.

7. COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	-	1	2	-	-	-	-	3	-	-	-	-
CO2	3	3	-	1	1	-	-	-	-	2	-	-	-	-
CO3	3	1	-	3	3	-	-	-	-	2	-	-	-	-
CO4	3	3	-	1	1	-	-	-	-	2	-	-	-	-
CO5	3	1	-	3	3	-	-	-	-	2	-	-	-	-
CO6	3	1	-	2	2	-	-	-	-	2	-	-	-	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

11 Hours

Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient.

Frequent patterns. Network motifs. Cliques and k-cores.

Unit II

13 Hours

Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length.

Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS.

Unit III

12 Hours

Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering.

Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems

Unit IV

12 Hours

Predicting human behaviour and privacy issues: Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

Applications of SNA: covert networks, community welfare, collaborative networks, co-citation networks

Total: 48 Hours

Textbook (s)

1. David Easley and John Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press 2010.
2. Stanley Wasserman and Katherine Faust, Social Network Analysis. Methods and Applications, Cambridge University Press, 1994

Reference (s)

1. Matthew O. Jackson, Social and Economic Networks, Princeton University Press, 2010.
2. Eric Kolaczyk, Gabor Csardi, Statistical Analysis of Network Data with R, Springer, 2014.
3. Mark Newman, Networks: An Introduction, Oxford University Press, 2010.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE
Remember	50	40	-
Understand	30	40	-
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
Total (%)	100	100	100

Remember

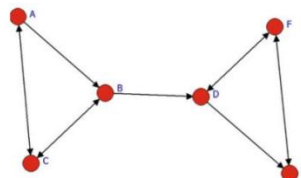
1. What are the limitations of current web?
2. List the statistical properties of social networks
3. Define social similarity.
4. What are the two different measures in influence related statistics

Understand

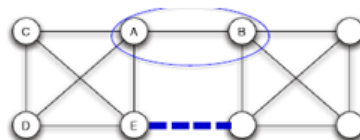
1. Explain about development of semantic web in research.
2. Demonstrate web based networks.
3. Illustrate the ways of visualizing social networks with matrix based representation and node – link diagram.
4. Explain core methods of community detection and mining.
5. Explain algorithms and systems for expert location in social networks.
6. Outline the models and algorithms for social influence analysis.

Apply

1. Make use of the following graph to solve Degree Centrality, Between-ness Centrality and Cliques.



2. Solve Path, Length and Distance between nodes (i.e., Density measures) using SNA Data Processing Tools.
3. Make use of the above graph to solve network density and cut points.
4. Develop random graphs using ErdosReini Model
5. Solve Weak Ties, Traidic closure for the following graph.

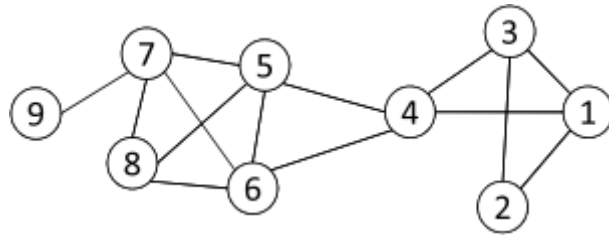


Analyze

1. Compute PageRank for the following figure.



2. Discover Spectral Clustering steps for the following graph.



4. Examine the ways to visualize community's hubs and node centrality measures using sna package.
4. Analyze positive, moderate and negative feeds using sentiment analysis on twitter data.

Course Outcomes

1. Explain the Objectives of Information Retrieval Systems and its relation to Digital Libraries and Data warehouse
2. Illustrate various System Search Browse and Miscellaneous Capabilities
3. Explain Automatic Indexing, Information Extraction methods
4. Demonstrate Inverted file structures, N-gram data structure, and PAT data structure
5. Interpret Classical techniques of Information Retrieval, and additional techniques employed by Web search engines
6. Develop a small information retrieval system by using user search techniques and text search Algorithms

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	2	2	-	-	-	-	-	3	-	-	-	3
CO2	3	2	2	2	-	-	-	-	-	2	-	-	-	3
CO3	2	3	1	1	-	-	-	-	-	2	-	-	-	3
CO4	2	3	1	1	-	-	-	-	-	2	-	-	-	3
CO5	2	3	1	1	-	-	-	-	-	2	-	-	-	3
CO6	3	3	2	2	-	-	-	-	-	2	-	-	-	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**11 Hours**

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.

Information Retrieval System Capabilities: Search, Browse, Miscellaneous.

Miscellaneous capabilities.

Unit II**13 Hours**

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction.

Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

Signature file structure, Hypertext data structure.

Unit III**12 Hours**

Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Conceptindexing, Hypertext linkages

Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

Measurement Example-TREC Results.

Unit IV**12 Hours**

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Searching the Internet and hypertext, Information Visualization

Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems.

Hardware text search systems

Total: 48 Hours**Textbook (s)**

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. <http://nlp.stanford.edu/IR-book/html/htmledition/evaluation-in-information-retrieval-1.html>

Reference (s)

1. Frakes, W.B. and RicardoBaeza Yates, Information Retrieval Data Structures and Algorithms, 1st Edition Prentice Hall, 1992.
2. Robert Korfhage, Information Storage & Retrieval, 1st Edition, John Wiley & Sons, 2005

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	10	20	80
Analyze	20	10	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define measures for IRS
2. Define PAT
3. State Browse capabilities
4. List automatic indexing
5. Recall term clustering algorithms

Understand

1. Explain Functional Overview
2. Explain Stemming algorithms
3. Summarize Brute force algorithms
4. Illustrate S/w text search Algorithms
5. Interpret standard test collection
6. Classify S/w & H/w text search system

Apply

1. Demonstrate Precision
2. Design a hybrid Indexing Data Structure
3. Use stemming Algorithms for IRS

Analyze

1. Analyze s/w and h/w indexing methods
2. Analyze search and Browse capabilities
3. Compare Pat and Stemming algorithms
4. Analyze Term clustering Algorithms

Evaluate

1. Determine Which of the indexing algorithm is efficient
2. Check all automatic indexing methods for its efficiency
3. Compare S/w text search and H/w text search algorithms

Course Outcomes:

1. Illustrate the need of Improvement and value of DevOps
2. Outline the Value Stream using DevOps
3. Describe the Organizational Change and transformation
4. Illustrate the Concept and Goal of Accelerate Flow
5. Outline Feedback Loops and its usage
6. Demonstrate the Concept and Goal of Learning

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	3	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	2	-	-	3
CO3	3	2	2	-	-	-	-	-	-	-	2	-	-	3
CO4	3	2	3	-	-	-	-	-	-	-	2	-	-	3
CO5	3	3	3	-	-	-	-	-	-	-	2	-	-	3
CO6	3	2	3	-	-	-	-	-	-	-	2	-	-	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I**12 Hours**

Introduction to DevOps: Understanding Improvement, The Convergence, History, and Value of DevOps;
Understanding the Value Stream using DevOps: Analyzing the technology Value Stream; The ways of DevOps: Flow, Feedback Loops, Culture of Continual Experimentation and Learning;

Infrastructure as Code (IaC), Versioning and Reusability

UNIT II**12 Hours**

Value Stream in DevOps: Concept and Goals of Streams, Picking a Value Stream, Understanding Organizational Change, Enabling Transformation;

Canary Deployments, Service Mesh

UNIT III**13 Hours**

Accelerate Flow: Concept and Goal of Accelerate Flow, Continuous Delivery Patterns and Practices, the Deployment Pipeline, Creating Consistency in the Pipeline, Automated Testing, Deployment Strategies;
Amplifying the Feedback Loops: Concept and Goals of Feedback Loops, Creating a Service Reliability Culture, Fast Feedback, Understanding Monitoring, Understanding Complexity

Incident Response and Management, Resilience Engineering

UNIT IV**11 Hours**

Learning Acceleration with DevOps: Concept and Goal of Learning, Learning Organizations, Communication, Blameless Culture.

Psychological Safety, Systems Thinking.

Total: 48 Hours**Text Books:**

1. Kim, G., Behr, K., and Spafford, G. (2013). The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win. IT Revolution Press
2. Kim, G., Humble, J., Debois, P., and Willis, J. (2016). The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations. IT Revolution Press

Reference Books:

1. JulianFish, The Practical Guide to Enterprise DevOps and Continuous Delivery

Internal Marks Assessment:

CognitiveLevel	Int. Test 1(%)	Int. Test 2(%)	OBE Test (%)
Remember	25	25	
Understand	40	30	40
Apply	20	20	30
Analyze	15	20	30
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Questions**Remember**

- 1) What is DevOps
- 2) Define Value Stream
- 3) What is **Accelerate Flow**

Understand

- 1) Explain about Ways of DevOps
- 2) Explain Picking Value Stream min DevOps
- 3) Describe Feedback Loops

Apply

- 1) Give Some Real Time Applications of DevOps
- 2) Design a deployment pipeline using automated testing and deployment strategies.
- 3) Show how blameless culture and psychological safety improve incident response.

23FIX01 Full Semester Internship (FSI)

0009

Course Outcomes

- 1) Use the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
- 2) Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- 3) Select appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
- 4) Use ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- 5) Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- 6) Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

COs – POs Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PO ₆	PO ₇	PO ₈	PO ₉	PO ₁₀	PO ₁₁	PO ₁₂	PSO ₁	PSO ₂
C01	3	3	3	2	3	2	2	2	2	2	2	2	3	3
C02	3	3	3	3	3	2	2	2	2	2	2	2	3	3
C03	3	3	3	2	3	3	3	2	2	2	3	2	3	3
C04	2	2	2	3	3	3	3	2	2	2	3	2	2	3
C05	2	2	3	3	3	3	3	2	2	3	3	3	3	3
C06	3	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Department of Computer Science and Engineering

AR23 - Career Path Courses

Sem	Course Code	Course	POs &PSOs	L	T	P	Credit s
Career Path-1: Artificial Intelligence& Machine Learning							
5	23CSC11	Artificial Neural Networks	1,2,3,5,12	3	0	0	3
6	23CSC12	Deep Learning	1,2,3,4,5,PSO1	3	0	2	4
7	23CSC13	Natural Language Processing	2,3,4,12,PSO1	3	0	0	3
Career Path-2: Full Stack Developer							
5	23CSC21	Backend Programming Languages	1,2,3,5,PSO1,PSO2	3	0	0	3
6	23CSC22	Web Application Frameworks	1,2,3,5,PSO1, PSO2	3	0	2	4
7	23CSC23	Web Application Databases	1,3,5,PSO1	3	0	0	3
Career Path-3: Cyber Security							
5	23ITC31	Fundamentals of Security	1,2,3,4,PSO1,PSO2	3	0	0	3
6	23ITC32	Cybernet Security	1,3,4,12,PSO1,PSO2	3	0	2	4
7	23ITC33	Cloud Security	1,2,4,8,12,PSO2	3	0	0	3
Career Path-4: Cloud Computing							
5	23MLC31	Fundamentals of Cloud Computing	1,2,3,4,5,PSO1,PSO2	3	0	0	3
6	23MLC32	Cloud Services using AWS	1,2,3,4,5,PSO1	3	0	2	4
7	23MLC33	Cloud Security Essentials	1,2,3,4,5,PSO1	3	0	0	3

Career Path I (Artificial Intelligence & Machine Learning)
23CSC11 Artificial Neural Networks

3 0 0 3

Course Outcomes

1. Explain the structure and functioning of biological and artificial neural networks
2. Analyse the behaviour of basic neural network models in solving linearly and non-linearly separable problems.
3. Design feedforward neural networks using backpropagation and gradient descent techniques.
4. Describe associative memory networks and demonstrate pattern storage and retrieval using feedback models like Hopfield Networks.
5. Explain different unsupervised learning models and their learning mechanisms..
6. Apply neural network models to solve real-world problems such as character recognition, image classification, and signal processing.

CO-PO Mapping

COs	PO1	PO2	PO3	PO5	PO12
1	3	2	2	1	1
2	3	3	2	1	1
3	3	3	3	1	1
4	3	3	3	1	2
5	3	3	3	2	2
6	3	3	3	2	3

3-Strongly Linked | 2- Moderately linked | 1- Weakly linked

Unit I

12 Hours

Basics of Neural Networks: Introduction to Biological Neural Networks, Biological Neural Networks vs Artificial Neural Networks.

Artificial Neural Networks: Introduction to Artificial Neural Networks, Neural Networks Terminologies, Activation Functions and its Types, Basic Models of Neural Networks (McCulloch-Pitts Neuron and Hebb Network), Types of Learning Laws.

Benefits of Neural Networks, Evolution of Neural Network Models

Unit II

Supervised Learning Networks

12 Hours

Perceptron Networks: Perceptron, Perceptron Learning Algorithm, Linearly Separable Problem (AND, OR, XOR), Perceptron Convergence Theorem.

Multi-Layer Feedforward Networks: Introduction to Feed Forward Neural Networks, Multilayer Perceptron Architecture and Layers, Cross Validation, Gradient Descent Algorithm, variations of gradient descent. Back Propagation Algorithm.

Overfitting and Underfitting in Neural Networks, Vanishing and Exploding Gradient Problem

Unit III

Associative and Feedback Networks

12 Hours

Associative Memory: Hetero-associative Memory Neural Network, Auto-associative Network, Bidirectional Associative Memory (BAM).

Feedback Networks: Hopfield Networks - Energy Function and Convergence - Pattern Storage and Retrieval
Limitations of Associative Memories and Hopfield Networks

Unit IV**12 Hours**

Supervised Learning Networks: Competitive Learning, Kohonen Self-Organizing Maps, Learning Vector Quantization (VLQ), Adaptive Resonance Theory (ART1).

Applications of Neural Network: Character Recognition, Signal Processing, Image Classification.

Comparison of SOM, and ART1, Applications of SOM

Total: 48 Hours**Textbook (s)**

1. Laurene Fausett, "Fundamentals of Neural Networks" , Pearson Education, 2004.
2. Simon Haykin, "Neural Networks - A comprehensive foundation", Pearson Education, 2003.
3. S. N. Sivanandam, S N Deepa, Principles of Soft Computing, 2nd Edition Wiley India, 2007.
4. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep Learning." An MIT Press book in preparation, 2015.

Reference (s)

1. Satish Kumar, "Neural Networks: A Classroom Approach" Tata McGraw Hill Education, 2004.
2. Simon Haykin, "Neural networks and Learning Machines", Prentice Hall, 2008
3. Josh Patterson and Adam Gibson "Deep Learning A Practitioner's Approach" O'Reilly Media, Inc. 2017

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	20	20	40
Analyze	20	20	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

Sample Questions**Remember**

1. Define the simple artificial neuron and the calculation of net input.
2. Define the bias and threshold
3. list out various activation functions

Understand

1. Explain the basic models of Artificial Neural Networks.
2. List the terminologies of artificial neural networks
3. Explain about the Neural Network with backpropagation algorithm and its architecture in detail.

Apply

1. Demonstrate the perceptron network architecture with training algorithm in detail
2. Demonstrate the Full Counter Propagation Network (CPN) algorithm with neat architecture.
3. Construct the convolution neural network with neat diagram.

Analyze

1. Justify the Back propagation network architecture and analyse its training algorithm
2. Analyse different layers of convolution neural network in detail.

Evaluate

1. Kohonen Self – Organizing net with two cluster units and five inputs. The weight vector for cluster units are given by $W = \begin{bmatrix} 1.0 & 0.9 & 0.7 & 0.5 & 0.3 \\ 0.3 & 0.5 & 0.7 & 0.9 & 1.0 \end{bmatrix}$

Use the square of the Euclidean distance to find the winning cluster unit for the input pattern $x = [0.0 \ 0.5 \ 1.0 \ 0.5 \ 0.0]$.

Using learning rate 0.25, find the new weights for the winning unit.

2. Consider the CPN net with using the input pair $x = [0110]$ and $y = [01]$ perform Phase 1 of training (one step only). Find the activation of the cluster layer units and update the weights using learning

rates $\alpha = 0.2$ and $\beta = 0.3$. $V = \begin{bmatrix} 0.7 & 0.5 \\ 0.7 & 0.5 \\ 0.5 & 0.7 \\ 0.5 & 0.7 \end{bmatrix}$ $W = \begin{bmatrix} 0.2 & 0.2 \\ 0.2 & 0.2 \end{bmatrix}$

Course Outcomes

1. Explain the fundamentals of deep learning and Deep Neural networks
2. Give Differences between MLP and Deep Neural Networks.
3. Make use of different CNN models.
4. Compare different character encoding techniques.
5. Exemplify different Deep unsupervised models.
6. Examine different deep learning applications.

COs-POs Mapping

COs	PO1	PO2	PO3	PO4	PO5	PSO1
1	3	2	2	1	3	2
2	3	3	2	1	2	2
3	3	3	3	2	3	2
4	3	2	3	2	3	2
5	3	2	2	2	2	2
6	3	3	3	3	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+8 Hours**

Introduction Deep Learning: Introduction, need of Deep learning, Applications of Deep Learning, Relu function, types of Relu function, Model Parameters vs Hyper parameters.

Deep neural networks (DNNs): Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization).

Types of learning laws, limitation of Deep Learning.

Practical Components

1. Design Structure and Parameter's Initialization in a Neural Network Model
2. Determine the forward Computation and cost function in MLP
3. Implement Backpropagation algorithm for MLP
4. Implement Deep Neural Network Model and predict the Output

Unit II**12+10 Hours**

Convolutional networks: Building blocks of CNNs, Filters and Feature Maps, Pooling layers, Convolutions over volumes, Softmax regression, hyper-parameter tuning.

CNN models: Lenet, Alex Net, VGG -16, Residual Networks, YOLO.

Transfer Learning: introduction, types of transfer learning, transfer learning with CNN models.

Linear Least Square Filters, Least Mean Square Algorithm, XOR Problem

Practical Components

1. Implement Digit recognizer using CNN of MNIST Data set
2. Implement Character recognizer using CNN
3. Implement Transfer Learning with VGG -16
4. Transfer Learning with YOLO

Unit III

11+8 Hours

Recurrent Networks: One-hot encoding of words and characters, using word embeddings, Recurrent Neural Network Model, vanishing gradients with RNNs, Gated Recurrent Unit (GRU) LSTM (long short-term memory).

Keras ,tensorflow, data augmentation, Batch Normalization, Dropout

Practical Components

1. One-Hot Encoding and Word Embeddings
2. Pretrained Word Embeddings
3. RNN model for text classification
4. Understand and Implement LSTM

Unit IV

12 + 6 Hours

Sequence Models: Encoder Decoder sequence to sequence architectures

Deep Unsupervised Learning: Auto encoders, Variational Auto encoders, Generative Adversarial Network, Deep Boltzmann Machines.

Case study: Image segmentation, object detection,

n-grams ,bag-of-words, Bi directional RNN, Exploding gradient

Practical Components

1. Understand and Implement Auto encoders
2. Understand and Implement Variational Auto encoders
3. Understand and Implement Generative Adversarial Network
4. Understand and Implement Deep Boltzmann Machines

Total: 48+32 Hours

Textbook (s)

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep Learning." An MIT Press book in preparation. (2015).
2. Fundamentals of Deep Learning: Designing Next-generation Machine Intelligence Algorithms by Nicholas Locascio and Nikhil Buduma O'Reilly Media; 1 edition (June 29, 2017)
3. Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition
4. B. Yegnanarayana , "Artificial Neural Networks" , PHI.

Reference (s)

1. FrancoisChollet, Deep Learning with Python
2. Deep Learning: A Practitioner's Approach by Adam Gibson and Josh Patterson Shroff/O'Reilly; First edition (2017)
3. Python Deep Learning by Daniel Slater and GianmarioSpacagna, Packt Publishing; 2/e (January 16, 2020)
4. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006
5. Kevin P. Murphy.,MachineLearning:A Probabilistic Perspective

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	20	20
Understand	50	50
Apply	30	30
Analyze	--	--
Evaluate	--	--

Create	--	--
Total (%)	100	100

SAMPLE QUESTION (S)

Remember

1. What is neuron?
2. List any two learning rules.
3. Define Convolution neural network
4. Define one-hot encoding technique
5. Define LSTM

Understand

1. Explain Multilayer perceptron
2. Explain data representation through tensors
3. Outline different character encoding techniques
4. Illustrate usage of auto encoders
5. Construct Gated Recurrent Unit (GRU)

Apply

1. Apply 2D tensors to represent image data
2. Develop CNN model to classify digits.
3. Build a CNN model to recognize images
4. Apply LSTM to extract text from a video
5. Build an appropriate DL model for image segmentation

Analyze

1. Examine differences between ANN and CNN.
2. Compare ML with DL
3. Compare and contract different activation functions.

Evaluate

1. Evaluate performace of DL and ML for an image classification problem.

23CSC13 Natural Language Processing

3 0 0 3

Course Outcomes

1. Describe the fundamentals & building blocks of Natural Language Processing
2. Demonstrate different text representations & labelling methods
3. Apply different Natural Language models and named entities
4. Apply Recurrent neural network for NLP
5. Make use of GRUs and LSTM models for translation
6. Discuss different applications of NLP

CO-PO Mapping:

CO	PO2	PO3	PO4	PO12	PSO1
1	3	2	1	2	1
2	3	3	2	2	1
3	3	2	2	2	2
4	2	3	1	2	1
5	3	3	2	2	2
6	3	2	2	2	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

12 Hours

Introduction to NLP: Definition, History, NLP in the real world, Building blocks of language, Approaches to NLP, NLP Pipeline, NLP Challenges, Deep learning in NLP, Morphology fundamentals;

Objectives of NLP, The applications of NLP.

Unit II

12 Hours

Text Representation and Sequence Labelling: Basic Vectorization approaches- One-Hot Encoding, Bag of Words, Bag of N-Gram, TF-IDF; Distributed universal text and handcrafted feature Representations, Neural language models, N-gram language model.

Sequence labeling for POS and Named Entities: POS tagging, Named Entities tagging, hidden markov models, conditional Random Fields Visualizing Embeddings, Viterbi algorithm.

Evaluation of Named Entity Recognition, Markov chains.

Unit III

12 Hours

Deep learning architectures for NLP:

RNN for language model, GRUs and LSTMs for machine translation, - Sequence to sequence modelling - Encoder decoder -Attention mechanism, Transformer Networks – BERT, GPT, Graph NLP, Hidden Markov Model, Conditional Random Field, Topic modelling .

Transformers as Autoregressive Language Models, Potential Harms from Language Models.

Unit IV

12 Hours

Applications of NLP:

Sentiment analysis, machine translation, automated speech recognition systems, question-answering based systems, topic modelling, Text Generation and Summarization, Evaluation metrics for NLP models and Visualization.

Textbook (s)

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft)
2. Daniel Jurafsky, James H Martin, Speech & language processing, preparation [cited 2020 June 1] Available from: <https://web.stanford.edu/~jurafsky/slp3> (2018).
4. Vajjala, Sowmya, Bodhisattwa Majumder, Anuj Gupta, and Harshit Surana. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems. O'Reilly Media, 2020.

Reference (s)

1. Rajesh Arumugam, Rajalingappa Shanmugamani : Hands-On Natural Language Processing with Python
2. Manning C., Schütze H., Foundations of Statistical Natural Language Processing--.(MIT Press)
3. Jacob Eisenstein. Natural Language Processing.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is Natural language processing.
2. Define purpose of different building blocks of NLP
3. List any two challenges in NLP.

Understand

1. Explain different Basic Vectorization approaches
2. Explain the role of various Named Entities
3. Explain purpose of Viterbi algorithm

Apply

1. Apply various Deep learning models for NLP
2. Make use of RNN for text translation

Analyze

1. Compare and contrast GRUs and LSTMs for machine translation.
2. Distinguish various methods to Convolutional neural networks for sentence classification.

Evaluate

1. Evaluate the statistics of a sentiment analysis
2. Design an automated speech recognition systems

Open book Question:

1. Design a model to analyse a given sentence is negative, positive or neutral for a given dataset.
2. Design and develop a model to translate a text to speech for a given set of statements.

Career Path II - Full Stack Developer
23CSC21 Backend Programming Languages

3 0 0 3

Course Outcomes:

1. Demonstrate a comprehensive understanding of web fundamentals.
2. Apply RESTful API for modern web applications.
3. Develop and deploy basic web applications using Node.js and Express.js.
4. Demonstrate the ability to understand C# concepts and build web applications using ASP.NET MVC.
5. Create efficient and dynamic RESTful APIs with CRUD functionality.
6. Design and develop web applications using Python.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO5	PSO1	PSO2
1	3	2	1	1	2	1
2	3	3	3	2	3	3
3	3	3	3	3	3	3
4	3	3	3	3	3	3
5	3	3	3	3	3	3
6	3	3	3	3	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit-I

12 Hours

Overview of the web: Basic concepts of web, Anatomy of HTTP transaction, Request and response structures, HTTP status codes, REST APIs, Browser storage - Local storage & Session storage

RESTful programming: Introduction to Restful API, REST Principles, Resource Identification, Representation of Resources: JSON, XML and Plain Text/HTML, HTTP Methods: GET, POST, PUT and DELETE, Stateless Communication, Versioning, Error Handling, Pagination.

Basic HTML Tags, Basic CSS concepts, Authentication and Authorization in RESTful

Unit-II

12 Hours

Programming with JavaScript

Introduction to Node.js, Features of Node.js, npm, understanding package. json, Modules: fs, http, path and os, Express.js: Introduction to Express.js, Setting up an Express server, Handling GET and POST requests, Middleware in Express, Template Engine: Embedded JavaScript Templates, rendering dynamic HTML, building a REST API: Creating routes for CRUD operations, understanding authentication vs. authorization, Implementing basic JWT.

Basics of JavaScript and ES6 JavaScript, Node Packages, async, await

Unit-III

14Hours

Programming with C#

Introduction to .NET: Introduction, .NET Framework vs .NET Core vs .NET, components of .NET, CLR, FCL, Managed code and Unmanaged code, C# Concepts: Introduction, Features, Datatypes, Functions, Arrays, Classes and Objects, Properties, Inheritance, Polymorphism, Interfaces, Namespaces, Collections, Delegates, Events, Exception Handling, Introduction to ASP.NET: MVC, Routing, Razor pages vs MVC, Create RESTful endpoints, Model Binding

C# variables, LINQ, async/await, Multithreading, ORM, ASP.NET life cycle, web forms, ADO.NET introduction

Unit-IV

10 Hours

Programming with Python

Introduction to Python, Classes and objects, Constructors, Encapsulation, Inheritance, Polymorphism, Decorators and Closures, Abstract Base Classes, Generators and Iterators, Metaclasses, Functional Programming: map(), filter(), reduce(), Python's HTTP package, building a REST API: creating routes for CRUD operations.

Basic concepts of python, Python packages

Total: 48 Hours

Textbook (s)

1. Restful Web APIs, Leonard Richardson, Mike Amundsen, Sam Ruby, O'Reilly Media.
2. Web Development with Node and Express, Ethan Brown, O'Reilly Media.
3. C# Programming, Wikibooks Contributors, Platypus Global Media.
4. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference (s)

1. Pro ASP.NET Core 6, Adam Freeman, 9th edition, Apress.
2. Automate the Boring Stuff with Python, Al Sweigart, No Starch Press, 2nd Edition.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember:

1. What are the advantages of Restful API?
2. What is the difference between Node.js and Express.js?
3. Define C# Function?
4. Write a short note about Abstract Base Classes.
5. Write a short note on Browser Storage.

Understand:

1. Explain about request and response structure.
2. What is Restful API? Explain about various Rest principles.
3. Describe the procedure to use middleware in Express.js.
4. Explain in detail about CLR.
5. Discuss about map(), filter(), reduce() in Python.

Apply:

1. Implement a basic Node.js program that reads and writes a file using the fs module.
2. Create a simple HTTP server using the http module that responds with "Welcome to Node.js!".
3. Write a simple C# program to handle an Exception.
4. Write a simple C# code that calculates and displays the sum of two numbers entered by the user.
5. Implement a simple HTTP server in Python that handles GET and POST requests.

Analyze:

1. How does the client-server architecture impact the way web applications handle user requests?

2. Compare the http module in Node.js with Express.js in terms of request handling and ease of use.
3. Compare how Razor pages are different from MVC.
4. Analyze the difference between .NET Framework and .NET Core?
5. Analyze the difference between synchronous and asynchronous HTTP requests in Python.

23CSC22 Web Application Frameworks

3 2 0 4

Course Outcomes:

1. Describe the fundamentals of web framework.
2. Design and implement Angular-based applications.
3. Design and implement React-based applications.
4. Build robust and secure web applications using Spring Boot.
5. Create efficient and dynamic REST APIs with CRUD functionality
6. Design and develop dynamic web applications using MVT architecture

CO-PO Mapping:

COs	PO1	PO2	PO3	PO5	PS01	PS02
1	3	3	1	1	2	1
2	3	3	3	3	2	3
3	3	3	3	3	2	3
4	3	3	3	3	3	2
5	2	3	2	3	2	3
6	3	3	3	2	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit-I

13+10 Hours

Fundamentals of Web Framework

Introduction to frameworks-Framework applications, General-purpose website frameworks-Server-side, Client-side features, Types of framework architecture.

Angular.js

Introduction – Angular MVC, Ajax, Data binding, Angular concepts - Directives, Components & Modules, Templates & Data Binding, Routing & Navigation, Modules, Expressions, HTTP and API integration.

JavaScript ES6 concepts, MVC, Three-tier organisation, Ajax, Scopes, Controllers

Practical Components

1. Implementation of angular directives
2. Implementation of angular components
3. Implementation of custom/user-defined directive
4. Create a TODO Application using Angular JS (Single page application)
5. Implement routing and navigation in Angular JS

Unit-II

13+12 Hours

React.js

Introduction to React: What is Full-Stack Web Development?, Introduction to React, React App Overview, Core Components: Introduction to JSX, React Components, State and Props, Lifecycle Methods: class and function components, use of fetch and axios, Hooks, React Router and Single Page Applications: Presentational and Container Components, React Virtual DOM, React Router: Parameters, React Forms, Flow Architecture and Introduction to Redux: Controlled Forms, Uncontrolled Components, The Flux Architecture, Introduction to Redux, React Redux Forms

JavaScript ES6 concepts, React Events, State Management, Introduction to React Native

Practical Components

1. React Components
2. React Router and Single page applications
3. Controlled Form Validation, Uncontrolled Forms
4. Create a TODO Application using React JS

5. Creating a movie list Application in React JS
6. Creating a Progressive web application with Reusable React Components

Unit-III

10+4 Hours

Spring Boot

Introduction to Spring Boot, Application Structure, Framework Theory, Annotations, Bean Management, Dependency Injection, Spring Data: JDBC, ORM, JPA, Building Rest APIs, Starter Dependencies, database Integration, Creating Model Class.

Spring MVC, Error Handling, Spring Boot Security, Asynchronous Programming

Practical Components

1. Configuration in Spring Boot and Create a Simple Spring Boot Application
2. Apply Validation to given input data with REST endpoint and test with valid or invalid data using any API tester.

Unit-IV

Django

12+6 Hours

Introduction, virtual environment, install Django, Create Django App, App Life Cycle, Project Structure, URL mapping, Django MVT - model and CRUD operations on model, Django view and Django template and configuration, Static File Handling, Django Admin- create user, Response and Redirect, Django Forms

Basic concepts of python, Python packages, Django Cookies and sessions handling

Practical Components

1. Creating models for database queries
2. Writing Django template for rendering data
3. Implementation of REST API using Django

Total: 48+32 Hours

Textbook (s)

1. Angular: Up and Running, ShyamSeshadri, 1st Edition, O'Reilly, 2018
2. Struts the Complete Reference, James Holmes, 2nd Edition, Mc. Graw Hill Professional, 2006.
3. Professional Java Development with the Spring Framework, Alef Arendsen, Thomas Risberg, Rod Johnson, Wiley publications, 2007.
4. Programming with Django, Wiley Publishing

Reference (s)

1. Angular 6 for Enterprise-Ready Web Applications, DoguhanUluca, 1st edition, 2018
2. The Definitive Guide to Django, Adrian Holovaty, Jacob Kaplan-Moss, Apress, 2009.
3. Struts 2 In Action, Donald Brown, Chad Michael Davis, Scott Stanlick, Dreamtech press, 2008.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	50	40
Understand	30	40
Apply	20	20
Analyze	--	--
Evaluate	--	--
Create	--	--
Total (%)	100	100

SAMPLE QUESTION (S)

Remember:

1. What is a web framework?
2. Define Full-Stack Web Development.
3. What is Spring Boot?
4. What is Django?
5. What command is used to create a Django project?

Understand:

1. Explain the concept of Model-View-Controller (MVC) in a framework.
2. Explain the difference between state and props in React.
3. Describe the role of JSX in React.
4. Explain the purpose of Spring Boot Annotations with examples.
5. What is the difference between Django MVT and traditional MVC architecture?

Apply:

1. Create a simple HTTP request using a client-side framework.
2. Write a simple React component using JSX.
3. Write a simple Spring Boot application that prints "Hello, World!".
4. Implement a simple CRUD application using Spring Data JPA.
5. Develop a Django model for a product catalog and apply CRUD operations.

Analyze:

1. Compare and contrast server-side and client-side frameworks.
2. Compare useEffect and lifecycle methods in class components.
3. How does Spring Boot handle Bean Management and Dependency Injection?
4. How does Django's URL dispatcher work?
5. Compare Django ORM vs. raw SQL queries.

23CSC23 Web Application Databases

3 0 0 3

Course Outcomes:

1. Describe the architecture and programming concepts of web databases.
2. Implement state management and database connectivity mechanisms
3. Apply structured database management techniques.
4. Apply the principles of unstructured databases and NoSQL technologies.
5. Develop proficiency in database connections and communication protocols.
6. Analyze the security mechanisms for web services

CO-PO Mapping:

COs	PO1	PO3	PO5	PSO1
1	3	1	2	3
2	2	3	3	3
3	3	3	1	3
4	3	2	2	2
5	2	3	3	3
6	2	2	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-I

11 Hours

Overview of Web databases

Web application Overview: Basic concepts of web, Web database architectures, Web database gateways, Web-database programming: Client-side and server-side web database programming, State management: Session management, cookies, request and response header.

Database gateways, CGI, Browser extensions

Unit-II

13 Hours

Structured Database – PostgreSQL

13 Hours

Structured Databases: Structured data, Data models, Relational database management systems, Overview of PostgreSQL – Introduction, Environment Setup, PostgreSQL Database: Create, Select and Drop, CRUD operations, Advanced PostgreSQL: Constraints, Views, Transactions, Auto Increment, Privileges, Functions, Python interface, Concept of migrate database, Challenges of structured data- MySQL, SQLite
PostgreSQL Interfaces, Triggers, MySQL Connection, SQLite Connection

Unit-III

13 Hours

Unstructured Database – MongoDB

Unstructured Databases: Unstructured data and its usages, NoSQL databases, Overview of MongoDB – Introduction, No SQL Database, Advantage over RDBMS, MongoDB Data Types, Install MongoDB, Data Modeling, MongoDB Operators, Database Commands, MongoDB Architecture - Create Database, Drop Database, Collection - Create Collection, Drop Collection, CRUD: Documents, MongoDB Shell, MongoDB Cloud, Challenges of unstructured data- Cassandra, GraphQL

Architecture of Cassandra, Cassandra Data model, GraphQL Architecture and Application Components

Unit-IV

Database connections, Security & Communication in web services

11 Hours

Connecting to database: Native database APIs, Database-independent APIs, Template-driven database access packages, Third-party class libraries.

Web requests: Structure of web requests, JavaScript Object Notation (JSON), Request methods – GET, POST, PUT, DELETE, response status codes

Security: User authentication, User authorisation, Proxy servers, Digital signatures, Digital certificates, SSL and HTTPS.

JDBC, ODBC, template parsing, JSON, User authentication and authorisation

Total: 48 Hours

Textbook (s)

1. Web Database Applications with PHP and MySQL, Hugh E. Williams, David Lane, 2nd Edition, O'Reilly, 2004.
2. Mastering PostgreSQL 13, Hans-Jürgen Schönig, 4th Edition, Kindle Edition.
3. NoSQL Distilled, PramodSadhalage, Martin Fowler, 1st Edition, 2012

Reference (s)

1. Getting Started with NoSQL, GauravVaish, Paperback, Packt, 2013.
2. Fundamentals of Database Systems, ElmasriNavathe Pearson Education.
3. An Introduction to Database systems, C.J. Date, A.Kannan, S.SwamiNadhan, Pearson, 8th Edition.
4. Web Application Security, Andrew Hoffman, O'Reilly, 2020.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	20	20	40
Analyze	20	20	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

Sample Questions

Remember:

1. What are the basic components of a web application?
2. What is a web database architecture?
3. What is a relational database management system (RDBMS)?
4. List different types of NoSQL databases.
5. Define database-independent APIs.

Understand:

1. Explain the process of session management in a web application.
2. Explain how PostgreSQL handles transactions.
3. Explain the architecture of MongoDB and how it differs from RDBMS.
4. How does JSON differ from XML in web communication?
5. Explain the difference between DELETE and TRUNCATE in PostgreSQL.

Apply:

1. Create a client-side script that validates form inputs.
2. Perform a database migration using PostgreSQL.
3. Implement CRUD operations in MongoDB using Python or Node.js.
4. Implement JWT-based authentication in a web application.
5. Write a query to filter data using comparison operators.

Analyze:

1. Compare two-tier and three-tier web database architectures.
2. Compare PostgreSQL, MySQL, and SQLite in terms of performance and scalability.
3. How does MongoDB handle ACID properties compared to traditional databases?

4. Compare session-based authentication vs. token-based authentication.
5. Analyze the impact of response status codes on API performance.

Career Path-3: Cyber Security
23ITC31 Fundamentals of Security

3 0 0 3

Course Outcomes

1. Describe the fundamental concepts of information security
2. Illustrate the use of cryptography and its functions
3. Identify different types of Cryptography techniques
4. Classify different types of Security Threats and Vulnerability
5. Demonstrate the concepts of network security
6. Summarize transport and network layer security

CO-PO Mapping

CO	PO ₁	PO ₂	PO ₃	PO ₄	PSO1	PSO2
1	3	1	1	1	3	3
2	3	3	2	2	3	2
3	2	2	2	2	2	2
4	2	2	2	2	3	3
5	3	2	2	2	2	3
6	3	2	2	2	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

12 Hours

Security concepts

What is security, Data vs Information vs Cyber security, Goals of Information Security, Computer Security Concepts, threats, attacks and assets, security functional requirements, fundamental security design principles, computer security strategy.

protocols suite, hacking, network sniffing, social engineering

Unit II

12 Hours

Cryptography

Introduction to cryptography, Cryptographic functions (Authentication, Nonrepudiation, confidentiality, integrity, Availability), Cryptanalysis. Types of Cryptography (Symmetric key and Asymmetric Key), Cryptography, cryptographic Algorithms, Substitution Techniques, Transportation, Techniques Message Integrity, Digital Signatures, Email Standards: MIME and PGP.

Applications of Cryptography, cipher types, steganography

Unit III

12 Hours

Security Threats and Vulnerabilities

Malware, Types of malware, Overview of Security Threats and Vulnerability: Types of attacks on Confidentiality, Integrity and Availability, Security Counter-Measures: Passwords, Access Control (Authenticating users, Handling User Access), Antivirus Software, Firewalls, Intrusion Detection Systems & IPS.

Types of firewalls, advanced persistent threat, Buffer Overflow

Unit IV

12 Hours

Network Security

TCP/IP Suite, DNS, MITM, Attacks on TCP and DNS, VPN, Application layer security (PGP, S/MIME), Transport layer security (TLS), Network layer security (IPSec) Anonymous networks: Tor, I2P.

TCP Vulnerabilities, SSH vs SSL,

Total: 48 Hours

Textbook (s)

1. William Stallings, Lawrie Brown, Computer Security Principle sand Practice Third Edition,2015
2. Nihad A. Hassan, Rami Hijazi, Digital Privacy and Security Using Windows: A Practical Guide, Apress, 2017

Reference (s)

1. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.
2. Ross Anderson, Security Engineering: A Guide to Building Dependable Distributed, 3rd Edition, John Wiley & Sons Inc, 2023.
3. Kozierok, Charles M. The TCP/IP guide: a comprehensive, illustrated Internet protocols reference, 2005
4. Harris, Shon, "CISSP all-in-one exam guide." Sixth edition (2013).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is security.
2. Define cyber security
3. List any four computer security concepts
4. Define threat
5. Define intrusion

Understand

1. Explain Cryptographic functions
2. Explain the role of Symmetric key cryptography
3. Illustrate hashing techniques
4. Outline the purpose of digital signatures

Apply

1. Digital signature
2. Buila a firewall mechanism to protect laptop
3. RSA algorithm with example

Analyze

1. Compare and contrast RSA and ECC.
2. Distinguish differences between Symmetric and Asymmetric key cryptography.

3. Examine the key sharing techniques in both Symmetric and Asymmetric key cryptography techniques

Evaluate

1. Justify the ECC is best public key cryptosystem than other public key approaches.
2. Explain the importance of IPSec protocol.
3. Explain the importance of I2P protocol

Open Book Exam Questions

Question 1:

In a public-key system using RSA, you intercept the ciphertext $C=10$ sent to a user whose public key is $e=5$, and $n=35$. What is the plaintext M ? and Perform encryption and decryption using the RSA algorithm for the following: 1. $P=3$; $q=11$, $e=7$; $M=5$. 2. $P=17$; $q=31$, $e=7$; $M=2$.

Question 2:

Suppose we have a set of blocks encoded with the RSA algorithm and we don't have the private key. Assume $n=pq$, e is the public key. Suppose also someone tells us they know one of the plaintext blocks has a common factor with n . Does this help us in any way?

Course Outcomes

1. Describe the fundamental concepts of Cyber security
2. Demonstrate the web security and different attacks
3. Make use of different network scanning and security measures
4. Analyze different types of Intrusion detection techniques
5. Develop different types of Intrusion prevention systems
6. Identify different cybercrimes, IT laws and acts.

CO-PO Mapping

CO	PO1	PO3	PO4	PO12	PSO1	PSO2
1	3	3	1	2	2	2
2	3	3	1	3	2	1
3	1	2	3	3	2	2
4	3	1	1	3	2	2
5	1	3	3	3	3	3
6	1	3	2	1	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+8 Hours****Introduction to Cyber Security**

What is Cyber Security, its need, cyber-threats, Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage), Career Growth, Statistics, Inferences, Need for a Comprehensive Cyber Security Policy, Classification of Cyber Crimes, kinds of cybercrimes, Reasons for Cyber Crimes, Cyber Security Tools : Nmap, Metasploit, wireshark, tcpdump, snort.

Cyber security awareness, social engineering, cyber stalking

Practical Components

1. Lab Activity: Study the use of network reconnaissance tools like WHOIS, dig, ping, hping, traceroute, nslookup to gather information about networks and domain registrars.
2. Lab Activity: Study of packet sniffer tools like tcpdump, wireshark etc.
3. Lab Activity: Perform Network Scanning using NMAP in windows.
4. Lab Activity: Perform Network Scanning using and ZENMAP in kali Linux.

Unit II**12+8 Hours****Web security**

Same origin Policy, Cross Origin Resource Sharing, DDOS, SQL Injection, XSS, Homograph, Generating and storing session tokens.

Networking Scanning & Security Measures:

Packet Sniffing and spoofing, Network scanning types, port scanning & its tools, and Network Architecture

Security Measures: IPtables(firewalls), Webservers (Nmap & Metasploit for securing webservers), Cyber Threats and Attacks (Malware, DOS, MITM, Social engineering attacks, Spoofing, Phishing)

Cross-Site Request Forgery (XSRF/CSRF), spear phishing.

Practical Components

1. Lab Activity: Perform port scanning using Nmap
2. Lab Activity: Penetration Testing and Exploiting with Metasploit, Armitage and msfconsole
3. Lab Activity: Simulate DOS and DDOS attacks using various tools.
4. Lab Activity: Study of SQLMap to explore SQL Injection attacks

Unit III**12+8 Hours**

Intrusion Detection System

Intruders, Intrusion Detection, Analysis Approaches, Network-Based IDS, Host-Based IDS, signature based IDS, anomaly based IDS, advantages and disadvantages of NIDS and HIDS

Intrusion Detection Tools, snort architecture, snort rules, case studies of intrusion detection systems, Intrusion detection exchange format.

Honeypots, different types of honeypots, benefits and dangers of honeypots

firewall vs IDS, Physical IDS, honeynet

Practical Components

1. Lab Activity: Use iptables in linux to create firewalls..
2. Lab Activity: Study of Intrusion detection tool SNORT. Use Snort as packet sniffer and write your own IDS rules
3. Lab Activity: Setup honeypot
4. Lab Activity: Demonstrate Intrusion Detection System (IDS) using any tool (SNORT or any other software)

Unit IV

12 + 8 Hours

Cyber Laws and Digital Forensics

Digital Forensics: Introduction to Digital Forensics, historical background of digital forensics, Forensic Software, and Hardware, need for computer forensics science, special tools and techniques digital forensic life cycle, challenges in digital forensic.

Law Perspective: Introduction to the Legal Perspectives of Cybercrimes and Cybersecurity, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyber laws, The Indian IT Act, Cybercrime Scenario in India, Digital Signatures and the Indian IT Act.

Cybercrime and Punishment

Practical Components

1. Lab Activity: Write a security policy for password protection
2. Lab Activity: Install Rootkits to study variety of options
3. Lab Activity: Implement Digital Signature Scheme.
4. Lab Activity: Case Study on Indian IT ACT 2000

Total: 48+32 Hours

Textbook (s)

1. Wenliang Du, Computer & Internet Security: A Hands-on Approach, (2019)
2. William Stallings, Lawrie Brown, Computer Security Principle sand Practice Third Edition, 2015
3. Sunit Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt. Ltd, 2011.
4. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi

Reference (s)

1. Pande, Jeetendra. "Introduction to Cyber Security.", (2017)
2. Pavan Duggal, Cyber frauds, cybercrimes & law in India.
3. Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010
4. Roberto Di Pietro, Luigi V. Mancini (2008), Intrusion Detection System, Springer
5. Dafydd Stuttard and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Wiley Publication

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	50	40
Understand	30	40
Apply	20	20

Analyze	--	--
Evaluate	--	--
Create	--	--
Total (%)	100	100

Sample Question (S)

Remember

1. What is cyber security.
2. Define security policy.
3. List classification in cyber security.
4. Define network scanning.
5. What is digital forensics.

Understand

1. Explain security policy for password protection.
2. Explain reasons for cyber crime.
3. Outline SQL injection attack.
4. Classify different approaches for packet filtering using firewall.
5. Explain IP Spoofing.

Apply

1. Apply IPS methods to prevent intruder.
2. Apply snort rules to detect intrusion
3. Identify open ports in a network using nmap.
4. Plan to filter unauthorized packets using iptables
5. Build host based IPS.

Analyze

1. Compare and contrast iptables and snort.
2. Compare and contrast different tools to address DOS.
3. Examine different post scanning methods.
4. Distinguish nmap and metasploit.
5. Compare different tools related to digital forensics

Open Book Exam Questions

Question 1:

	Source Address	Source Port	Dest Address	Dest Port	Action
1	Any	Any	192.168.1.0	> 1023	Allow
2	192.168.1.1	Any	Any	Any	Deny
3	Any	Any	192.168.1.1	Any	Deny
4	192.168.1.0	Any	Any	Any	Allow
5	Any	Any	192.168.1.2	SMTP	Allow
6	Any	Any	192.168.1.3	HTTP	Allow
7	Any	Any	Any	Any	Deny

The above table shows a sample of a packet filter firewall ruleset for an imaginary network of IP address that range from 192.168.1.0 to 192.168.1.254. Describe the effect of each rule.

Question 2:

Perform following activities using nmap tool:

- a. Write an nmap command to check/find list of open ports for "gmrit.org" website.
- b. Nmap to reveal open services and ports by IP address as well as by domain name(Note: IP number is of your choice).
- c. Nmap command to scan multiple hosts at once.
- d. Nmap command to find OS information of a host(host IP address is of your choice).
- e. Nmap command to check firewall settings of a host(host IP address is of your choice).

Course Outcomes

At the end of the course, students will be able to

1. Describe core concepts of the cloud computing paradigm
2. Illustrate characteristics, advantages and challenges brought by the various models and services in cloud computing.
3. Classify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based services.
4. Categorize security challenges, threats and risks involved in the cloud application
5. Analyze the Security Requirements for the Architecture in cloud services
6. Examine the Data Security measures and best practices for ensuring the security of the cloud.

CO-PO Mapping

CO	PO1	PO2	PO4	PO8	PO12	PSO2
1	3	2	1	2	2	2
2	2	2	2	2	2	2
3	3	2	2	2	3	2
4	3	2	2	2	2	2
5	3	3	3	3	2	3
6	3	2	2	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit 1: Introduction to Cloud Computing,**12 Hours**

Cloud Computing Fundamentals - Definition and evolution of Cloud Computing, Essential Characteristics, Benefits, Cloud Reference Architecture, Cloud Service Models: SaaS, Paas, IaaS, Cloud Deployment Models: Public, Private, Hybrid, Community.

Unit 2: Cloud Security Risks, Threats, Vulnerabilities, and Privacy Issues**12 Hours**

Cloud Computing Software Security Fundamentals- Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Security Concerns, Risk Tolerance, Legal and Regulatory Issues.

Unit 3: Security Challenges, Threats, and Risks in Cloud Applications**12 Hours**

Cloud Computing Risk Issues and Security Challenges: The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure, Data, and Access Control, Cloud Service Provider Risks Security Challenges- Security Policy Implementation, Virtualization, Virtual Machine, Virtualization of CPU, Memory and I/O devices, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques.

Unit 4: Security Architecture, Data Security in the Cloud and Best Practices**12 Hours**

Securing the cloud: Architecture and Data Security Requirements for the Architecture, Security Patterns and Architectural Elements, Cloud Security Architecture, Planning Key Strategies for Secure Operation. Overview of Data Security in Cloud Computing, Data Encryption: Applications and Limits, Cloud Data Security: Sensitive Data Categorization, Cloud Data Storage, Cloud Lock-in, Key strategies to secure the cloud, best practices for cloud computing, Security monitoring

Total: 48 Hours**Textbook (s)**

1. Russell Dean Vines and Ronald L. Krutz ,Cloud Security: A Comprehensive Guide To Secure Cloud Computing, Wiley India Pvt Ltd, 2010
2. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier) ,2011

Reference (s)

1. Cloud Computing Design Patterns by Thomas Erl (Prentice Hall)
2. Barrie Sosinsky, Cloud Computing Bible, Wiley India,2011
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE
Remember	50	40	-
Understand	30	40	-
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
Total (%)	100	100	100

Sample Questions

Remember

1. Define Cloud Computing.
2. List Cloud Service Models
3. List Cloud Information Security Objectives
4. What is cloud foundry?

Understand

1. Identify Cloud Computing Risk Issues and Security Challenges
2. Explain the Data Security
3. Explain all session management techniques
4. Explain different cloud service models

Apply

1. Demonstrate the process for war file deployment in the cloud.
2. How does Sensitive Data Categorization happens in Cloud?

Analyze

1. Justify your answer which technique is used for Session management.
2. Deploy Security Challenges

Career Path-4: Cloud Computing

23MLC31 Fundamentals of Cloud Computing

3 0 0 3

Course Outcomes

1. Interpret the architecture and infrastructure models of cloud computing, strengths, and limitations of cloud computing.
2. Understand the techniques of virtualization, including virtual machines and virtualized datacenters.
3. Apply design principles and architectural patterns to develop scalable, resilient, and cloud-native applications.
4. Compare and contrast various cloud service provider implementations and deployment models based on performance, cost, and features.
5. Understand the strategies for cloud scaling, load balancing, fault tolerance, and disaster recovery in cloud environments.
6. Identify and assess security, privacy, and risk management issues associated with cloud computing platforms and services.

COs–POs Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂
1	3	2	2	1	2	2	1
2	3	3	2	2	3	2	2
3	2	2	3	2	3	3	2
4	3	2	3	2	2	2	2
5	3	3	3	2	2	2	2
6	2	2	2	2	2	2	2

3–Stronglylinked|2–Moderatelylinked|1–Weakly linked

Unit I

12 Hours

Cloud Computing

Cloud computing: Introduction, SOA, Cloud computing architectures, Value of cloud computing, Cloud Infrastructure models including SaaS, PaaS, IaaS, Storage-as-a-Service, Database-as-a-Service, Information-as-a-Service, Process-as-a-Service, Application-as-a-Service, Integration-as-a-Service, and Security-as-a-Service. Public cloud, private cloud and hybrid cloud, Cloud Services.

Before moving into the cloud: Know Your Software Licenses, The Shift to a Cloud Cost Model. History of Cloud Computing, Advantages of Cloud Computing, and Disadvantages of Cloud Computing.

Companies in the Cloud Today, Amazon Web Services, Google services, IBM Cloud, Windows Azure, Tata Cloud, Salesforce.com

Unit II

13 Hours

Virtualization & Design

Virtualization, Virtual machine, Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Datacentre, Virtualization for Data-Centre Automation. Service Levels for Cloud Applications Ready for the cloud: Web Application Design, Machine Image Design, Privacy Design, Database Management.

Various hypervisors like VMware, KVM, Oracle VM,

Unit III**12 Hours****Cloud centres, Scaling a Cloud Infrastructure and Disaster Recovery:**

Cloud centres in detail: Comparing approaches, Xen, Eucalyptus, CloudStack, and OpenStack. Cloud Scaling: Capacity Planning, Cloud Scale, Types of cloud scaling.

Disaster Recovery: Disasters in cloud, Disaster Recovery Planning, Cloud Disaster Management.

Requirements for modern data centres-high availability and Service Orientated-Infrastructures(SOI). Modern data centre use case studies.

Unit IV**11 Hours****Cloud Computing Software Security Fundamentals**

Data Security, Network Security, Host Security, Compromise Response.

Cloud information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation.

Cloud Computing Risk Issues: The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks.

Microsoft Azure, IBM Bluemix

Total: 48 Hours**Textbook(s)**

1. George Reese, Cloud Application Architectures, 1st Edition O'Reilly Media, 2009
2. Ronald L. Krutz and Russell Dean Vines, Cloud Security, 1st Edition, Wiley Publishing, 2010

Reference(s)

1. Michael Miller, Cloud Computing-Web Based Applications that change the way you work and collaborate online, 1st Edition, Pearson Education, Publishing, 2011
2. Kai Hwang, Geoffrey C Fox and Jack J. Dongarra, Distributed & Cloud Computing from Parallel Processing to the Internet of Things, 1st Edition, MK Publishing, 2010
3. David S. Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, 1st Edition, Addison-Wesley, 2009

SAMPLE QUESTION(S)**Internal Assessment Pattern**

Cognitive Level	Int. Test1 (%)	Int. Test2 (%)	Assignment Test ³ (%)
Remember	40	45	20
Understand	40	45	60
Apply	20	10	
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total(%)	100	100	100

Remember

1. Define Cloud Computing.
2. List types of virtualization.
3. Define proactive scaling.

4. What is CIAT RAID?

Understand

1. Explain different cloud Infrastructure models.
2. Explain different levels of virtualization.
3. Explain about Recovery Point Objective.
4. With neat diagram explain the functioning of Xen Architecture.
5. List and explain various cloud service providers risks.

Analyze

1. Compare cloud center and service infrastructure.
2. Analyze different cloud services provided by Amazon

Course Outcomes

1. Describe various services offered by Amazon Web Services (AWS) and their applications in cloud computing.
2. Understand the concepts and implementation of Identity and Access Management (IAM) for secure AWS resource access.
3. Demonstrate the usage of AWS Directory Services and AWS Artifact for identity integration and compliance.
4. Deploy and manage scalable computing resources using Amazon Elastic Compute Cloud (EC2).
5. Illustrate the features and functionalities of Amazon Elastic File System (EFS) for scalable storage.
6. Compare AWS storage solutions such as S3, EBS, and Glacier based on use cases and performance needs.

COs–POs Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁
1	2	2	2	2	2	2
2	2	2	2	2	2	2
3	2	2	3	2	2	2
4	3	3	3	3	3	2
5	2	2	2	2	2	2
6	2	2	2	2	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-I

12+8 Hours

Introduction to AWS:

Classic Data Center , Virtualization, Service Comparison: AWS, Azure, and GCP, Amazon Web Services (AWS) and its Benefits, AWS Global Infrastructure, Signup an AWS Free Tier Account.

Different Amazon Web Services, Ways to access AWS: CLI, Console, and SDKs, Explore Management Console and Configure AWS CLI

AWS CloudShell

Practical Components

1. Signup an AWS Free Tier Account
2. Explore Management Console and configure AWS CLI
3. Access AWS: CLI, Console, and SDKs
4. Working with AWS services in AWS CloudShell

Unit-II

12+8 Hours

Identity and Access Management in AWS:

Identity and Access Management (IAM), Managing Users with IAM, Managing Permissions with Groups, IAM Policy and its Elements, IAM Roles ,Password Policy, Best Practices for IAM

AWS Security Token Services, AWS Single Sign-on, AWS Resources Access Manager, Active directory, Microsoft Active directory, AWS Directory Services, AWS Artifact, AWS Audit Manager, Accessing Billing and Alerts.

AWS Certificate Manager

Practical Components

1. Creating New Users, Roles, and Policies on AWS Console
2. Creating an user group for a collection of IAM users
3. Login to AWS Console via MFA
4. AWS Artifact

Unit-III

12+8 Hours

Amazon Elastic Compute Cloud (EC2):

Amazon Elastic Compute Cloud (EC2) and Its Benefits, Amazon Machine Image (AMI), Security Groups in AWS, Authentication through Key-pair, Hardware Tenancy – Shared vs. Dedicated, Networking Layer in EC2: VPC, Elastic Network Interface (ENI) and Its Attributes

Public IP vs. Elastic IP, Instance Store

Elastic Block Store (EBS), Its Features and Volume Types

Solid State Drive: General Purpose SSD and Provisioned IOPS

Hard Disk Drive: Throughput Optimized HDD and Cold HDD

Snapshots, Elastic File System (EFS) and Its Features, Amazon Batch, Windows File Server

Amazon FSx for Windows File Server

Practical Components

1. Creating an EC2 instance and Custom AMI
2. Host the Website Inside EC2 instance
3. Create an Elastic IP and attaching an EBS Volume Externally
4. Creating a Snapshot

Unit-IV

12+8 Hours

AWS Storage Options:

Traditional Storage, Need to Move to Cloud Storage, Traditional vs. Cloud Storage Cost, Cloud Storage, Different Storage Options Available on AWS, Simple Storage Service (S3) and Its Components, Working of S3, Bucket Policy, Access Control List (ACL)

Cross-Region Replication (CRR) and Its Use Case, Amazon S3 Transfer Acceleration, Choice of Storage Classes on S3, Lifecycle Policy of S3 Bucket, AWS Backup.

CDN: CloudFront, Storage Gateway

Practical Components

1. Hosting a Static Website on Amazon S3
2. Replicating Data Across Regions
3. Transfer and Retrieve Data from Glacier
4. Accessing Website Using CloudFront

Total:48+32 Hours

Textbook(s):

1. Amazon Web Services (AWS) 2022 Everything You Need To Know About The Amazon Web Service From Start To End, 2022, Maxwell Harris, Maxwell Harris.
2. Implementing AWS: Design, Build, and Manage your Infrastructure, Yohan Wadia, Rowan Udell, Lucas Chan, Udit Gupta, packt publishers.

Internal Assessment Pattern

Cognitive Level	Internal Test 1 %	Internal Test 2 %	Lab Examination %
Remember	25	25	---
Understand	50	25	---
Apply	25	50	40
Analyze	---	---	20
Evaluate	---	---	40
Create			
Total (%)	100	100	100

Sample Question(s)

Remember

1. List any two cloud services provided by Amazon AWS.
2. What is AWS Artifact?
3. Define EC2.
4. What is Access Control List?

Understand

1. What is Virtualization and explain about that.
2. Explain about Identity and Access Management (IAM).
3. Write and explain about AWS Directory Services.
4. Explain about Access Control List (ACL).

Apply

1. How do we sign up for an AWS Free Tier Account?
2. Illustrate the process of Move to Cloud Storage from normal storage.
3. How Cross-Region Replication (CRR) works?

23MLC33 Cloud Security Essentials (Elective V)

3 0 0 3

Course Outcomes

1. Understand the fundamental concepts and architecture of cloud computing from a security perspective.
2. Describe the characteristics, benefits, and challenges of various cloud service and deployment models in relation to security.
3. Identify and evaluate common threats, vulnerabilities, risks, and privacy concerns in cloud-based environments.
4. Understand security challenges, threats and risks involved in the cloud application.
5. Analyze the Security Requirements for the Architecture in cloud services.
6. Understand Data Security and best practices involved in securing the cloud.

CO-PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁
1	3	2	2	2	2	2
2	3	2	2	2	2	2
3	2	2	2	2	2	2
4	2	2	2	2	2	2
5	3	2	3	2	3	2
6	3	2	2	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

12 Hours

Cloud Computing Software Security Fundamentals- Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Security Concerns, Risk Tolerance, Legal and Regulatory Issues

Unit II

12 Hours

Cloud Computing Risk Issues and Security Challenges:

The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure, Data, and Access Control, Cloud Service Provider Risks, Disaster Recovery-Disaster Recovery Planning, Disasters in cloud, Cloud Disaster Management. Security Challenges- Security Policy Implementation, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques.

Unit III

12 Hours

Securing the cloud: Architecture and Data Security

Security Requirements for the Architecture, Security Patterns and Architectural Elements, Cloud Security Architecture, Planning Key Strategies for Secure Operation.

Unit IV

12 Hours

Overview of Data Security in Cloud Computing, Data Encryption: Applications and Limits, Cloud Data Security: Sensitive Data Categorization, Cloud Data Storage, Cloud Lock-in, Key strategies to secure the cloud, Best practices for cloud computing, security monitoring

Total: 48 Hours

Textbook (s)

1. Russell Dean Vines and Ronald L. Krutz, Cloud Security: A Comprehensive Guide To Secure Cloud Computing, Wiley India Pvt Ltd, 2010
2. Vic Winkler (J.R.), Securing The Cloud: Cloud Computing Security Techniques and Tactics, Syngress/Elsevier, 2011

Reference (s)

1. Thomas Erl, Cloud Computing Design Patterns, Prentice Hall, 2015
2. Barrie Sosinsky, Cloud Computing Bible, Wiley India, 2011
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms,

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam
Remember	50	40	-
Understand	30	40	-
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
Total (%)	100	100	100

Remember

1. Define Cloud Computing.
2. List Cloud Service Models
3. List Cloud Information Security Objectives
4. What is cloud foundry?

Understand

1. Identify Cloud Computing Risk Issues and Security Challenges
2. Explain the Data Security
3. Explain all session management techniques
4. Explain different cloud service models

Apply

1. Demonstrate the process for war file deployment in the cloud.
2. How does Sensitive Data Categorization happens in Cloud?

Analyze

1. Justify your answer which technique is used for Session management.
2. Deploy Security Challenges

Department of Computer Science and Engineering

List of Open Electives

Se m	Course Code	Course Name	POs	L	T	P	Credit s
Open Elective 1- Data Analytics and Machine Learning (only for CSE)							
5	2300511	Data Wrangling and Preprocessing	1,2,3,5,12	3	0	0	3
6	2300512	Data Visualization Techniques	1,2,3,5,10	3	0	0	3
7	2300513	Time Series Data Analysis and Modelling	1,2,3,10,12	3	0	0	3
8	2300514	AI for Business Intelligence	1,2,3,5,12	2	0	0	2

Open Elective I - Data Analytics and Machine Learning (only for CSE)

2300511 - Data Wrangling and Preprocessing

3 0 0 3

Course Outcomes

At the end of the course, students will be able to

1. Describe the fundamentals of Data Science and Analytics.
2. Discuss various data cleaning, fusion, and integration techniques to improve data quality.
3. Analyze challenges in data integration, fusion, and preprocessing, and propose strategies for improvement.
4. Apply various data reduction techniques to optimize data for analysis.
5. Apply feature selection and dimensionality reduction in machine learning.
6. Apply different data transformation techniques to enhance data quality and improve machine learning model performance.

COs-POs Mapping

COs	PO1	PO2	PO3	PO5	PO12
1	3	2	1	-	2
2	3	3	2	-	2
3	2	3	3	1	2
4	3	2	2	1	2
5	3	2	2	-	2
6	3	3	3	1	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

12 Hours

Foundations of Data Wrangling and Preprocessing

Introduction to Data Wrangling and Preprocessing - Types of Data Analytics: Descriptive, Diagnostic, Predictive, and Prescriptive Analytics - Role of Data Preparation in Data Analytics & Machine Learning. Understanding Data and Databases : DIKW pyramid: Data, Information, Knowledge, Wisdom - Types of data and formats - Information versus pattern in data. Databases for Data Science: Introduction to databases- Types of databases (Relational, NoSQL, etc.) - Connecting to and Extracting Data from Databases using Python (SQLite, MySQL, MongoDB).

Data privacy and security, Similarity measures for various data

Unit II

12 Hours

Data Quality and Preprocessing Techniques

Data Quality and Preprocessing: Importance of Data Quality. Techniques for Data Cleaning - Handling Missing Values, Outliers, and Errors - Reindexing and multi-level indexing. - Unpacking, restructuring, and reformulating the table.

Data Fusion and Data Integration - Data Fusion Techniques- Data Integration Strategies - Challenges in Data Fusion and Integration

AI-driven data preprocessing, ETL (Extract, Transform, Load) processes in data integration

Unit III

12 Hours

Data Reduction and Feature Selection

Data Reduction: Data Reduction Techniques - Numerosity data reduction: random sampling, stratified sampling, and random over/undersampling. Dimensionality reduction methods: regression, decision tree, random forest, computational dimension reduction, functional data analysis (FDA), and principal component analysis (PCA). Feature Selection -Wrapper, Filter, and Embedded Methods for Feature Selection. Feature Selection using Python (Scikit-learn SelectKBest, Recursive Feature Elimination, Lasso Regression)

Autoencoders for feature reduction, Trade-offs Between Feature Selection and Dimensionality Reduction,

Unit IV**12 Hours****Data Transformation and Preprocessing for Machine Learning**

Introduction to Data Transformation and Massaging - data transformation versus data massaging- Normalization and standardization techniques - Binary coding, ranking transformation, and discretization- Attribute construction - feature extraction. Advanced Data Massaging: Log transformation, smoothing, aggregation, and binning.

Data Augmentation in Computer Vision & NLP

Total: 48 Hours**Textbook (s)**

1. Jafari, Roy. Hands-On Data Preprocessing in Python. Packt Publishing, 2022. ISBN-13: 978-1-80107-213-7.
2. Joel Grus – Data Science from Scratch: First Principles with Python. O'Reilly Media, 2019. ISBN-13: 978-1492041139.
3. Wes McKinney – Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. O'Reilly Media, 2017. ISBN-13: 978-1491957660.

Reference (s)

1. Provost, Foster, and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking. " O'Reilly Media, Inc.", 2013.
2. Navlani, Avinash, Armando Fandango, and Ivan Idris. Python Data Analysis: Perform data collection, data processing, wrangling, visualization, and model building using Python. Packt Publishing Ltd, 2021.
3. Zheng, Alice, and Amanda Casari. Feature engineering for machine learning: principles and techniques for data scientists. " O'Reilly Media, Inc.", 2018.
4. García, Salvador, Julián Luengo, and Francisco Herrera. Data preprocessing in data mining. Vol. 72. Cham, Switzerland: Springer International Publishing, 2015.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam /Assignment (%)
Remember	10	10	--
Understand	50	50	--
Apply	20	20	50
Analyze	20	20	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Questions**Remember**

1. Define Descriptive, Diagnostic, Predictive, and Prescriptive Analytics with examples.
2. Explain the DIKW pyramid and its significance in data processing.
3. What are the types of data formats commonly used in data science?
4. Define Data Cleaning and its importance in data preprocessing.
5. Define data reduction and its significance in data science.
6. Define Data Transformation and its importance.
7. Define log transformation and its effect on skewed data.

Understand

1. Differentiate between structured, semi-structured, and unstructured data.
2. Compare Relational and NoSQL databases with real-world examples.
3. Why is data extraction important in analytics, and what challenges can arise?
4. Describe the role of error handling in data cleaning processes.
5. Explain the role of PCA (Principal Component Analysis) in data compression.
6. Explain the impact of redundant data on storage and analytics.
7. What are the benefits of ranking transformation?

Apply

1. Demonstrate how to connect to a database and retrieve data using SQL.
2. Write an SQL query to fetch customer transaction records from a relational database.
3. Given a dataset with missing values, demonstrate how you would handle them.
4. Write a Python function using Pandas to remove duplicate values from a dataset.
5. Perform random sampling on a dataset using Python.
6. Write a Python script to perform over-sampling and under-sampling on an imbalanced dataset.
7. How would you identify and remove redundant attributes from a dataset?

Analyze

1. What are the challenges of using NoSQL databases for structured data?
2. Compare the effectiveness of different missing data imputation techniques.
3. Analyze the challenges faced in data fusion from multiple sources.
4. Why is data redundancy sometimes necessary in distributed databases?
5. Unit IV: Data Transformation and Messaging
6. Compare Z-score standardization and Min-Max scaling.
7. Analyze the effectiveness of different binning techniques.

Course Outcomes

At the end of the course, students will be able to

1. Explain the basics of data visualization, including its importance, aesthetics, and coordinate systems.
2. Apply data mapping techniques using colors, scales, and different visualization types.
3. Create visualizations for amounts using bar plots, dot plots, and heatmaps.
4. Analyze distributions using histograms, density plots, and Q-Q plots.
5. Illustrate proportions and nested proportions using pie charts, stacked bars, and treemaps.
6. Interpret relationships among multiple variables using scatterplots, correlograms, and dimension reduction techniques.

COs-POs Mapping

COs	PO1	PO2	PO3	PO5	PO10
1	3	2	-	2	3
2	3	2	3	3	1
3	2	3	3	3	2
4	3	3	2	2	2
5	3	2	3	2	1
6	3	3	3	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 hours****Introduction to Data Visualization**

Introduction: Definition, Importance of Data Visualization, Ugly, Bad, and Wrong figures,

Visualizing Data: Mapping Data onto Aesthetics - Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes - Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes.

Advantages of Data Visualization, Limitations of Data Visualization

Unit II**12 hours****From Data to Visualization**

Color Scales: Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight

Directory of Visualizations: Amounts, Distributions, Proportions, x-y relationships, Geospatial Data, Uncertainty

Visualizing Amounts: Bar plots, Grouped and stacked bars, Dot Plots and Heatmaps

Visualizing Distributions: Histograms and Density Plots - Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time

Geospatial Data- Projections, Layers, Choropleth, Cartograms

Unit III**12 hours**

Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots - Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile-Quantile Plots

Visualizing Many Distributions at Once: Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis.

Visualizing Proportions:

A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total.

Individual Time Series, Multiple Time Series and Dose- Response Curves.

Unit IV

12 hours

Visualizing Nested Proportions: Nested Proportions Gone Wrong, Mosaic Plots and Tree maps, Nested Pies, Parallel Sets

Visualizing Associations Among Two or More Quantitative Variables: Scatterplots, Correlograms, Dimension Reduction, Paired Data.

Visualizing Trends- Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition

Visualization Tools - Tableau, Power BI, Qlik, and Infogram.

Total: 48hours

Textbook (s)

1. Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st edition, O'Reilly Media Inc, 2019.
2. Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization, O'Reilly, 2016
3. Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Press, 2018

Reference (s)

1. "Data Visualisation: A Handbook for Data Driven Design" by Andy Kirk
2. "Fundamentals of Data Visualization" by Stephen Few
3. "The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios" by Andy Kirk

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam /Assignment (%)
Remember	20	20	--
Understand	40	40	--
Apply	20	20	50
Analyze	20	20	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember:

1. Define data visualization and explain its importance.
2. List the different types of coordinate systems used in data visualization.
3. Identify the key components of mapping data onto aesthetics.
4. Name different types of plots used to visualize distributions.
5. Recall the various methods used to visualize proportions.

Understand:

1. Explain how aesthetics and data types of influence data visualization.
2. Describe the role of colour in distinguishing, representing, and highlighting data values.
3. Differentiate between Cartesian coordinates and coordinate systems with curved axes.
4. Interpret the significance of histograms and density plots in visualizing distributions.
5. Summarize the advantages and limitations of using pie charts, stacked bars, and treemaps for visualizing proportions.

Apply:

1. Apply appropriate aesthetics to visualize a dataset with categorical and numerical variables.
2. Use a color scale to highlight key trends in a heatmap representation of sales data.
3. Construct a histogram and density plot to compare the distribution of two different datasets.
4. Demonstrate the use of stacked bar charts to represent population proportions across multiple regions.

5. Implement a scatterplot to analyze the relationship between two quantitative variables in a given dataset.

Analyze:

1. Analyze the impact of choosing nonlinear axes instead of Cartesian coordinates in data visualization.
2. Compare different visualization techniques for representing proportions, such as pie charts, stacked bars, and treemaps.
3. Examine how colour scales affect the interpretation of data in heatmaps and density plots.
4. Differentiate between empirical cumulative distribution functions and Q-Q plots for analyzing distributions.
5. Investigate how dimension reduction techniques help in visualizing high-dimensional data relationships.

Course Outcomes

At the end of the course, students will be able to

1. Explain the fundamentals of time series data analysis.
2. Apply various statistical and machine learning techniques to model time series data.
3. Implement time series models using Python libraries.
4. Visualize time series data and interpret key patterns and trends.
5. Analyse and forecast time series data using advanced techniques.
6. Solve real-world time series problems through case studies.

COs-POs Mapping

COs	PO1	PO2	PO3	PO10	PO12
1	3	3	-	1	2
2	2	2	2	2	2
3	3	3	3	2	2
4	3	2	3	3	2
5	3	2	2	2	2
6	3	3	2	1	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT-I Fundamentals of Time Series Data**12 hours**

Introduction to Time Series - Trend, seasonality, cyclicity, and irregularity. **Different types of time series data** - Univariate vs Multivariate, Cross-sectional, Time Series Data, panel data. **Models for time series analysis** - Zero mean models, Random Walk, Trend models, and Seasonality models. **Exploratory Data Analysis (EDA)**-Data Cleaning and Handling Missing Data, Basic Time Series Visualizations (Line plots, ACF, PACF), Autocorrelation and Partial Autocorrelation Functions, Time Series Decomposition.

Fourier Analysis in Time Series, Wavelet Transform for Time Series Analysis

UNIT-II Time Series Modelling with Machine Learning**12 Hours**

Introduction to Machine Learning for Time Series: Supervised vs Unsupervised Learning, Feature Engineering for Time Series, and Time Series Forecasting vs Classification. **Autoregressive Integrated Moving Average (ARIMA)**- Overview of AR, MA, and ARIMA Models, Hyperparameter Tuning using ACF and PACF, and Forecasting with ARIMA. **Machine Learning Algorithms for Time Series** -Random Forests for Time Series Forecasting, XGBoost and Gradient Boosting for Time Series Data. **Handling Non-Stationary Data**- Differencing and Transformation Techniques.

Anomaly Detection in Time Series using Isolation Forests, Transfer Learning for Time Series Forecasting

Unit-III Advanced Time Series Modelling**12 hours**

Seasonal Decomposition of Time Series (STL)- Decomposition using Seasonal-Trend decomposition using LOESS, Modelling and Forecasting with Seasonal Decomposition. **Long Short-Term Memory (LSTM) Networks** -Introduction to Recurrent Neural Networks (RNNs), Building LSTM Models for Time Series Forecasting, Hyperparameter Tuning, **Model Evaluation and Selection**- Cross-validation for Time Series Data and Metrics: RMSE, MAE, MAPE, AIC, BIC.

Bayesian Methods for Time Series Forecasting, Hybrid Models (Combining ARIMA with Machine Learning)

Unit-IV: Time Series Data Visualization and Case Studies**12 hours**

Time Series Visualization Techniques: Visualizing Trends, Seasonality, and Anomalies, Advanced Visualization: Heatmaps, Boxplots, Violin Plots, Dynamic Plots using Plotly and Matplotlib, **Case Studies and Applications:** Case Study 1: Forecasting Stock Prices, Case Study 2: Predicting Electricity Consumption, Case Study 3: Sales Forecasting using Machine Learning.

Geospatial Time Series Analysis, Real-Time Time Series Forecasting Systems

Total: 48hours

Textbooks

1. Practical time series analysis: master time series data processing, visualization, and modelling using Python, 1st edition, Avishek Pal and PKS Prakash, Packt Publishing, 2017.
2. Machine Learning for Time-Series with Python: Forecast, predict, and detect anomalies with state-of-the-art machine learning methods, 1st edition, Ben Auffarth, Packt Publishing, 2021.
3. Time Series Analysis with Python Cookbook: Practical recipes for exploratory data analysis, data preparation, forecasting, and model evaluation, 1st edition, Tarek A. Atwan, Packt Publishing, 2022

References:

1. Introduction to Time Series Forecasting with Python - How to Prepare Data and Develop Models to Predict the Future, 1st edition, Jason Brownlee, v1.9, 2020.
2. Pandas Cookbook: Recipes for Scientific Computing, Time Series Analysis and Data Visualization using Python, 1st edition, Theodore Petrou, Packt Publishing, 2017.
3. Online Resources:
 - www.machinelearningmastery.com
 - www.kaggle.com

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	20	20	50
Analyze	20	20	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Questions

Remember:

1. Define time series data and explain its key characteristics.
2. What are the components of a time series? Provide examples.
3. Define stationarity in time series and explain its importance in modelling.
4. What is the purpose of ACF (Autocorrelation Function) and PACF (Partial Autocorrelation Function)?
5. List the different methods used for time series decomposition.

Understand:

1. Explain the difference between univariate and multivariate time series data.
2. Describe the concept of seasonality in time series and how it can be detected.
3. How does the Augmented Dickey-Fuller (ADF) test work, and what does it indicate?
4. Explain how moving averages can be used for trend estimation.
5. What is the significance of using train-test splits in time series modelling?

Apply:

1. Given the time series data: **[120, 135, 150, 165, 180, 195, 210]**, apply a 3-point moving average to smooth the series.
2. Perform first-order differencing on the following time series: **[10, 20, 30, 40, 50]**.

3. Given an AR(1) model $Y(t) = 0.7Y(t-1) + \epsilon(t)$, forecast the next value when $Y(5) = 100$ and $\epsilon(5) = 2$.
4. Using Python, apply the **Augmented Dickey-Fuller test** on a given dataset and interpret the result.
5. Given a dataset of monthly sales, build an ARIMA model and forecast the next 6 months.

Analyse:

1. Compare and contrast ARIMA and LSTM models for time series forecasting.
2. Analyse the impact of differencing on stationarity and model performance.
3. Compare the computational efficiency of Random Forest, XGBoost, and Neural Networks in time series forecasting.
4. Discuss the advantages and limitations of using Facebook Prophet for time series prediction.
5. Analyse the importance of cross-validation in time series forecasting and compare different techniques.

Course Outcomes

At the end of the course, students will be able to

1. Explain AI and Business Intelligence concepts and their role in improving business processes.
2. Demonstrate an understanding of Business Analytics, data-driven decision-making techniques.
3. Apply machine learning techniques to solve business problems like customer segmentation and sales forecasting.
4. Apply forecasting techniques such as time-series analysis, ARIMA, and regression models to support business decision-making and optimize performance.
5. Demonstrate understanding about AI-driven decision support systems for business strategies.
6. Analyze real-world business cases and identify AI-powered BI tools for innovation.

COs-POs Mapping

COs	PO1	PO2	PO3	PO5	PO12
1	3	2	2	2	2
2	3	3	2	3	3
3	3	3	3	3	2
4	3	3	3	3	2
5	3	3	3	3	2
6	3	3	3	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**8 hours****Introduction to Artificial Intelligence and Business Intelligence**

Artificial Intelligence: Definition and scope of AI, Types of AI: Narrow AI, General AI, and Super intelligence, Applications of AI in business

Fundamentals of Business Intelligence: Definition and components of Business Intelligence (BI), Data Collection and Data Sources, Relationship between AI and BI

AI and BI Integration: Role of AI in enhancing BI capabilities, Data-driven business strategies.

BI tools and technologies

Unit II**8 hours****Introduction to Business Analytics**

Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future. Recommender Systems, Automated Decision-Making, Reinforcement Learning for Decision-Making.

Business Analytics tools, Social Media KPIs

Unit III**8 hours****Machine Learning Models for Business Intelligence**

Data mining, Text mining, Web mining, Spatial mining, Process mining, Data warehouse and datamarts.

Data mining process KDD, CRISP-DM, SEMMA and Domain-Specific, Classification and Prediction performance measures -RSME, MAD, MAP, MAPE, Confusion matrix.

Application of ML models in sales forecasting, customer segmentation, Applications in market basket analysis.

SVM, Ensemble Models

Unit IV**8hour****AI for Predictive and Prescriptive Analytics in Business**

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, ARIMA, Theil's coefficient.

Coefficient of Variation, Shannon Diversity Index, Simpson's Diversity Index.

AI for decision support systems (DSS), Prescriptive models in supply chain management, inventory control

Real-world applications of AI and BI: Healthcare, Finance, Marketing, E-commerce

Total: 32 hours

Textbooks:

1. Artificial Intelligence for Business" – John Paul Mueller & Luca Massaron
2. Business Intelligence: A Managerial Perspective on Analytics" – Ramesh Sharda, Dursun Delen, and Efraim Turban
3. Artificial Intelligence for Business: A Roadmap for Getting Started with AI" – Doug Rose
4. Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking" – Foster Provost & Tom Fawcett
5. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die – Eric Siegel.

Reference Books:

1. "Artificial Intelligence: A Guide for Thinking Humans" – Melanie Mitchell
2. Business Intelligence Guidebook: From Data Integration to Analytics" – Rick Sherman
3. The AI Advantage: How to Put the Artificial Intelligence Revolution to Work" – Thomas H. Davenport
4. Deep Learning for Business with Python" – Nikhil Ketkar & Jojo Moolayil

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	20	20	50
Analyze	20	20	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define Artificial Intelligence and Business Intelligence.
2. List five AI-powered BI tools commonly used in industries.
3. What are the key components of a Business Intelligence System?
4. Identify different types of Machine Learning algorithms used in AI for BI.
5. Describe the role of data preprocessing in Business Intelligence.

Understand

1. Explain how AI enhances Business Intelligence in decision-making.
2. Differentiate between Descriptive, Predictive, and Prescriptive Analytics in BI.
3. Describe how data visualization improves BI reporting.
4. Interpret the impact of AI-driven automation on business processes.
5. Explain the importance of data quality in AI-based BI models.

Apply:

1. Apply machine learning techniques to identify customer segments in an e-commerce business.
2. Demonstrate how to use data preprocessing techniques to clean a business dataset.
3. Given a dataset, implement a predictive analytics model to forecast sales.

4. Use AI tools to analyze customer sentiment from online reviews.
5. Design a BI dashboard using a real-world dataset to visualize business insights.

Analyze:

1. Analyze the differences between traditional BI and AI-powered BI.
2. Examine how AI-based chatbots improve customer engagement and business intelligence.
3. Compare supervised and unsupervised learning in BI applications.
4. Investigate the ethical challenges of AI in business decision-making.
5. Analyze the impact of real-time AI analytics on supply chain management.