MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

MADANAPALLE

(UGC-AUTONOMOUS)

www.mits.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (NETWORKS)

Course Structure

&

Detailed Syllabi

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the Academic Year 2023-24

and

B. Tech. Lateral Entry Scheme from the Academic Year 2024-25

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (NETWORKS)

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: COMPUTER SCIENCE AND ENGINEERING (NETWORKS)

Total Credits	163 Credits for 2023(Regular) & 123 Credits 2024(Lateral Entry) Admitted Batch onwards

I. Induction Program and Holistic Development Activities

Sl.No	Title	Duration
1	Induction Program (Mandatory)	Three weeks' duration at the start of First Year

R23 - Curriculum Structure
I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BS&H	23MAT101	Linear Algebra and Calculus	3	0	0	3	3
2	BS&H	23PHY101	Engineering Physics	3	0	0	3	3
3	ESC	23EEE101	Basic Electrical and Electronics Engineering	3	0	0	3	3
4	ESC	23CSE101	Introduction to Programming	3	0	0	3	3
5	ESC	23ME101	Engineering Graphics	1	0	4	5	3
6	BS&H	23PHY201	Engineering Physics Laboratory	0	0	2	2	1
7	ESC	23EEE201	Electrical and Electronics Engineering Workshop	0	0	3	3	1.5
8	ESC	23CSE201	Computer Programming Laboratory	0	0	3	3	1.5
9	ESC	23CSE202	IT Workshop	0	0	2	2	1
10	BS&H	23HUM202	NSS / NCC / Scouts and Guides / Community Service	-	-	1	1	0.5
Total				**13**	**0**	**15**	**28**	**20.5**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BS&H	23ENG101	Communicative English	2	0	0	2	2
2	BS&H	23MAT102	Differential Equations and Vector Calculus	3	0	0	3	3
3	BS&H	23CHE102	Chemistry	3	0	0	3	3
4	ESC	23CME101	Basic Civil and Mechanical Engineering	3	0	0	3	3
5	PCC	23CSE102	Data Structures	3	0	0	3	3
6	HSC	23ENG201	Communicative English Laboratory	0	0	2	2	1
7	BS&H	23CHE202	Chemistry Laboratory	0	0	2	2	1
8	ESC	23ME201	Engineering Workshop	0	0	3	3	1.5
9	PCC	23CSE203	Data Structures Laboratory	0	0	3	3	1.5
10	BS&H	23HUM201	Health and Wellness, Yoga and Sports	-	-	1	1	0.5
Total				**14**	**0**	**11**	**25**	**19.5**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

R23 - Curriculum Structure
II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	23HUM101	Universal Human Values	2	1	0	3	3
2	HSMC	23HUM102	Economics and Financial Accounting For Engineers	2	0	0	2	2
3	BSC	23MAT107	Probability and Statistics for Computer Science	3	0	0	3	3
4	ESC	23CSN103	Digital Logic and Computer Organization	3	0	0	3	3
5	PCC	23CSN101	Object-Oriented Programming Through JAVA	3	0	0	3	3
6	PCC	23CSN102	Operating Systems	3	0	0	3	3
7	PCC	23CSN201	Object-Oriented Programming Through JAVA Laboratory	0	0	3	3	1.5
8	PCC	23CSN202	Operating Systems Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – I** *(Refer ANNEXURE - VI)*	1	0	2	3	2
Total				**17**	**1**	**8**	**26**	**22**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	23MAT108	Discrete Mathematical Structures	3	0	0	3	3
2	ESC		**Design Thinking and Innovation Related Courses** *(Refer ANNEXURE - II)*	1	0	2	3	2
3	PCC	23CSN104	Data Communications and Computer Networks	3	0	0	3	3
4	PCC	23CSN105	Automata Theory and Compiler Design	2	1	0	3	3
5	PCC	23CSN106	Advanced Data Structures and Algorithms Analysis	2	1	0	3	3
6	PCC	23CSN203	Computer Networks Laboratory	0	0	3	3	1.5
7	PCC	23CSN204	Advanced Data Structures and Algorithms Analysis Laboratory	0	0	3	3	1.5
8	SEC		**Skill Enhancement Course – II** *(Refer ANNEXURE - VI)*	1	0	2	3	2
9	AUC	23CHE901	Environmental Science	2	0	0	2	-
Total				**14**	**2**	**10**	**26**	**19**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

R23 - Curriculum Structure
III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CSN107	Cryptography and Network Security	2	1	0	3	3
2	PCC	23CSN108	Database Management Systems	3	0	0	3	3
3	PCC	23CSN109	Network Programming	3	0	0	3	3
4	ESC	23PHY102	Introduction to Quantum Technologies and Applications	3	0	0	3	3
5	PE		**Professional Elective-I** *(Refer ANNEXURE - IV)*	3	0	0	3	3
6	OE		**Open Elective – I** *(Refer ANNEXURE - III)*	3	0	0	3	3
7	PCC	23CSN205	Database Management Systems Laboratory	0	0	3	3	1.5
8	PCC	23CSN206	Network Programming Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – III** *(Refer ANNEXURE - VI)*	1	0	2	3	2
10	AUC	23ENG901	Technical Paper Writing and IPR	2	0	0	2	-
11	PROJ	23CSN701	Summer Internship I	0	0	4	4	2
Total				**20**	**1**	**12**	**33**	**25**

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CSN110	Software Engineering	2	1	0	3	3
2	PCC	23CSN111	Internetworking with TCP/IP	3	0	0	3	3
3	PCC	23CSN112	Cloud Computing	3	0	0	3	3
4	PE		**Professional Elective - II** *(Refer ANNEXURE - IV)*	3	0	0	3	3
5	PE		**Professional Elective - III** *(Refer ANNEXURE - IV)*	3	0	0	3	3
6	OE		**Open Elective - II** *(Refer ANNEXURE - III)*	3	0	0	3	3
7	PCC	23CSN207	Internetworking with TCP/IP Laboratory	0	0	3	3	1.5
8	PCC	23CSN208	Cloud Computing Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – IV** *(Refer ANNEXURE - VI)*	1	0	2	3	2
10	ESC	23ECE501	Tinkering Laboratory	0	0	2	2	1
11	MC	23CSN901	Workshop *	0	0	0	0	0
Total				**18**	**1**	**10**	**29**	**24**

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* Domain specific workshop should be completed at the end of III Year I Semester

Tentative Structure for Final Year:

R23 - Curriculum Structure
IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CSN113	Blockchain Technology	3	0	0	3	3
2	MC		**Management Course** *(Refer ANNEXURE - V)*	2	0	0	2	2
3	PE		**Professional Elective – IV** *(Refer ANNEXURE - IV)*	3	0	0	3	3
4	PE		**Professional Elective – V** *(Refer ANNEXURE - IV)*	3	0	0	3	3
5	OE		**Open Elective - III** *(Refer ANNEXURE - III)*	3	0	0	3	3
6	OE		**Open Elective – IV** *(Refer ANNEXURE - III)*	3	0	0	3	3
7	SEC		**Skill Enhancement Course – V** *(Refer ANNEXURE - VI)*	1	0	2	3	2
8	AUC	23HUM901	Gender Sensitization	2	0	0	2	-
9	PROJ	23CSN702	Summer Internship II	0	0	4	4	2
Total				**20**	**0**	**6**	**26**	**21**

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PROJ	23CSN703	Project Work and Internship	0	0	24	24	12
Total				**0**	**0**	**24**	**24**	**12**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

- ***Proficiency modules***

  - Basic Computer Proficiency
  - Interpersonal skills
  - Computer Graphics
  - Web programming
  - Mobile Apps
  - Vocabulary enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-Development
6. Nature and Environment
7. Innovation

ANNEXURE - II

DESIGN THINKING AND INNOVATION RELATED COURSES (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1	23IIC5M01	Design, Technology and Innovation
2	23IIC5M02	Introduction on Intellectual Property to Engineers and Technologists
3	23IIC5M03	Product Engineering and Design Thinking
4	23IIC5M04	Intellectual Property Rights and Competition Law
5	23IIC5M05	Innovation, Business Models and Entrepreneurship
6	23IIC5M06	Understanding Incubation and Entrepreneurship
7	23IIC5M07	Intellectual Property
8	23IIC5M08	Roadmap for Patent Creation
Any new Innovation and Incubation Course offered by SWAYAM NPTEL can be appended in future.		

ANNEXURE – III

OPEN ELECTIVE – I (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	23HUM301	Indian Knowledge System	Humanities
2	23MAT301	Advanced Numerical Methods	Mathematics
3	23MAT302	Engineering Optimization	Mathematics
4	23PHY301	LASER Physics and Advanced LASER Technology	Physics
5	23PHY302	Thin Film Technology and its Applications	Physics
6	23PHY303	Waste To Sustainable Energy and Energy Systems	Physics
7	23CHE301	Chemistry of Polymers and its Applications	Chemistry
8	23CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
9	23CHE303	Chemistry of Energy Systems	Chemistry
10	23CE301	Disaster Management	Civil
11	23CE302	Green Buildings	Civil
12	23ME301	Materials Science for Engineers	Mechanical
13	23ME302	Sustainable Energy Technologies	Mechanical
14	23EEE301	Electrical Safety Practices and Standards	EEE
15	23EEE302	Introduction to MEMS	EEE
16	23ECE301	Bio-Medical Electronics	ECE
17	23ECE302	VLSI Design	ECE
Any new Interdisciplinary Course can be appended in future.			

OPEN ELECTIVE – II (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	23HUM3M01	English Language for Competitive Exams	Humanities and Social Sciences
2	23HUM3M02	Public Speaking	Humanities and Social Sciences
3	23HUM3M03	Indian Business History	Humanities and Social Sciences
4	23HUM3M04	Indian Economy: Some Contemporary Perspectives	Humanities and Social Sciences
5	23MG3M01	E – Business	Management
6	23MG3M02	AI in Human Resource Management	Management
7	23MG3M03	AI in Marketing	Management
8	23MG3M04	Artificial Intelligence for Investments	Management
9	23CE3M01	Plastic Waste Management	Civil
10	23CE3M02	Safety in Construction	Civil
11	23ME3M01	Operations Management	Mechanical
12	23EEE3M01	Transducers For Instrumentation	EEE
13	23ECE3M01	Microprocessors and Interfacing	ECE
14	23ECE3M02	Microprocessors and Microcontrollers	ECE
15	23MD3M01	Research Methodology	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

OPEN ELECTIVE – III

(To be offered under MOOC's Category from SWAYAM – NPTEL)

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	23HUM3M05	Indian Society: Sociological Perspectives	Humanities and Social Sciences
2	23MAT3M01	Foundations of R Software	Mathematics
3	23MAT3M02	Foundations of R Software (in Hindi Language)	Mathematics
4	23MGM05	HR Analytics	Management
5	23MG3M06	Management Information System	Management
6	23MG3M07	Business Analytics & Text Mining Modeling Using Python	Management
7	23CE3M03	Building Materials and Composites	Civil
8	23ME3M02	Power Plant Engineering	Mechanical
9	23EEE3M02	Design of Photovoltaic Systems	EEE
10	23ECE3M03	System Design Through Verilog	ECE
11	23MD3M03	Learning Analytics Tools	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

OPEN ELECTIVE – IV

(To be offered under Conventional Mode)

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	23PHY304	Smart Materials and Devices	Physics
2	23CHE304	Introduction to Nano Science and Technology	Chemistry
3	23CHE304	Water Pollution and its Management	Chemistry
4	23CE303	Environmental Impact Assessment	Civil
5	23CE304	Ground Improvement Techniques	Civil
6	23CE305	Sustainability in Engineering Practice	Civil
7	23ME303	Total Quality Management	Mechanical
8	23ME304	3D Printing Technologies	Mechanical
9	23EEE303	Robotics	EEE
10	23ECE303	Embedded Systems	ECE
11	20ECE304	DSP Architecture	ECE
12	20ECE305	Community Radio Technology	ECE
Any new Interdisciplinary Course can be appended in future.			

ANNEXURE - IV

List of Professional Elective

Professional Elective – I (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	23CSN4M01	Privacy and Security in Online Social Media
2.	23CSN4M02	Distributed Systems
3.	23CSN4M03	Social Networks
4.	23CSM4M04	Advanced Computer Architecture
5.	23CSM4M05	Human Computer Interaction (in English)
6.	23CSM4M06	Human Computer Interaction (in Hindi)
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Professional Elective – II		
Sl. No.	**Course Code**	**Course Title**
1.	23CSN401	Image Processing
2.	23CSN402	Advanced Computer Networks
3.	23CSN403	Mobile Application Development
4.	23CSN404	Network Administration
5.	23CSN405	DevOps
Any advanced courses can be appended in future.		

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	23CSN406	Graph Neural Networks
2.	23CSN407	Artificial Intelligence
3.	23CSN408	Natural Language Processing
4.	23CSN409	Cyber Forensics
5.	23CSN410	Big Data Analytics
Any advanced courses can be appended in future.		

Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	23CSN411	Generative AI
2.	23CSN412	Wireless Networks
3.	23CSN413	Internet of Things
4.	23CSN414	Real Time Systems
5.	23CSN415	Game Theory
Any advanced courses can be appended in future.		

Professional Elective –V		
Sl. No.	**Course Code**	**Course Title**
1	23CSN416	Machine Learning
2	23CSN417	Neural Networks and Deep Learning
3	23CSN418	Wireless Security
4	23CSN419	Adhoc and Sensor Networks
5	23CSN420	Information Retrieval Systems
Any advanced courses can be appended in future.		

ANNEXURE - V

MANAGEMENT COURSE		
Sl. No.	**Course Code**	**Course Title**
1	23HUM103	Business Ethics and Corporate Governance
2	23HUM104	Principles of Management
3	23HUM105	Human Resource Development
4	23HUM106	Management Science
5	23HUM107	National Cadet Corps

ANNEXURE - VI

List of Skill Enhancement Courses

Skill Enhancement Course – I		
Sl. No.	**Course Code**	**Course Title**
1.	23CSN601	Python Programming
Any Courses can be appended in future.		

Skill Enhancement Course – II		
Sl. No.	**Course Code**	**Course Title**
1.	23CSN602	Data Science using Python
Any Courses can be appended in future.		

Skill Enhancement Course – III		
Sl. No.	**Course Code**	**Course Title**
1.	23CSN603	UI Design
Any Courses can be appended in future.		

Skill Enhancement Course – IV		
Sl. No.	**Course Code**	**Course Title**
1.	23ENG601	Soft Skills
Any Courses can be appended in future.		

Skill Enhancement Course – V		
Sl. No.	**Course Code**	**Course Title**
1.	23CSN604	Ethical Hacking
2.	23CSN605	Web Programming
Any Courses can be appended in future.		

ANNEXURE – VII

Minor in Quantum Computing

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Stream Name: Quantum Computing

Sl. No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23MDINS101	Introduction to Quantum Computing	3	0	0	3	3
2	Professional Core Course	23MDINS102	Mathematical Foundations for Quantum Computing	3	0	0	3	3
3	Professional Core Course	23MDINS201	Quantum Programming and Simulation Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23MDINS103	Quantum Algorithms	3	0	0	3	3
5	Professional Core Course	23MDINS104	Quantum Information and Communication	3	0	0	3	3
6	Professional Core Course	23MDINS202	Quantum Algorithms Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23MDINS105	Quantum Machine Learning (QML)	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

Minor in Quantum Technologies

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Stream Name: Quantum Technologies

Sl. No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23MDINS106	Foundations of Quantum Technologies	3	0	0	3	3
2	Professional Core Course	23MDINS107	Solid State Physics for Quantum Technologies	3	0	0	3	3
3	Professional Core Course	23MDINS203	Quantum Devices and Materials Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23MDINS108	Introduction to Quantum Communication	3	0	0	3	3
5	Professional Core Course	23MDINS109	Introduction to Quantum Sensing	3	0	0	3	3
6	Professional Core Course	23MDINS204	Quantum Communication and Sensing Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23MDINS110	Quantum Optics Prerequisites for Quantum Technologies	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

ANNEXURE - VIII

Honors in CSE (Networks)

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23HDCSN101	Intrusion Detection and Prevention System	3	0	0	3	3
2	Professional Core Course	23HDCSN102	Cloud Security	3	0	0	3	3
3	Professional Core Course	23HDCSN201	Cloud Security Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23HDCSN103	Cyber Laws and Ethics	3	0	0	3	3
5	Professional Core Course	23HDCSN104	Network Management Systems and Operations	3	0	0	3	3
6	Professional Core Course	23HDCSN202	Network Management Systems and Operations Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23HDCSN105	5G Technologies	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

I Year I Semester

B. Tech I Year I Semester

23MAT101 LINEAR ALGEBRA AND CALCULUS

L	T	P	C
3	0	0	3

Course Objectives:

To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

UNIT I MATRICES **9 hours**

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, Jacobi and Gauss Seidel Iteration Methods.

UNIT II EIGENVALUES, EIGENVECTORS AND ORTHOGONAL TRANSFORMATION **9 hours**

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 canonicalforms by Orthogonal Transformation.

UNIT III CALCULUS **9 hours**

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.

UNIT IV PARTIAL DIFFERENTIATION AND APPLICATIONS (MULTI VARIABLE CALCULUS) **9 hours**

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functionsof two variables, method of Lagrange multipliers.

UNIT V MULTIPLE INTEGRALS (MULTI VARIABLE CALCULUS) **9 hours**

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).

Course Outcomes:

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

CO1: Solve the system of linear equations and apply the matrix algebra techniques in practical applications.

CO2: Utilize the Eigenvalues, Eigenvectors and applications of diagonalization in the field of Science and Technology.

CO3: Relate the results of mean value theorems in real life problems.

CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.

CO5: Compute the area and volume by interlinking them to appropriate double and triple integrals.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition

2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14^{th} Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, AlphaScience International Ltd., 2021 5^{th} Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5^{th}Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9^{th}edition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23PHY101 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

UNIT I WAVE OPTICS 9 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 9 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 QUANTUM MECHANICS AND FREE ELECTRON THEORY 9 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

UNIT IV SEMICONDUCTORS 9 hours

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.

UNIT V DIELECTRIC AND MAGNETIC MATERIALS 9 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.

Course Outcomes:

CO1: Apply the knowledge of Interference, Diffraction and Polarization techniques for materials testing and explore their applications in both science and technology.

CO2: Explain the crystal structure in terms of atomic positions, unit cells, and crystal symmetry and also relate the crystal symmetry to the symmetry observed in a diffraction pattern.

CO3: Evaluate the Schrodinger wave equations for simple potentials and explain the concept of conductivity of different types of materials.

CO4: Distinguish the semiconductors using Fermi level and identify the type of semiconductors using Hall effect.

CO5: Explain the origin of fundamental magnetic phenomena and types of magnetic materials. Understand the induced fields in dielectrics, and electrical behaviour of dielectrics.

Text Books:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS ArunMurthy, S. Chand Publications, 11th Edition 2019.

2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.

2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.

3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010

4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23EEE101 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

- To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC CIRCUITS 8 hours

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: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II MACHINES AND MEASURING INSTRUMENTS 8 hours

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

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

UNIT III ENERGY RESOURCES, ELECTRICITY BILL & SAFETY MEASURES 8 hours

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, two-part electricitytariff, calculation of electricity bill for domestic consumers.

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

Course Outcomes:

After the completion of the course students will be able to

CO1: Infer the basic AC and DC electrical circuits.

CO2: Analyze construction and operation of AC and DC machines, different electrical measuring instruments.

CO3: Illustrate operation of various power generating stations, energy consumption and electrical safety.

Text Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti,Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019,Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford UniversityPress, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.

UNIT I SEMICONDUCTOR DEVICES 8 hours

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - 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.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION 8 hours

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III DIGITAL ELECTRONICS 8 hours

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of BooleanAlgebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only).

Course Outcomes:

After the completion of the course students will be able to

CO1: Explain the theory, construction, and operation of electronic devices.

CO2: Apply the concept of science and mathematics to explain the working of diodes, transistors, and their applications.

CO3: Analyze logic gates and its applications in design of combinational circuits.

Text Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.

2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.

3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version,Pearson Education,2009.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23CSE101 INTRODUCTION TO PROGRAMMING

L	T	P	C
3	0	0	3

Course Objectives:

- Comprehensive knowledge to computer systems, programming languages, and problem-solving techniques.
- Know the concept of control structures and their usage in programming.
- Introduce to the arrays, memory models, and basic string concepts
- Gain a knowledge from the concept of functions, including declaration, definition, and various aspects of function usage.
- Acquire the advanced programming concepts, including user-defined data types, pointers, and file handling.

UNIT I INTRODUCTION TO PROGRAMMING AND PROBLEM SOLVING **9 hours**

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II CONTROL STRUCTURES **9 hours**

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do- while) Break and Continue.

UNIT III ARRAYS AND STRINGS **9 hours**

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings, String Operations and String functions.

UNIT IV POINTERS & USER DEFINED DATA TYPES **9 hours**

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions, Dynamic memory allocation.

UNIT V FUNCTIONS & FILE HANDLING **9 hours**

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation**.**

Course Outcomes:

A student after completion of the course will be able to

CO1: Illustrate the basic computer concepts and programming principles of C language.

CO2: Develop programs using various control structures in 'C'.

CO3: Design applications using arrays and basic string manipulation.

CO4: Demonstrate the applications of pointers, user-defined types and dynamic memory allocation.

CO5: Design various applications using functions and file concepts.

Text Books:

1. C Programming, A Problem Solving Approach, Forouzan, Gilberg,Prasad, CENGAGE, 3rd edition.

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-HillEducation, 2008.

2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition

3. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988

4. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education,1996

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23ME101 ENGINEERING GRAPHICS

L	T	P	C
1	0	4	3

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing.
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

UNIT I **9 hours**

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.
Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.
Scales: Plain scales, diagonal scales and vernier scales.

UNIT II **9 hours**

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.
Projections of Straight Lines: 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.

UNIT III **9 hours**

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 and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV **9 hours**

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.

UNIT V **9 hours**

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.
Computer graphics: Creating 2D&3D drawings ofobjects including PCB and Transformations using Auto CAD (Not for end examination).

Course Outcomes:

Students will use the Auto CAD software and will be able to
CO1: Construct the geometrical constructions, engineering curves and scales.
CO2: Draw the projections of points, straight lines and planes
CO3: Draw the projections of solids in various positions
CO4: Sketch the sections of solids and developments of surfaces
CO5: Draw the conversion of the isometric views to orthographic views and vice versa.

Text Books:

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

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.

2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.

3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, TataMcGraw Hill, 2017.

Mode of Evaluation: Day-to-day Evaluation, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23PHY201 ENGINEERING PHYSICS LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a Compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

Course Outcomes:

CO1: Know the various phenomena of light practically and gain knowledge about various optical technique methods.
CO2: Verify the theoretical concepts of optics, magnetism and dielectrics by hands on experiment.
CO3: Apply the scientific process in the conduct of semiconductor experiments and report the experimental findings.
CO4: Understand mechanical phenomena by instruments and apply them in real time applications.
CO5: Acquire and interpret experimental data to examine the physical laws.

Web Resources:

www.vlab.co.in
https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

Reference Books:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.

3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; AtulPrakashan, 2021-22.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23EEE201 ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

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 usedby 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 thestudents.
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 LABORATORY

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.

Course Outcomes:

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

CO1: Analyze basic DC circuits.

CO2: Understand the usage of common electrical & electronic measuring instruments.

CO3: Understand the basic characteristics of electrical machines and perform energy calculations.

PART B: ELECTRONICS ENGINEERING LABORATORY

Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

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 rectifier.
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gatesusing ICs.
8. 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.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using Hardware / Software.

Course Outcomes:

At the end of the course, the student will be able to
CO1: Plot and discuss the characteristics of various electron devices.
CO2: Explain the operation of a digital circuit.

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 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.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23CSE201 COMPUTER PROGRAMMING LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

- Provide hands-on experience in programming fundamentals, algorithm design, and basic problem-solving techniques.
- Enable students to implement control structures for program flow control in practical scenarios.
- Reinforce understanding of arrays, memory models, and string manipulation through practical exercises
- Provide hands-on practice with functions, function calls, and parameter manipulation using pointers.
- Offer practical exposure to advanced programming concepts, including user-defined data types, file handling, and pointer operations.

UNIT I

WEEK 1

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

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with 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 seriesof finite steps both using textual notation 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.

Suggested Experiments/Activities:
Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.
Problems to Practice:

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT II

WEEK 4
Objective: Explore the full scope of expressions, type-compatibility of variables & constantsand operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:
Lab4: Write C program to solve Simple computational problems using the operator' precedence and associativity
Problems to Practice:

i) Evaluate the following expressions.
    a. A+B*C+(D*E) + F*G
    b. A/B*C-B+A*D/3
    c. A+++B---A
    d. J= (i++) + (++i)
ii) Find the maximum of three numbers using 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 one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 5: Write C program for Problems involving if-then-else structures.
Problems to Practice:

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 switch case.
v) Write a C program to find the given year is a leap year or not.

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 eachof these statements is more appropriate to use.

Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops
Lab 6: Write a C program for Iterative problems e.g., the sum of series
Problems to Practice:

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

UNIT III

WEEK 7:
Objective: Explore the full scope of 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:Write a C program to solve 1D Array manipulation, linear search
Problems to Practice:

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D 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 usedas Strings by using null character and get comfortable with string 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: Write a C program to solve Matrix problems, String operations, Bubble sort
Problems to Practice:

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

WEEK 9:

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 de-allocation using malloc (), calloc (), realloc () and free () functions. Gainexperience processing command-line arguments received by C

Suggested Experiments/Activities:
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Write a C program for Pointers and structures, memory dereference.
Problems to Practice:

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 alongwith the total.
v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures(Singly linked lists) and nested structures

Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the samewithout using bit- fields

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: Write a C program to solve Simple functions using call by value, solving differential equations using Eulers theorem.
Problems to Practice:

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'smethod

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functionsthat 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: Write C program for Recursive functions.

Problems to Practice:

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: Write a C program to solve Simple functions using Call by reference, Dangling pointers.

Problems to Practice:

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 othercharacters using pointers.

WEEK14:

Objective: To understand data files and file handling with various file I/O functions. Explore thedifferences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: Write a C program to handle File operations.

Problems to Practice:

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-linearguments.
v) Find no. of lines, words and characters in a file.

Write a C program to print last n characters of a given file.

Course Outcomes:

CO1: Implement coding and debugging the simple programs, create algorithms, and practice problem solving strategies using programming languages.

CO2: Demonstrate programs that incorporate conditional statements, loops, and break/continue statements to control program execution.

CO3: Apply coding for real time examples with arrays, array indexing, and manipulate strings in programming tasks.

CO4: Create, call, and debug functions, modify function parameters using pointers, and gain practical knowledge of variable scope within functions.

CO5: Apply user-defined data types, manipulate files, pointer operations to solve real-world programming challenges.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.

2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India

2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23CSE202 IT WORKSHOP

L	T	P	C
0	0	2	1

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSSTo teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

PC Hardware & Software Installation

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. Labinstructors should verify the work and follow it up with a Viva. Also students need to go throughthe 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. Labinstructor 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 (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configuredas dual boot (VMWare) with both Windows and BOSS. 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. Finallystudents should demonstrate, to the instructor, how to access the websites and email. If there isno 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 La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX 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 La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX 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 Colors, Inserting Header and Footer, Using Date and Time option in both La TeX 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

POWER POINT
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?'"

Course Outcomes:

CO1: Gain expertise in computer hardware, assembly, and dual-boot OS configuration, enhancing their ability to manage and troubleshoot computer systems effectively.
CO2: Learn to connect to the LAN, configure browsers, use search engines effectively, and practice cyber hygiene for secure internet use.
CO3: Create well-formatted documents and presentations using Microsoft Office and Latex
CO4: Gain proficiency in using Excel or its FOSS equivalent for tasks like scheduling, GPA calculation, data manipulation, and formatting.
CO5: Craft effective and tailored inputs to obtain desired responses from AI tools like ChatGPT.

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech,2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
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, David Anfins on and KenQuamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCOPress, Pearson Education, 3rd edition

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23HUM202 NSS/NCC/SCOUTS AND GUIDES/COMMUNITY SERVICE

L	T	P	C
0	0	1	0.5

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.

UNIT I ORIENTATION **5 hours**

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

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personaltalents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasingroad 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.
v)

UNIT II NATURE & CARE **5 hours**

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 **5 hours**

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders-Surveyin 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 PopulationEducation.
v) Any other programmes in collaboration with local charities, NGOs etc.

Course Outcomes:

After completion of the course the students will be able to

CO1: Understand the importance of discipline, character and service motto.

CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.

CO3: Explore human relationships by analyzing social problems.

CO4: Determine to extend their help for the fellow beings and downtrodden people.

CO5: Develop leadership skills and civic responsibilities.

Reference Books:

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

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:

- Evaluated for a total of 100 marks.
- 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.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

I Year II Semester

B. Tech I Year II Semester

23ENG101 COMMUNICATIVE ENGLISH

L	T	P	C
2	0	0	2

Pre-requisite: None

Course Objectives:

The main objective of introducing this course, Communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

UNIT I Lesson: HUMAN VALUES: Gift of Magi (Short Story) 6 hours

Listening: Identifying the topic, the context and specific pieces of information by listeningto 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 ofinformation.
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 II Lesson: NATURE: The Brook by Alfred Tennyson (Poem) 6 hours

Listening: Answering a series of questions about main ideas and supporting ideas afterlistening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structuretalks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to linkthe ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
Vocabulary: Homonyms, Homophones, Homographs.

UNIT III Lesson: BIOGRAPHY: Elon Musk 6 hours

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what

isdiscussed
Reading: Readinga text in detail by making basic inferences -recognizing and interpretingspecific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

UNIT IV **Lesson: INSPIRATION: The Toys of Peace by Saki** **6 hours**

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: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

UNIT V **Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)** **6 hours**

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

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

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

Vocabulary: Technical Jargons

Course Outcomes:

CO1: Understand the topic, context, and pieces of specific information from personal , professional and social situations

CO2: Apply discourse markers to speak clearly in formal discussions

CO3: Analyze and apply grammatical structures to formulate contextualized phrases and sentences

CO4: Analyze texts and images to write summaries based on global comprehension

CO5: Draft coherent paragraphs and structured essays

Text Books:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

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. Anchor, 2014.

Web Resources

Grammer

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23MAT102 DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

L	T	P	C
3	0	0	3

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

UNIT I DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE **9 hours**

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) **9 hours**

Definitions, homogenous and non-homogenous, complimentary function, general solution, 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 **9 hours**

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 DIFFERENTIATION **9 hours**

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

UNIT V VECTOR INTEGRATION **9 hours**

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 related problems.

Course Outcomes:

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

CO1: Find the solution of engineering problems formulated in the form of linear first order differential equations.

CO2: Solve the linear higher order differential equations related to various engineering fields.

CO3: Determine the solutions for linear partial differential equations that model the physical processes.

CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence.

CO5: Estimate the work done against field, circulation and flux using vector calculus.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition

2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10thEdition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, PearsonPublishers, 2018, 14th Edition.

2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones andBartlett, 2018.

3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018,5th Edition.

4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5th Edition (9th reprint).

5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23CHE102 CHEMISTRY

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

UNIT I STRUCTURE AND BONDING MODELS 9 hours

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of N2, O2 and NO, CO π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II MODERN ENGINEERING MATERIALS 9 hours

Semiconductors – Introduction, basic concept, role of doping agents, applications
Super conductors -Introduction, basic concept, applications.
Supercapacitors: Introduction, Basic Concept-Classification – Applications.
Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphene nanoparticles.

UNIT III ELECTROCHEMISTRY AND APPLICATIONS 9 hours

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).
Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.
Primary cells – Zinc-air battery, Sodium-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV POLYMER CHEMISTRY 9 hours

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation, Poly Dispersity Index (PDI) & it's significance
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), Poly Lactic Acid (PLA).

UNIT V INSTRUMENTAL METHODS AND APPLICATIONS 9 hours

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

Course Outcomes:

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

CO1: Explain the foundations of Quantum mechanics and concept of bonding in homo and hetero diatomic molecules like O2, CO etc.

CO2: Apply the principle of Band diagrams in the application of conductors and semiconductors. Properties and applications of nanomaterials.

CO3: Compare the materials of construction for battery, its working principles, fuel cells & electrochemical sensors.

CO4: Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.

CO5: Explain the principles of spectrometry, technique of HPLC in separation of solid and liquid mixtures. Summarize the concepts of Instrumental methods.

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.

2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.

3. G V Subba Reddy, K N Jayaveera, C Ramachandraiah, Engineering Chemistry, McGraw-Hill; First Edition, 2019.

Reference Books:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008

3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23CME101 BASIC CIVIL AND MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

PART A: BASIC CIVIL ENGINEERING

UNIT I BASICS OF CIVIL ENGINEERING 8 hours

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.

UNIT II SURVEYING 8 hours

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

UNIT III TRANSPORTATION ENGINEERING 8 hours

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.

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).

Course Outcomes:

CO1: Identify various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Measure of distances, angles and levels through surveying.

CO3: Identify various transportation infrastructures, sources of water and various water conveyance, storage structures like dams and reservoirs.

Text Books:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt.Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers.2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. FifthEdition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, KhannaPublishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, KhannaPublishers, 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.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives:

The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

UNIT I **8 hours**

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

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

UNIT II **8 hours**

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

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III **8 hours**

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 - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject).

Course Outcomes:

On completion of the course, the student should be able to

CO1: Understand the role and importance of mechanical engineering and engineering materials

CO2: Identify the different manufacturing processes for engineering applications and explain the basics of thermal engineering and its applications.

CO3: Explain the working of different mechanical power transmission systems, power plants and robotics.

Text Books:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India)Pvt. Ltd.

2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications,(India) Pvt. Ltd.

3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengagelearning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I

2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications

3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.

4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, TataMcGraw Hill publications (India) Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23CSE102 DATA STRUCTURES

L	T	P	C
3	0	0	3

Course Objectives:

- To attain proficiency in essential knowledge and skills for effectively employing linear data structures and making informed decisions when utilizing them to tackle real-world practical challenges.
- To gain a comprehensive understanding of linked lists, including their different types, operations, and practical applications.
- To explore stacks properties, operations and how stacks are utilized for the evaluation of mathematical expressions, including infix, postfix, and prefix notations.
- To understand the concepts of queues, their operations, and their applications in areas like breadth-first search and scheduling.
- To Provide an overview of Trees and Hashing as a technique for data organization.

UNIT I **9 hours**

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.

UNIT II **9 hours**

Linked Lists: 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

UNIT III **9 hours**

Applications of stacks in expression evaluation, backtracking, reversing list etc.

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

UNIT IV **9 hours**

Trees: Introduction to Trees, Binary Tree, Tree Traversal, Binary Search Tree – Insertion, Deletion & Traversal, Height Balanced Trees, Heap Tree, Heap Sort

UNIT V **9 hours**

Graphs: Representations, Biconnected components, Topological sort.

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.

Course Outcomes:

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

CO1: Apply their knowledge and skills in the context of linear data structures, algorithmic analysis, searching, and sorting, enabling them to solve practical problems.

CO2: Implement linked lists, stack and their applications.

CO3: Implement queues and its applications.

CO4: Implement tree operations for binary tree, binary search tree, height balanced trees and heap tree.

CO5: Design graph and analyse various collision resolution techniques for hashing.

Text Books:

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 PeterSanders

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 DavidRanum

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

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23ENG201 COMMUNICATIVE ENGLISH LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Course Outcomes:

CO1: Understand the English speech sounds, stress, rhythm, intonation and syllabic division for better listening and speaking
CO2: Apply communication strategies and implement them in language learning activities.
CO3: Analyze and enhance job-relevant writing skills
CO4: Evaluate and exhibit professionalism in debates and group discussions.
CO5: Make effective presentations by developing public speaking abilities

Suggested Software:

1. Walden Infotech
2. Young India Films

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

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

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23CHE202 CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

- Verify the fundamental concepts with experiments.

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of functional groups in simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Course Outcomes:

At the end of the course, the students will be able to
CO1: Determine the cell constant and conductance of solutions.
CO2: Prepare advanced polymer Bakelite materials.
CO3: Measure the strength of an acid present in secondary batteries.
CO4: Measure the wavelength of absorption of some organic compounds using UV-Vis spectroscopy.
CO5: Determine the EMF & redox potentials using potentiometric titrations.

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

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23ME201 ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

List of Experiments

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridlejoint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire punctureand change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Course Outcomes:

CO1: Identify workshop tools and their operational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.

CO3: Apply fitting operations in various applications.

CO4: Apply basic electrical engineering knowledge for House Wiring Practice.

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, MediaPromoters 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.; AtulPrakashan, 2021-22.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23CSE203 DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

The course aims to strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures.

List of Experiments:

Exercise 1: Array Manipulation

i) Write a program to reverse an array.
ii) C Programs to implement the Searching Techniques – Linear & Binary Search
iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

i) Implement a singly linked list and perform insertion and deletion operations.
ii) Develop a program to reverse a linked list iteratively and recursively.
iii) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

i) Create a program to detect and remove duplicates from a linked list.
ii) Implement a linked list to represent polynomials and perform addition.
iii) Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

i) Implement a doubly linked list and perform various operations to understand its properties and applications.
ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

i) Implement a stack using arrays and linked lists.
ii) Write a program to evaluate a postfix expression using a stack.
iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

i) Implement a queue using arrays and linked lists.
ii) Develop a program to simulate a simple printer queue system.
iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

i) Use a stack to evaluate an infix expression and convert it to postfix.
ii) Create a program to determine whether a given string is a palindrome or not.
iii) Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Tree & Binary Search Tree

i) Implement Binary tree using array and linked list.
ii) Implement BST using Linked List.
iii) Traversing of BST.

Exercise 9: Hashing

i) Implement a hash table with collision resolution techniques.
ii) Write a program to implement a simple cache using hashing.

Course Outcomes:

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

CO1: Implement different types of sorting and searching algorithms using array.

CO2: Demonstrating the different types of linked lists with its basic operations and applications.

CO3: Develop programs using stacks to handle evaluating expressions and solve related problems.

CO4: Apply queue-based algorithms for efficient task scheduling and other related real world problems.

CO5: Implement trees, graph and recognize scenarios where hashing is advantageous and design hash-based solutions for specific problems.

Text Books:

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 PeterSanders

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 DavidRanum

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.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23HUM201 HEALTH AND WELLNESS, YOGA AND SPORTS

L	T	P	C
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.

UNIT I **5 hours**

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 **5 hours**

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 **5 hours**

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.
ii) Practicing general and specific warm up, aerobics
iii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

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

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,
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. HumanKinetics, 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 manyas Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- 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.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

II Year I Semester

B. Tech II Year I Semester

23HUM101 UNIVERSAL HUMAN VALUES

L	T	P	C
2	1	0	3

Course Prerequisite: None or Universal Human Values – I (desirable)

Course Description :

The course has 28 lectures and 14 tutorials in 5 Units. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

Course Objectives: None. Universal Human Values-I (desirable)

The main objectives of the course is to

1. help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure happiness and prosperity in continuity, which are the core aspirations of all human beings.
2. facilitate the development of a Holistic perspective among students towards life and profession based on right understanding of the Human reality, family, society and the rest of nature. Such holistic perspective forms the basis of Universal Human Values (UHV) and movement towards value-based living in a natural way.
3. highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. aid the students to realize their full human potential and act accordingly.
5. assist the students to live with feeling of relationship, harmony and co-existence.

UNIT I INTRODUCTION TO VALUE EDUCATION 6 hours

Lecture 1: Understanding Value Education
Lecture 2: self-exploration as the Process for Value Education
Tutorial 1: Practice Session PS1 - Sharing about Oneself
Lecture 3: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 - Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 - Exploring Natural Acceptance

UNIT II HARMONY IN THE HUMAN BEING 6 hours

Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 - Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 - Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 - Exploring Harmony of self with the body

UNIT III HARMONY IN THE FAMILY AND SOCIETY **6 hours**

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 - Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 - Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 - Exploring Systems to fulfil Human Goal

UNIT IV HARMONY IN THE NATURE/EXISTENCE **6 hours**

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 - Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 - Exploring Co-existence in Existence.

UNIT V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS **6 hours**

Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 - Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 - Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 - Exploring Steps of Transition towards Universal Human Order

Course Outcomes:

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

CO1: Understand the Natural Acceptance and basic human aspiration.

CO2: Aware of themselves and self-regulation.

CO3: Recognize human-human relationship (Justice) and identify human goals in the society.

CO4: Appreciate the harmony in the nature and existence.

CO5: Develop as socially and ecologically responsible engineers in handling problems with sustainable solutions (user-friendly and eco-friendly).

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Online Learning Resources

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
10. https://uhv.org.in/

11. https://www.youtube.com/@UniversalHumanValues/playlists
12. https://fdp-si.aicte-india.org/index.php

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23HUM102 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
2	0	0	2

Course Prerequisite: NIL

Course Description:

The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the positions of financial statements are explained to know the analysis of financial matters.

Course Objectives:

This course enables students to

1. Describe the nature of engineering economics in dealing with the issues of scarcity;

2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets;

3. Explain the different market structures and price determination in various market conditions.

4. Explain the accounting principles, types of accounting and preparation of final accounts; and

5. Describe the financial statement analysis and investment evaluation through ratios and capital budgeting techniques.

UNIT I DEMAND ANALYSIS 6 hours

Scope and Significance of Economics- Elements of market Economy: Demand, Supply and Market Equilibrium- Theory of Demand, Elasticity of Demand, Supply and Law of Supply.

UNIT II PRODUCTION AND COST ANALYSIS 6 hours

Production Function – Short-run and long-run production – Cost Analysis: Cost concepts - Cost Structure of Firms and Output Decision- Break-Even Analysis (BEA) – significance and Limitations of BEA - Determination of Break Even Point (Simple Problems).

UNIT III MARKET STRUCTURE AND PRICING 6 hours

Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic – Price determination under Perfect, Monopoly, and Monopolistic Competition, Pricing objectives- Pricing Strategies.

UNIT IV BASICS OF ACCOUNTING 6 hours

Accounting - Double Entry System - Accounting Principles - Classification of Accounts - Rules of Debit & Credit- Accounting Cycle: Journal, Ledger, Trial Balance. Final Accounts: Trading Account - Profit & Loss Account - Balance Sheet with Adjustments, (Simple Problems).

UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING 6 hours

Ratio Analysis - Liquidity, Solvency, Activity and Profitability Ratios - Capital Budgeting. (Simple Problems).

Course Outcomes:

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

CO1: Understand Engineering economics basic concepts,

CO2: Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,

CO3: Compare various different market structures and identify suitable market,

CO4: Demonstrate an understanding and analyzing the accounting statements, and

CO5: Exhibit the ability to apply knowledge of ratio analysis and capital budgeting techniques in financial statement analysis and investment evaluation respectively.

Text Books:

1. Case E. Karl & Ray C. Fair, "Principles of Economics", Pearson Education, 8th Edition, 2007
2. Aryasri: Business Economics and Financial Analysis, 4/e. MGH.
3. Financial Accounting, S. N. Maheshwari, Sultan Chand, 2009
4. Varshney & Maheswari: Management Economics, Sultan Chand
5. Financial Statement Analysis, Khan and Jain, PHI, 2009
6. Financial Management, Prasanna Chandra, T.M.H, 2009

Reference Books:

1. Lipsey, R. G. & K. A. Chrystal , "Economics", Oxford University Press, 11th Edition, 2007
2. Samuelson P. A. & Nordhaus W. D. "Economics", Tata McGraw-Hill 18th Edition, 2007
3. Financial Management and Policy, Van Horne, James, C., Pearson, 2009.
4. Financial Management, I. M. Pandey, Vikas Publications

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23MAT107 PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE

L	T	P	C
3	0	0	3

Course Prerequisite: 23MAT101, 23MAT102

Course Description:

This course provides an introduction to probability, distributions and statistics with applications. Topics include: Conditional probability, Random variables, Probability distributions, Joint densities, Bayesian inference, descriptive statistics, Correlation and Regression, Estimation, Confidence intervals, Hypothesis testing.

Course Objectives:

This course enables students to

1. To extend and formalize knowledge of the theory of probability and random variables.
2. To solve real time problems in engineering and science by using discrete and continuous distributions
3. To analyze and interpret basic summary and modeling techniques for Multi-variate data
4. To analyze the data by using descriptive statistics for decision making
5. To apply the statistical inference involving confidence interval and hypothesis testing in data analysis.

UNIT I PROBABILITY **9 hours**

Introduction to Probability, Sample space and events, axioms of probability, theorems on probability, conditional probability, multiplication theorem and independence of events, Baye's theorem.

Random variables (discrete and continuous), probability density functions, distribution function, mathematical expectation, properties. moment generating function.

UNIT II PROBABILITY DISTRIBUTIONS **9 hours**

Discrete probability distributions - Binomial, Poisson, Geometric and their properties

Continuous probability distributions - Uniform, Exponential, Gamma, Normal distributions and their properties, Chebychev's inequality.

UNIT III JOINT DISTRIBUTIONS **9 hours**

Joint densities and Independence - Marginal distributions (discrete & continuous)- Expectation and Covariance, Correlation, Conditional densities and Regression, Curves of regression, Transformation of random variables.

UNIT IV STATISTICS FOR DATA ANALYSIS **9 hours**

Data Visualization, Moments, skewness, kurtosis, correlation, correlation coefficient, rank correlation, principle of least squares, lines of regression, regression coefficients and their properties.

UNIT V STATISTICAL INFERENCE **9 hours**

Population, sampling, Estimation, Point estimation, MLE, formulation of null hypothesis, alternative hypothesis, level of significance, types of errors and power of the test. Large Sample Tests: Test for single mean, single proportion, difference of means, difference of proportions, Confidence interval for parameters in one sample and two sample problems, t test for single mean, difference of means, test for ratio of variances.

Course Outcomes:

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

CO1: Understand the probability concepts and their importance in engineering.

CO2: Apply discrete and continuous probability distributions to solve various engineering problems.

CO3: Get an idea about joint density functions, distribution functions to the random variables and analyse the multivariate problems in engineering

CO4: Apply the method of least squares to estimate the parameters of a regression model.

CO5: Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.

Text Books:

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Dr.B.S.Grewal, " Higher Engineering Mathematics", Khanna Publications, 42nd Edition.

Reference Books:

1. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
3. Dean G. Duffy, "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.

E Books:

1. http://nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf
2. https://www.khanacademy.org

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CSN103 DIGITAL LOGIC AND COMPUTER ORGANIZATION

L	T	P	C
3	0	0	3

Course Objectives:

The main objectives of the course is to

1. Provide a comprehensive understanding of digital logic design principles and computer organization fundamentals
2. Illustrate Computer Arithmetic Operations and Processor Organization
3. Explain the fundamentals of Memory and Input/output (I/O) systems

UNIT I **9 hours**

Data Representation: Signed and Unsigned Binary Arithmetic – Fixed and Floating Point Binary Number representations – Hamming Code - Error Detection and Correction

Digital Logic & Combinational Circuits: Boolean Algebra, Minimization of Logic expressions, Quine–McCluskey Method - K-Map Simplification - Combinational Circuits: - Adders, Multiplexers, De-Multiplexers, Encoders and Decoders – Code Converters

UNIT II **9 hours**

Digital Logic & Sequential Circuits: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers

Introduction to Computer Architecture: Computer Types, Functional units, Bus structures, Software, Technology, Computer Generations, Von- Neumann Architecture, Eight Great Ideas

UNIT III **9 hours**

Computer Arithmetic: Fixed Point and Floating Point Arithmetic - Addition, Subtraction, Unsigned and Signed Multiplication, Division Algorithms - Floating Point Arithmetic Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction Cycle – CISC and RISC Processors – x86 and ARM Addressing Modes and Instruction set

UNIT IV **9 hours**

Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memory, Elements of Cache – Memory Mapping Techniques, Cache Performance - Redundant Array of Independent Disks.

UNIT V **9 hours**

Pipelining and Parallelism: Pipelining Strategy, Pipeline performance, Pipeline Hazards. Parallel Architecture - Flynn's classification – Multicore Architecture – Clusters – GPU Architecture

Input/output Organization: Data Transfer Schemes: - Programmed I/O, Interrupt Driven I/O, Direct Memory Access.

Course Outcomes:

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

CO1:Demonstrate the fundamental principles of digital system design and design combinational logic circuits.

CO2: Design sequential logic circuits and explain the functional units of computer

CO3: Apply algorithms for Arithmetic Operations and understand Instruction Set Architectures

CO4: Explain memory hierarchy and Concepts of Cache

CO5: Understand the concepts of Pipelining, Parallelism and I/O

Text Books:

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6th edition, McGraw Hill
2. William Stallings, "Computer Organization and Architecture Designing for Performance",11th Edition, Pearson Publications.
3. Digital Design, 6th Edition, M. Morris Mano, Pearson Education.

Reference Books:

1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier
3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson

Online Learning Resources

1. https://nptel.ac.in/courses/106/103/106103068/

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CSN101 OBJECT-ORIENTED PROGRAMMING THROUGH JAVA

L	T	P	C
3	0	0	3

Prerequisite: 23CSE101

Course Objectives:

1. Identify Java language components and how they work together in applications.
2. Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3. Learn how to extend Java classes with inheritance and interfaces in Java applications.
4. Understand how to use Java packages, Exceptions and I/O Streams for program development.
5. Understand how to design applications with threads in Java.

UNIT I OBJECT ORIENTED PROGRAMMING 9 hours

Object Oriented Programming: Basic concepts, Program Structure in Java: Introduction, Writing Simple Java Programs, Data types, Type casting, Tokens in Java Programs , Java Statements –Control statements, Looping Statements, Break Statement, Continue Statement. Command Line Arguments, User Input to Programs, Escape Sequences, Comments, Programming Style.

UNIT II CLASSES, OBJECTS AND METHODS 9 hours

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, this and static keywords.

Methods: Introduction, Defining Methods, Overloaded Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods.

UNIT III ARRAYS, INHERITANCE AND INTERFACES 9 hours

Arrays: one dimensional and multi-dimensional array.

Inheritance: Basics, Types of Inheritances, Usage of Super, Method Overriding, Abstract Classes, Final Keyword.

Interfaces: Creating, Implementing, Using, Extending, and Nesting of interfaces.

UNIT IV PACKAGES, EXCEPTION AND I/O STREAMS 9 hours

Packages: Defining, Finding and Importing packages, Member Access.

Exception Handling: Fundamentals, Types, Multiple catch clauses, Nested try blocks, Thrown Class, Using Finally and Throws, Built-in exceptions, User-defined exceptions.

I/O Streams: Byte Stream Classes and Character Stream Classes.

UNIT V STRING HANDLING IN JAVA AND MULTITHREADED PROGRAMMING 9 hours

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Course Outcomes:

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

CO1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
CO2: Design and implement classes to model real-world entities, with a focus on attributes, behaviours, and relationships between objects.
CO3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and interface concept.
CO4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
CO5: Develop multithreaded applications with synchronization.

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.

2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.

Reference Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH

2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

3. JAVA for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year I Semester

23CSN102 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Objectives:

1. To describe the operating system structures, services and system call.
2. To demonstrate process management concepts and threads.
3. To illustrate scheduling algorithms and process synchronization.
4. To understand the concept of deadlocks.
5. To analyze various memory management techniques.

UNIT I INTRODUCTION 9 hours

Concept of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Case study on UNIX and Windows Operating System.

Korn Shell Programming: Basic Script Concepts, Expressions, Decisions: Making Selections, Repetition, Special Parameters and Variables, Changing Positional Parameters, Argument Validation, Debugging Scripts.

UNIT II PROCESS CONCEPTS 9 hours

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling.

UNIT III PROCESS SYNCHRONIZATION AND DEADLOCKS 9 hours

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

UNIT IV MEMORY MANAGEMENT STRATEGIES 9 hours

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

UNIT V FILE SYSTEM 9 hours

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (Bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk

reliability, Disk formatting, Boot-block, Bad blocks.
Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix

Course Outcomes:

At the end of this course students will demonstrate the ability to
CO1: Write shell scripts using korn shell.
CO2: Create processes & threads and implement the various process scheduling techniques.
CO3: Analyse the concurrent processing and deadlock situations.
CO4: Design algorithmic solutions to solve memory management problems.
CO5: Implement the file protection techniques.

Text Books:

1. "Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 10th Edition, John Wiley and Sons Inc., 2018.
2. "Modern Operating Systems", Andrew S Tanenbaum, Pearson, 5th Edition, 2022 New Delhi.

Reference Books:

1. "Operating Systems – A Spiral Approach", Ramaz Elmasri, A. Gil Carrick, David Levine, Tata McGraw Hill Edition, 2010.
2. "Operating Systems: Internals and Design Principles", William Stallings, 7th Edition, Prentice Hall, 2018.
3. "Operating Systems", Achyut S.Godbole, Atul Kahate, McGraw Hill Education, 2016.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CSN201 OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 23CSE201

Course Objectives:

1. Practice object-oriented programming in the Java programming language
2. Implement Classes, Objects, Methods, Inheritance and interfaces concepts.
3. Illustrate implement Packages and Exception handling mechanism.
4. Construct Threads and various states.

List of Experiments:

1. Write a JAVA program to display default value of all primitive data type of JAVA.
2. Write a Java program that checks whether a given string is a palindrome or not.
   Ex: MADAM is a Palindrome.
3. Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
4. Write a JAVA program to implement constructor overloading.
5. Write a JAVA program implement method overloading.
6. Write a JAVA program to implement multi level Inheritance
7. Write a JAVA program give example for "super" keyword.
8. Write java program to create a super class called Figure that receives the dimensions of two dimensional objects. It also defines a method called area that computes the area of an object. The program derives two subclasses from Figure. The first is Rectangle and second is Triangle. Each of the sub class overridden area() so that it returns the area of a rectangle and a triangle respectively.
9. Write a JAVA program for abstract class to find areas of different shapes.
10. Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
11. Write a JAVA program that import and use the user defined packages
12. Write a JAVA program that describes exception handling mechanism
13. a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds,(Repeat the same by implementing Runnable)
    b) Write a program illustrating is Alive and join ()
    c) Write a Program illustrating Daemon Threads.
    d) Write a JAVA program Producer Consumer Problem

Software requirements:

JDK 1.4 or higher versons

Course Outcomes:

After completion of the course, students will be able to

CO1: Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling.

CO2: Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.

CO3: Familiar with commonly used Java Packages and exception handling in real time applications.

CO4: Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.

CO5: Proficiently construct multi-threading applications.

Reference Books:

1. P. J. Deitel, H. M. Deitel, "Java for Programmers", Pearson Education, PHI, 4th Edition, 2007.

2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, 2nd Edition, 2007.

3. Bruce Eckel, "Thinking in Java", Pearson Education, 4th Edition, 2006.

4. Sachin Malhotra, Saurabh Chaudhary, "Programming in Java", Oxford University Press, 5th Edition, 2010.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year I Semester

23CSN202 OPERATING SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: NIL

Course Objectives:

1. To understand the basics of Unix command and shell programming.
2. To implement various CPU scheduling algorithms.
3. To implement IPC, Deadlock Avoidance and Detection Algorithms.
4. To implement Page Replacement Algorithms.
5. To implement various memory allocation File Allocation methods.

List of Experiments:

1. a. Practicing the basic concepts with the help of Linux commands.
   b. Practicing basic UNIX commands and shell programming.
2. Write shell scripts for basic operations and decision-making.
3. Write shell scripts for file manipulation and interactive tasks. Simulate UNIX commands like cp, ls, grep, etc.
4. Write programs using UNIX system calls (fork, exec, getpid, exit, wait, close, stat, opendir, readdir).
5. Write C programs to implement FCFS, SJF, Priority, and Round Robin scheduling algorithms.
6. Write C programs to implement the following.
   a. Implement mutual exclusion using semaphores.
   b. Control the number of ports using semaphores and monitors.
7. Illustrate IPC strategy using the Producer-Consumer problem.
8. Write C program to implement Banker's algorithm for deadlock avoidance and prevention
9. Write C programs to implement First Fit, Worst Fit, and Best Fit memory allocation methods.
10. Write C programs to implement FIFO, LRU, and LFU page replacement algorithms.
11. Write C programs to implement sequential, indexed, and linked file allocation strategies using C programs.
12. Write C programs for the implementation of various disk scheduling algorithms**.**

Hardware Requirements:

INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17” or higher TFT Monitor, Keyboard and mouse.

Software requirements:

Windows 10 or higher operating system / Linux Ubuntu 20 or higher

Course Outcomes:

CO1: Understand the use of Linux commands.

CO2: Compare the performance of processor scheduling algorithms.

CO3:. Design algorithmic solutions for process synchronization problems.

CO4:. Analyze the performance of various file management schemes.

CO5: Implement different page replacement and disk scheduling algorithms.

Reference Books:

1. "Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 10th Edition, John Wiley and Sons Inc., 2018.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

II Year II Semester

B. Tech II Year II Semester

23MAT108 DISCRETE MATHEMATICAL STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisite: 23MAT101

Students should have a solid understanding of high school-level algebra, including Set notions, Relations, Functions, Permutations-Combinations, equations, and inequalities.

Course Description:

Discrete Mathematical Structures is a foundational course designed to introduce students to the essential concepts and structures of discrete mathematics. This course is crucial for students in computer science, information technology, computing, and related fields, providing the mathematical framework necessary for the analysis and design of algorithms, data structures, learning and intelligent systems.

Course Objectives:

This course enables students to

1. Develop a strong foundation in propositional and predicate logic, enabling the analysis and construction of logical arguments and proofs.
2. Master various counting techniques and understand the properties of algebraic structures such as groups and binary operations.
3. Gain a deep understanding of relations, equivalence classes, order relations, lattices, and Boolean algebras.
4. Learn to model and solve problems using sequences and recurrence relations, both homogeneous and nonhomogeneous.
5. Study the fundamental concepts of graph theory, including paths, cycles, trees, and the various types of graphs and their properties.

UNIT I LOGICAL STRUCTURES 9 hours

Introduction- Propositions and Truth Values- Logical Connectives and Truth Tables-Tautologies and Contradictions -Logical Equivalence and Logical Implication -The Algebra of Propositions - Arguments - Formal Proof of the Validity of Arguments -Predicate Logic - Arguments in Predicate Logic (Theory of Inference).

UNIT II COUNTING TECHNIQUES AND ALGEBRAIC STRUCTURES 9 hours

Counting Techniques- Pigeonhole principle- Inclusion-exclusion principle- Binary Operations and Their Properties- Algebraic Structures- Groups in Modular Arithmetic - Cyclic Groups- Groups of Permutations- Substructures-Morphisms.

UNIT III ORDERED STRUCTURES 9 hours

Relations and Their Representations- Equivalence Classes and Partitions- Order Relations- - Hasse Diagrams-Lattices- Properties of Lattices- Boolean Algebras – Properties of Boolean Algebras- Boolean Functions- Minimization of Boolean Expressions.

UNIT IV RECURRENCE RELATIONS 9 hours

Sequences - Recurrence Relations- Applications of Recurrence Relations- Modeling with Recurrence Relations- Solving Linear Recurrence Relations- Solving Linear Homogeneous Recurrence Relations with Constant Coefficients- Linear Nonhomogeneous Recurrence Relations with Constant Coefficients- Generating Functions- Useful facts about Power Series- Using Generating Functions to Solve Recurrence Relations

UNIT V GRAPH STRUCTURES **9 hours**

Graphs-Graph Terminology and Special Types of Graphs-Representing Graphs and Graph Isomorphism-Connectivity-Euler and Hamilton Paths-Shortest-Path Problems-Planar Graphs -Graph Coloring-Introduction to Trees-Spanning Trees-Minimum Spanning Trees.

Course Outcomes:

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

CO1: Evaluate the elementary logical arguments and identify the fallacious reasoning for the syntax of programming languages.

CO2: Utilize counting principles in computing techniques and algorithm analysis, and learn the properties of various algebraic structures.

CO3: Analyze various types of relations, equivalence classes, partitions using Hasse diagrams, and the properties of lattices and Boolean algebra.

CO4: Apply recurrence relations to model and solve many computational problems by generating functions.

CO5: Identify the special types of graphs for analyzing the connectivity models, and also study the properties of trees.

Text Books:

1. Rowan Garnier and John Taylor, Discrete Mathematics (Proof, Structures and Applications), CRC Press, an informa business, 3rd Edition, 2009.

2. Kenneth H. Rosen, Discrete Mathematics and its applications, 6th Edition, Tata McGraw Hill, 2011.

Reference Books:

1. J.P. Trembley and R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill – 13th reprint, 2012.

2. U.S. Gupta, ''Discrete Mathematical Structures'', 1st Edition, Pearson Education India, 2014.

3. Kevin Ferland, ''Discrete Mathematical Structures'', 1st Edition, Cengage Learning, 2009.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CSN104 DATA COMMUNICATIONS AND COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Objectives:

1. To study the evolution of computer networks, foundational principles, architectures, and techniques employed in computer networks.
2. To study the concepts of communication networks from layered perspective
3. To provide students with a theoretical and practical base in computer networks issues
4. Student will be able purse his study in advanced networking courses
5. To Prepare students for easy transfer from academia into future directions of research.

UNIT I THE PHYSICAL LAYER 9 hours

Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay.

ISDN Physical layer: Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

UNIT II THE DATA LINK LAYER 9 hours

Data link layer: Introduction, Framing, Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols.

Media Access control: Random Access, Controlled Access, Channelization, and connecting devices.

UNIT III THE NETWORK LAYER 9 hours

Network layer design issues, Routing algorithms, (Optimal, Shortest path, Distance Vector routing, Link State routing, Hierarchical routing, Routing in adhoc networks), Congestion control algorithms, Quality of service, Internetworking, the network layer in the Internet: IP Classes, IPV4 and IPV6, IP Addressing, NAT, IP support protocols, OSPF, BGP, RIP, IGMP.

UNIT IV THE TRANSPORT LAYER 9 hours

The Transport Service, Elements of Transport Protocols, Flow control, Congestion Control, The internet transport protocols: UDP, TCP, SCTP. Performance problems in computer networks, Network performance measurement. Performance Issues.

UNIT V THE APPLICATION LAYER 9 hours

Introduction, Client Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP. DNS, TELNET, e-mail, File Transfer, SNMP, Streaming Audio & Video, Content delivery. Case study- Computer Networks in health care.

Course Outcomes:

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

CO1: Understand and choose the transmission media and topologies depending on the requirements.

CO2: Apply error detection and error correction wherever required.

CO3: Analyze the concepts of routing, and congestion control

CO4: Evaluate the computer network logically, by enumerating the layers of the TCP/IP.
CO5: Create and make use of application-level protocols for file communication, and file transfer.

Text Books:

1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2012.
2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson,6th edition, 2021.

Reference Books:

1. "Internetworking with TCP/IP – Principles, protocols, and architecture", Volume 1, Douglas E. Comer, 5th edition, PHI
2. Peterson, Larry L., and Bruce S. Davie. Computer networks: a systems approach. Elsevier, 2007.
3. "Data communications & networking with TCP/IP protocol suite", Behrouz A. Forouzan, Mc Graw Hill Education, 2021.
4. Droms, R. (2001). Computer networks and internets: with internet applications. Prentice Hall.

Mode of Evaluation: Assignments, Internal Examination and External End Examination

B. Tech II Year II Semester

23CSN105 AUTOMATA THEORY AND COMPILER DESIGN

L	T	P	C
2	1	0	3

Pre-requisite: 23MAT108

Course Objectives:

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines to solve problems in computing
3. To familiarize Regular grammars, context frees grammar.
4. To learn the process of translating a modern high-level language to executable code.
5. To apply the optimization techniques to have a better code for code generation.

UNIT I AUTOMATA FUNDAMENTAL AND FINITE AUTOMATA 9 hours

Fundamentals: Formal Languages, Strings, Alphabets, Languages, Chomsky Hierarchy of languages. Finite Automata Deterministic Finite Automata Non-Deterministic Finite Automata Equivalence of NFA and DFA- Equivalence of NDFAs with and without Є-moves, Minimization of finite automata, Equivalence between two DFA's.

UNIT II REGULAR EXPRESSIONS AND CONTEXT FREE GRAMMAR AND LANGUAGES 9 hours

Regular Expressions – Identity rules, Converting DFA's to Regular Expression, Conversion of Regular Expression into DFA using Subset construction method - Pumping lemma for regular sets.
Context Free Grammar Parse Trees Ambiguity in Grammars and Languages Normal forms for context free grammars, Chomsky normal form, Greibach normal form, Pumping Lemma for Context free Languages.

UNIT III PUSH DOWN AUTOMATA AND INTRODUCTION TO TURING MACHINES 9 hours

PushDown Automata- Definition of the Pushdown Automata Languages of Pushdown Automata Equivalence of PDA's and CFG's, Deterministic PushDown Automata.
The Turing Machine, Programming Techniques for Turning Machine.

UNIT IV INTRODUCTION TO COMPILER AND LEXICAL ANALYSIS 9 hours

Introduction to Compiler Overview of compiler- Phases of a compiler- Interpreter Assembler Language Processor.
Lexical Analysis Role of Lexical Analyzer Input Buffering- Specification of Tokens Recognition of Tokens the Lexical Analyser Generator Lex.
Syntax Analysis - Role of Parser - Top Down Parsing – Bottom Up Parsing- LR Parser - SLR - YAAC.

UNIT V INTERMEDIATE CODE GENERATION AND CODE GENERATION 9 hours

Intermediate Code Generation - Intermediate Languages- Graphical Representations, Three address code.
Code Generation- Implementations Issues in the design of Code Generator - Optimization of Basic Blocks - A simple Code Generator - Peep-hole optimization.

Course Outcomes:

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

CO1: Acquire fundamental understanding of automata and constructing different automata.
CO2: Understand regular expression and Ambiguity of Context Free Grammar.
CO3: Design PDA and Turing Machines for any Language.
CO4: Design and develop lexical analyzers and parser.
CO5: Learn to implement code optimization techniques and a simple code generator.

Text Books:

1. J.E.Hopcroft, R. Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearsom Educationm 2006.
2. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, " Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2014.

Reference Books:

1. J.Martin, "Introduction to Languages and the Theory of Computation", Third Edition, TMH, 2003.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers- Elsevier Science, Indian Reprint 20023.

Mode of Evaluation: Assignments, Internal Examination and External End Examination

B. Tech II Year II Semester

23CSN106 ADVANCED DATA STRUCTURES AND ALGORITHMS ANALYSIS

L	T	P	C
2	1	0	3

Pre-requisite: 23CSE101, 23CSE102

Course Objectives:

1. Introduce the concepts of algorithm analysis, Tree and Graph applications.
2. Discuss various algorithm design strategies with examples.
3. Introduce NP-Hard and NP-Complete problem concepts.

UNIT I INTRODUCTION TO ALGORITHM ANALYSIS, TREES AND GRAPHS **9 hours**

Introduction to Algorithm Analysis, Space and Time Complexity Analysis, Asymptotic Notations.

AVL Trees – Creation, Insertion, Deletion Operations and Applications
B-Trees – Creation, Insertion, Deletion operations and Applications
Graphs – Basic search and Traversals

UNIT II Divide & Conquer and Greedy Method **9 hours**

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication.
Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees

UNIT III DYNAMIC PROGRAMMING **9 hours**

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths– General Weights (Bellman-Ford Algorithm), 0/1 Knapsack, Travelling Salesperson problem

UNIT IV BACKTRACKING AND BRANCH AND BOUND **9 hours**

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring.
Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT V NP-Hard and NP-Complete Problems **9 hours**

NP-Hard and NP-Complete Problems: Basic Concepts, Cook's theorem.
NP-Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP).
NP-Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Course Outcomes:

After completion of the course, students will be able to:
CO1: Illustrate the working of the advanced tree and graph data structures and their applications.
CO2: Design Divide and Conquer strategy and Greedy method for different problems.
CO3: Demonstrate Dynamic programming method to solve problems.
CO4: Apply Backtracking and Branch & bound strategy to solve problems.
CO5: Understand NP-Hard and NP-Complete problems.

Text Books:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition Universities Press
2. Computer Algorithms in C++, Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition University Press

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with Applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein &Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs: N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgotia Pub.
7. Data structures in Java: Thomas Standish, Pearson Education Asia

Mode of Evaluation: Assignments, Internal Examination and External End Examination

B. Tech II Year II Semester

23CSN203 COMPUTER NETWORKS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: NIL

Course Objectives:

1. To study the evolution of computer networks, foundational principles, architectures, and techniques employed in computer networks.
2. To study the concepts of communication networks from layered perspective
3. To provide students with a theoretical and practical base in computer networks issues
4. Student will be able purse his study in advanced networking courses.
5. To Prepare students for easy transfer from academia into future directions of research.

List of Experiments:

1. Study of Basic Network Commands and Network Configuration commands
2. Implement a program for OSI functionality to transmit data from client to server.
3. Implement a program for the following Encoding Techniques - NRZ, NRZ-I, Manchester.
4. Implement a program for framing Techniques

a) Character Count b) Bit Stuffing and Destuffing c) Byte Stuffing and Destuffing

5. Implement a program for Flow control based on Sliding Window protocol

a) Go Back N ARQ b) Selective repeat ARQ

6. Implement a program for CRC polynomials.
7. Simulation of Transferring data between two nodes using NS.
8. Simulation of data transfer and packet loss using NS.
9. Simulation of Congestion Control Algorithm using NS.
10. Simulate a 3 nodes point-to-point network with duplex links between them. Set the queue size vary the bandwidth and find the number of packets dropped.
11. Simulate a 4 nodes point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP n1-n3. Apply relevant Applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
12. Simulate an Ethernet LAN using N-nodes (6-10), change error rate and data rate and compare the throughput.

Course Outcomes:

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

CO1: Understand and choose the transmission media and topologies depending on the requirements.

CO2: Apply error detection and error correction wherever required.

CO3: Analyse the concepts of routing, and congestion control

CO4: Evaluate the computer network logically, by enumerating the layers of the TCP/IP.

CO5: Create and make use of application-level protocols for file communication, and file transfer.

Text Books:

1. Data Communications and Networking, Behrouz A. Forouzan, 6th , Tata McGraw Hill, 2021.

Reference Books:

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

2. Understanding Communications and Networks, Third Edition, W.A.Shay, Cengage Learning. Implementation and Management,6th Edition,2012.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year II Semester

23CSN204 ADVANCED DATA STRUCTURES AND ALGORITHMS ANALYSIS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 23CSE203

Course Objectives:

1. Learn how to analyze a problem &design the solution for the problem.
2. Strengthen the ability to identify and apply the suitable algorithm strategy for the given real-world problem.
3. Develop the optimal solution, i.e., time complexity & space complexity is low.

List of Experiments:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operations on the constructed tree. Write the contents of the tree into a new file using in-order.
2. Construct a B-Tree in an order of 5 with a set of 100 random elements stored in an array. Implement searching, insertion, and deletion operations.
3. Implement Graph traversals.
(a) BFT (b) DFT
4. Implement Quick Sort and Merge Sort and observe the execution time for various input sizes (Average, Worst and Best cases).
5. Implement Job Sequencing with Deadlines using Greedy strategy
6. Implement the Knapsack Problem using the Greedy method.
7. Construct Minimum Spanning Tree using
(a) Prim's Method (b) Kruskal's Method
8. Implement All Pairs Shortest Paths using Dynamic Programming method
9. Implement Single Source Shortest Paths using Dynamic Programming method
10. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
11. Implement the Travelling Sales Person problem using Dynamic Programming.
12. Implement N-Queens Problem Using Backtracking Strategy.
13. Implement the Backtracking method to solve the Graph Coloring problem.

Course Outcomes:

Upon successful completion of the course, students will be able to:
CO1: Implement the operations on AVL Trees, B- Trees, and Graphs.
CO2: Solve and analyze the problems using Divide & Conquer strategy.
CO3: Execute the problems using Greedy Method.
CO4: Apply Backtracking Methods to solve various problems.
CO5: Apply Dynamic Programming Methods to solve various problems.

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, Sahni Sartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz,Sartaj Sahni,Sanguthevar Rajasekaran, 2nd Edition, University Press
3. Data Structures and program design in C,Robert Kruse,Pearson Education Asia
4. An introduction to Data Structures with Applications,Trembley& Sorenson, McGraw Hill

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year II Semester
Audit Course

23CHE901 ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

Course Objectives:
This course enables students to

1. To make the students to get awareness of the environment.
2. To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
3. To save the earth from the inventions by the engineers.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 6 hours

Definition, Scope, and Importance – Need for Public Awareness.
Natural Resources: Energy resources**-** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

UNIT II ECOSYSTEMS 7 hours

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a) Forest ecosystem.
b) Grassland ecosystem
c) Desert ecosystem.
d) Aquatic ecosystems (freshwater - ponds, streams, lakes, rivers, marine ecosystem- oceans, estuaries)

Biodiversity and its Conservation : Introduction, Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Specific case studies.

UNIT III ORDERED STRUCTURES 6 hours

Definition, Cause, effects, and control measures of:
Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards
Pollution case studies - Role of an individual in the prevention of pollution

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes
Disaster management: floods, earthquakes, cyclones and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 5 hours

Sustainable Development Goals, From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rainwater harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6 hours

Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

Field Work: Visit a local area to document environmental assets River/forest grassland/hill/mountain – Polluted site - Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes.

Course Outcomes:

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

CO1: Exploring different types of renewable and non-renewable energy sources.

CO2: Students will learn about the structure and function of different ecosystems.
CO3: Students will learn about different types of pollution (air, water, soil) and their sources, effects, and control measures.
CO4: Exploring the science behind climate change, its evidence, and its impacts on ecosystems and human societies.
CO5: Understanding demographic factors and their environmental implications.

Text Books:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press, Third Edition, 2021.
2. Palaniswamy, “Environmental Studies”, Pearson Education, Second Edition, 2014.
3. S. Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K. Raghavan Nambiar, “Textbook of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd. Second Edition, 2008.
5. A. Koushik & C. P. Koushik, Perspectives in Environmental Studies, New Age International, Fourth Edition, 2006.

Reference Books:

1. Deeksha Dave and E. Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications, Second Edition, 2012.
2. M. Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, Second Edition, 2023.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, Third Edition, 2009.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice Hall of India Private Limited, Second Edition, 2004.
5. G.R. Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House, Fourth Edition, 2014.
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice Hall of India Private Limited, Third Edition, 2007.

Online Resources:

1. Atika Qazi; Fayaz Hussain; Nasrudin ABD. Rahim; Glenn Hardaker; Daniyal Alghazzaw, "Towards sustainable energy: a systematic review of renewable energy sources, technologies, and public opinions," 10.1109/ACCESS.2019.2906402, IEEE Access, vol. 7, pp. 63837-63851, 2019.
2. Gina Garland, Samiran Banerjee, Anna Edlinger, Emily Miranda Oliveira, Chantal Herzog, Raphaël Wittwer, Laurent Philippot, Fernando T. Maestre, Marcel G. A. van der Heijden, "A closer look at the functions behind ecosystem multifunctionality: A review," https://doi.org/10.1111/1365-2745.13511, Journal of Ecology, vol. 109, no. 2, pp. 600-613, 2021.
3. Siddiqua, A, Hahladakis, J.N. and Al-Attiya, “An overview of the environmental pollution and health effects associated with waste landfilling and open dumping,” https://doi.org/10.1007/s11356-022-21578-z, Environmental Science and Pollution Research, 29(39), pp.58514-58536, 2022.
4. Seddon N, Chausson A, Berry P, Girardin C.A, Smith A. and Turner B, “Understanding the value and limits of nature-based solutions to climate change and other global challenges,” https://doi.org/10.1098/rstb.2019.0120, Philosophical Transactions of the Royal Society B, 375(1794), p.20190120, 2020.
5. Hannes Weber and Jennifer Dabbs Sciubba, "The effect of population growth on the environment: evidence from European regions," https://doi.org/10.1007/s10680-018-9486-0, European Journal of Population, vol. 35, pp. 379-402, 2019.

Mode of Evaluation: Assignments and Mid Term Tests.

III Year I Semester

B. Tech III Year I Semester

23CSN107 CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
2	1	0	3

Prerequisites: Nil

Course Objectives:

The objectives of the course are to

1. Explain the importance and application of each of confidentiality, integrity, authentication and availability
2. Understand various cryptographic algorithms.
3. Understand the basic categories of threats to computers and networks
4. Describe public-key cryptosystem.
5. Describe the enhancements made to IPv4 by IPSec
6. Understand Intrusions and intrusion detection

UNIT I CRYPTOGRAPHY CONCEPTS AND TECHNIQUES 9 hours

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution and permutation techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT II SYMMETRIC AND ASYMMETRIC KEY CIPHERS 9 hours

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, Block cipher operation, Stream ciphers.

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT III CRYPTOGRAPHIC HASH FUNCTIONS 9 hours

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

UNIT IV TRANSPORT-LEVEL AND WIRELESS NETWORK SECURITY 9 hours

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH).

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.

UNIT V E-MAIL SECURITY 9 hours

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange.

Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

Course Outcomes:

At the end of this course students will be able to

CO1: Analyze the cryptographic algorithms, message and web authentication and security issues.

CO2: Analyze and evaluate the suitability of cryptographic algorithms in real world applications

CO3: Examine the current legal issues towards information security.

CO4: Apply Key management and distribution

CO5: Analyze IP security architecture.

Text Books:

1. "Cryptography and Network Security - Principles and Practice", William Stallings, Pearson Education, 6th Edition, 2013.
2. "Cryptography and Network Security", Atul Kahate, Mc Graw Hill, 3rd Edition, 2013.

Reference Books:

1. "Cryptography and Network Security", C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition. 2011.
2. "Cryptography and Network Security", Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition, 2015.
3. "Information Security Principles, and Practice", Mark Stamp, Wiley India, 3rd Edition, 2021.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23CSN108 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Objectives:

The objectives of the course are to

1. Gain an understanding of fundamental concepts and applications of database systems.
2. Develop proficiency in SQL and learn to construct effective queries.
3. Comprehend the principles of relational database design.
4. Understand key concepts in transaction processing and concurrency control.
5. Explore database storage structures and data access methods.

UNIT I DATABASE SYSTEM APPLICATIONS AND INTRODUCTION TO DATABASE DESIGN **9 hours**

Database System Applications: A Historical Perspective, File Systems versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, Structure of a DBMS

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model

UNIT II RELATIONAL MODEL AND SQL **9 hours**

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Logical Database Design: ER to Relational, Introduction to Views, Destroying/Altering Tables and Views.

SQL: Basic SQL Query, Union, Intersect, and Except, Nested Queries, Null Values, Complex Integrity Constraints, Aggregation Functions Group by and Having Clauses. Triggers, Cursors, Stored Procedures

UNIT III SCHEMA REFINEMENT AND NORMAL FORMS **9 hours**

Translating SQL Queries into Relational Algebra and Relational Calculus

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, First, Second, Third normal forms, BCNF, lossless join decomposition, multivalued dependencies, Fourth normal form, join dependencies, Fifth normal form.

UNIT IV TRANSACTION MANAGEMENT and CONCURRENCY CONTROL **9 hours**

Transaction Management: Transaction Concept, A simple Transaction Model, Storage Structure, ACID properties, Transaction Isolation, Serializability

Concurrency Control: Lock Based Protocols, Deadlock Handling, , Multiple Granularity, Timestamp Based Protocols, Validation- Based Protocols, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

UNIT V STORAGE AND INDEXING **9 hours**

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing: Cluster Indexes, Primary and Secondary Indexes, Index Data Structures: Hash Based Indexing,
Tree based Indexing, Comparison of File Organizations.
Tree Structured Indexing: Intuitions for Tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete, Duplicates
Recent Trends: Need of NoSQL, Cassandra and MongoDB.

Course Outcomes:

At the end of the course students will be able to

CO1: Construct an ER model and derive the relational schemas from the model.
CO2: Analyze the conceptual and logical database design using SQL queries.
CO3: Apply Normalization to improve database design.
CO4: Implement secure and consistent database transactions with concurrency and recovery control
CO5: Analyze file organization and indexing for efficient external data retrieval.

Text Books:

1. "Database System Concepts", A. Silberschatz, H. F. Korth S. Sudershan, , McGraw Hill, 6th Edition, 2021.
2. "Database Management Systems", Raghu Ramakrishnan, Mcgraw-Hill,3rd Edition, 2015.

Reference Books:

1. "Fundamentals of Database Systems", R. Elmasri S. B. Navathe, Addison Wesley,6th Edition, 2015.
2. "Database Systems: A Practical Approach to Design, Implementation and Management", Thomas Connolly, Carolyn Begg ,6th Edition,2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech III Year I Semester

23CSN109 NETWORK PROGRAMMING

L	T	P	C
3	0	3	3

Prerequisite: 23CSN104

Course Objectives:

The objectives of the course are to

1. Understand the fundamental concepts of network programming using sockets.
2. Develop client-server applications using TCP and UDP.
3. Explore I/O multiplexing and advanced socket operations.
4. Study raw sockets and application-level services such as DNS and RPC.
5. Prepare students for real-world networking environments and low-level protocol handling.

UNIT I INTRODUCTION TO NETWORK PROGRAMMING 9 hours

OSI Model - Unix Standards - TCP and UDP: Connection establishment and format - Buffer sizes and limitations - Standard Internet services and common protocol usage - Sockets: Address structures, value–result arguments, byte ordering, related functions - Elementary TCP sockets: socket(), connect(), bind(), listen(), accept() - Use of fork() and exec() for concurrent servers - close() and related functions

UNIT II TCP CLIENT SERVER AND I/O MULTIPLEXING 9 hours

TCP Echo server functions - Normal startup - Termination and signal handling - Server crash and reboot handling - UDP Echo Server: Lost datagrams - Summary - Lack of flow control - Outgoing interface - I/O Multiplexing: I/O models - select() function - Batch input - shutdown() function - poll() function - TCP Echo server

UNIT III SOCKET OPTIONS AND ADVANCED I/O FUNCTIONS 9 hours

getsockopt() and setsockopt() functions - Socket states - IPv6 socket options - ICMPv6 socket options - TCP socket options - Advanced I/O: Socket timeouts - recv() and send() functions - readv() and writev() functions - recvmsg() and sendmsg() functions - Ancillary data - How much data is queued? - Sockets and Standard I/O - T/TCP: TCP for Transactions

UNIT IV NAME AND ADDRESS CONVERSIONS, BROADCASTING AND MULTICASTING 9 hours

DNS - gethostbyname() function - Resolver options - IPv6 support - uname() function - Daemon Processes: syslogd - syslog() - daemon_init() - inetd - daemon_inetd() - Broadcasting: Broadcast addresses - Unicast vs. Broadcast - dg_cli() function using broadcasting - Race conditions - Multicasting: Multicast addresses - Multicasting vs. Broadcasting on a LAN - Multicasting on a WAN - Multicast socket options - mcast_join() and related functions - dg_cli() using multicasting - Receiving MBone session announcements - Sending and receiving SNTP - SNTP (continued)

UNIT V RAW SOCKETS AND REMOTE LOGIN 9 hours

Raw Sockets: Introduction - Raw socket creation - Raw socket output - Raw socket input - Ping program - Traceroute program - ICMP message daemon - Datalink Access: BPF (BSD Packet Filter) - DLPI (Data Link Provider Interface) - Linux: SOCK_PACKET - libpcap (Packet Capture Library) - Examining the UDP checksum field - Remote Login: Terminal line disciplines - Pseudo-terminals - Terminal modes - Control terminals - rlogin overview - RPC transparency issues

Course Outcomes:

At the end of this course students will be able to

CO1: Develop socket API-based programs

CO2: Design and implement client-server applications using TCP and UDP sockets

CO3: Analyze and handle issues in real-time network applications

CO4: Apply knowledge of socket options and advanced I/O in real-world scenarios

CO5: Build robust systems using raw sockets, broadcasting, multicasting, and system-level utilities

Text Books:

1. "UNIX Network Programming", Stevens W R, Fenner B, Rudoff A M, Pearson Education, 3rd Edition, 2004.
2. "UNIX Network Programming", Stevens W R, PHI, 1st Edition, 1990.

Reference Books:

1. "UNIX Systems Programming using C++", Chan T, PHI, 1st Edition, 1999.
2. "UNIX for Programmers and Users", Glass G, Ables K, Pearson Education, 3rd Edition, 2003.
3. "Advanced UNIX Programming", Rochkind M J, Pearson Education, 2nd Edition, 2004.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23PHY102 INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. Introduce fundamental quantum concepts like superposition and entanglement.
2. Understand theoretical structure of qubits and quantum information.
3. Explore conceptual challenges in building quantum computers.
4. Explain principles of quantum communication and computing.
5. Examine real-world applications and the future of quantum technologies.

UNIT I INTRODUCTION TO QUANTUM THEORY AND TECHNOLOGIES 9 hours

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison,Quantum states and measurement: nature of observation,Overview of quantum systems: electrons, photons, atoms,The concept of quantization: discrete energy levels,Why quantum? Strategic, scientific, and technological significance,A snapshot of quantum technologies: Computing, Communication, and Sensing,National and global quantum missions: India's Quantum Mission, EU, USA, China

UNIT II THEORETICAL STRUCTURE OF QUANTUM INFORMATION SYSTEMS 9 hours

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract,The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences,Philosophical implications: randomness, determinism, and observer role

UNIT III BUILDING A QUANTUM COMPUTER – THEORETICAL CHALLENGES AND REQUIREMENTS 9 hours

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers:

Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what's working and what remains elusive,The role of quantum software in managing theoretical complexities

UNIT IV **QUANTUM COMMUNICATION AND COMPUTING – THEORETICAL PERSPECTIVE** **9 hours**

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication,The Idea of the Quantum Internet – Secure Global Networking,Introduction to Quantum Computing,Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: Decoherence and Error Correction,Real-World Importance and Future Potential

UNIT V **APPLICATIONS, USE CASES, AND THE QUANTUM FUTURE** **9 hours**

Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum,Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization,Emerging careers in quantum: roles, skillsets, and preparation pathways,Educational and research landscape – India's opportunity in the global quantum race

Course Outcomes:

CO1: Explain core quantum principles in a non-mathematical manner.
CO2: Compare classical and quantum information systems.
CO3: Identify theoretical issues in building quantum computers.
CO4: Discuss quantum communication and computing concepts.
CO5: Recognize applications, industry trends, and career paths in quantum technology.

Text Books:

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
3. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

Reference Books:

1. David McMahon, *Quantum Computing Explained*, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing*, Oxford University Press, 2007.
3. Scott Aaronson, *Quantum Computing Since Democritus*, Cambridge University Press, 2013.
4. **Alastair I.M. Rae**, *Quantum Physics: A Beginner's Guide*, Oneworld Publications, Revised Edition, 2005.
5. **Eleanor G. Rieffel, Wolfgang H. Polak**, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
6. **Leonard Susskind, Art Friedman**, *Quantum Mechanics: The Theoretical Minimum*, Basic Books, 2014.
7. **Bruce Rosenblum, Fred Kuttner**, *Quantum Enigma: Physics Encounters Consciousness*, Oxford University Press, 2nd Edition, 2011.

8. **GiulianoBenenti, GiulioCasati, GiulianoStrini**, *Principles of Quantum Computation and Information, Volume I: Basic Concepts*, World Scientific Publishing, 2004.
9. **K.B. Whaley et al.**, *Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document*, Quantum Flagship, European Commission, 2020.
10. **Department of Science & Technology (DST), Government of India**, *National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers*, MeitY/DST Publications, 2020 onward.

Online Learning Resources:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23CSN205 DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Understand the components of DBMS and to study the database design.
2. Study the retrieval of data using relational algebra and calculus and the concept of normal forms in the design of database.
3. Comprehend the structure of SQL Queries to query, update, and manage a database.
4. Understand all constraints to develop a business application using cursors, triggers and stored procedures.
5. Provide sufficient skill to utilize the DBMS concept in real time applications.

LIST OF EXPERIMENTS

1. Development of Relational Database Schemas for using DDL Constructs of SQL.
2. To perform various data manipulation commands such as select, insert, update etc. of SQL on Relational Database.
3. To perform various DCL and TCL construct of SQL on Relational Database.
4. Implement different types of referential and integrity constraints on Relation Database.
5. To apply the concept of Aggregating Data using Group functions.
6. To retrieve the queries using Group by, Having and Order by clauses of SQL.
7. Design and development of Banking database and perform various type of JOIN operations.
8. i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
   ii. Insert the Data into table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL.
9. i. Create passing parameters IN and OUT of PROCEDURES.
   ii. Create a cursor to update the salary of employees in EMP table.
10. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers.
11. Design and implementation of real time application with database connection.

Course Outcomes:

At the end of the course students will be able to

CO1: Perform table creation, maintain, and manipulate a relational database using SQL.

CO2: Implement complex queries using SQL.

CO3: Apply Queries using Advanced Concepts of SQL.

CO4: Build PL/SQL programs including stored procedures, functions, cursors and triggers

CO5: Demonstrate the ability to establish a connection to a relational database using JDBC and perform basic database operations

Reference Books:

1. "Database System Concepts", A. Silberschatz, H. F. Korth S. Sudershan, McGraw Hill, 7th Edition, 2021.

2. "Fundamentals of Database Systems", R. Elmasri S. B. Navathe, Addison Wesley, 6th Edition, 2015.

3. "Database Management Systems", Raghu Ramakrishnan, Johannes Gehrke, Mcgraw-Hill,4th Edition, 2015.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B.Tech III Year I Semester

23CSN206 NETWORK PROGRAMMING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 23CSN104

Course Objectives:

The objectives of the course are to

1. Develop hands-on skills in advanced networking tools and utilities.
2. Enable students to implement core services like web, ping, DNS using socket programming.
3. Facilitate understanding of client-server architectures using concurrent and iterative models.
4. Provide practical experience in Remote Procedure Calls (RPC), non-blocking I/O, and multithreading.
5. Build foundational skills for designing and deploying real-world network applications.

LIST OF EXPERIMENTS:

1. Use and interpretation of ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whois commands.
2. Implementation of concurrent and iterative echo servers using both connection-oriented and connectionless sockets.
3. Implementation of time and daytime services using connection-oriented sockets.
4. Development of a custom ping-like service using raw sockets.
5. Building a basic web server to serve static content using socket programming.
6. Implementation of remote command execution via socket communication.
7. Demonstration of non-blocking I/O using select(), poll(), or epoll() system calls.
8. Development of a concurrent chat server to enable real-time communication between users.
9. Implementation of file access using Remote Procedure Call (RPC).
10. Implementation of basic DNS functionality using socket programming.
11. Design a secure, multithreaded file transfer application using TCP sockets and AES encryption, supporting user authentication and logging.
12. Build a socket-based client-server system that retrieves live weather updates from a public API and sends formatted data to clients in real-time.

COURSE OUTCOMES:

At the end of this course students will be able to

CO1: Implement networking tools and commands effectively.
CO2: Design and implement robust client-server applications using socket programming.
CO3: Apply advanced programming techniques in network applications.
CO4: Build foundational services like DNS, web servers, and file servers from scratch.
CO5: Apply RPC-based file access and remote executions.

Reference Books:

1. "Hands-on Networking with Internet Technologies", Comer D E, Pearson Education, 5th Edition, 2015.
2. "Unix Network Programming", Stevens W R, Prentice Hall/Pearson Education, 3rd Edition, 2009.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech III Year I Semester

23ENG901 TECHNICAL PAPER WRITING AND IPR

L	T	P	C
2	0	0	0

Pre-requisite: None

Course Objectives:

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

UNIT I **6 hours**

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language - highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

UNIT II **6 hours**

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problems and Framing Research Questions- Synopsis

UNIT III **6 hours**

Process of research: publication mechanism: types of journals- indexing- seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results-citation rules.

UNIT IV **6 hours**

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, ncies and treaties, importance of intellectual property rights

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting evaluating trade mark, trade mark registration processes.

UNIT V **6 hours**

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Course Outcomes:

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

CO1: Identify key secondary literature related to their proposed technical paper writing.

CO2: Explain various principles and styles in technical writing

CO3: Use the acquired knowledge in writing a research/technical paper

CO4: Analyse rights and responsibilities of the holder of Patent, Copyright, Trademark, International Trademark etc.

CO5: Evaluate different forms of IPR available at National & international levels
CO6: Develop skill of making search of various forms of IPR by using dern tools and techniques.

Text Books:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013

2. Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and Practives. Oxford.

Reference Books:

1. R.Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.

2. Prabuddha Ganguli, Intellectual Property Rights Tata Mcgraw Hill, 2001

3. P.Naryan, Intellectual Property Law, 3rd Ed ,Eastern Law House, 2007.

4. Adrian Wallwork. English for Writing Research Papers Second Edition. Springer Cham Heidelberg New York ,2016

5. Dan Jones, Sam Dragga, Technical Writing Style

Online Learning Resources

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriti ng.html
3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriti ng.html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper- journal/
5. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
6. https://lawbhoomi.com/intellectual-property-rights-notes/
7. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

Mode of Evaluation: Assignments and Mid Term Tests

III Year II Semester

B. Tech III Year II Semester

23CSN110 SOFTWARE ENGINEERING

L	T	P	C
2	1	0	3

Course Objectives:

The objectives of the course are to

1. Learn Different life cycle models.
2. Learn different phases in software engineering.
3. Learn design concepts and various design models.
4. Learn about testing strategies.
5. Understanding of software quality and assurance techniques.

UNIT I BASIC CONCEPTS OF SOFTWARE ENGINEERING & PROCESS MODEL **9 hours**

Ethics of Software engineering, Software characteristics, Software lifecycle model, Capability Maturity Model Integration (CMMI), Process models: The waterfall model, Incremental process models, Spiral model, Agile Development: Agile Process, Adaptive process models, Scrum, Dynamic systems development Method and Crystal.

UNIT II SOFTWARE REQUIREMENT ENGINEERING AND SYSTEM MODELS **9 hours**

Functional and Non-functional requirements, User requirements, System requirements and Software requirements specification (SRS). Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models: Context models, Behavioral models, Data models and Object models.

UNIT III SOFTWARE DESIGN AND ENGINEERING **9 hours**

Design process, Design model, Pattern based software design, Object oriented analysis and design (using UML): Class diagrams, Use case diagrams, Interaction diagrams, Activity diagrams. Modeling component-level design: Designing class-based components, conducting component-level design, Object constraint language. Performing User interface design: Golden rules, User interface analysis and design.

UNIT IV SOFTWARE TESTING AND METRIC PROCESS **9 hours**

A strategic approach to software testing, Test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing. Product metrics: Software Quality, Frame work for Product metrics, Metrics for analysis model, Metrics for design model, Metrics for testing, Metrics for maintenance. Metrics for Process and Products: Software Measurement, Metrics for software quality.

UNIT V SOFTWARE QUALITY ASSUARANCE **9 hours**

Software quality assurance, Software reviews, Formal technical reviews. Software Quality Assurance: Statistical software quality assurance, Software reliability, The ISO 9000 quality standards, Principles of Software Process Change.

Course Outcomes:

At the end of this course students will be able to

CO1: Analyze Software Types, Characteristics, Lifecycle Models, CMMI, and Agile Process Models.

CO2: Demonstrate software requirements and reengineering through system modelling techniques.

CO3: Apply object-oriented and component-level design with suitable concepts, models & patterns.

CO4: Illustrate software testing strategies, validation, and product metrics for quality assurance.

CO5: Utilize software quality concepts, assurance methods, and ISO 9000 standards to ensure reliability.

Text Books:

1. "Software Engineering: A practitioner's Approach", Roger S Pressman, McGraw Hill, 9th Edition 2020.

2. "Engineering Software Products: An Introduction to Modern Software Engineering", Ian Sommerville, Pearson Education, 1st Edition 2019.

Reference Books:

1. "Fundamentals of Software Engineering", Rajib Mall, PHI Learning Private Limited, 4th Edition, 2014.

2. "Software Engineering, A Precise Approach", Pankaj Jalote, Wiley India, 1st Edition 2010.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23CSN111 INTERNETWORKING WITH TCP/IP

L	T	P	C
3	0	0	3

Prerequisites: 23CSN109

Course Objectives:

The objectives of the course are to

1. Understand how the protocols and services work.
2. Exploring the operation and message sequences for all key data-link, network, and transport layer protocols.
3. Use a protocol analyzer and common IP software tools to document and troubleshoot a TCP/IP network, including basic addressing and setup

UNIT I INTERNETWORKING CONCEPTS **9 hours**

Principles of Internetworking, Connectionless Interconnection, Application-Level Interconnection, Network Level Interconnection, Properties of the Internet, Internet Architecture, Interconnection through IP Routers, TCP/IP Protocol suite, Addressing.

UNIT II TCP, UDP & IP **9 hours**

TCP Services, TCP Features, Segment, A TCP Connection, Flow Control, Error Control, Congestion Control, Process to Process Communication, User Datagram, Checksum, UDP Operation, IP Datagram, Fragmentation, Options, IP Addressing: Classful Addressing, IPV6.

UNIT III CONGESTION AND QUALITY OF SERVICE **9 hours**

Data Traffic, Congestion, Congestion Control, Congestion Control in TCP, Congestion Control in Frame Relay, Source Based Congestion Avoidance, DEC Bit Scheme, Quality of Service, Techniques to Improve QOS: Scheduling, Traffic Shaping, Admission Control, Resource Reservation, Integrated Services and Differentiated Services.

UNIT IV QUEUE MANAGEMENT **9 hours**

Concepts of Buffer Management, Drop Tail, Drop Front, Random Drop, Passive Buffer Management Schemes, Drawbacks of PQM, Active Queue Management: Early Random Drop, RED Algorithm.

UNIT V SCTP, MOBILE NETWORK LAYER AND MOBILE TRANSPORT LAYER **9 hours**

Stream Control Transmission Protocol: SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control.

Mobile Network Layer: Entities and Terminology, IP Packet Delivery, Agents, Addressing, Agent Discovery, Registration, Tunneling and Encapsulation, Inefficiency in Mobile IP.

Mobile Transport Layer: Classical TCP Improvements, Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/Fast Recovery, Transmission, Timeout Freezing, Selective Retransmission, Transaction Oriented TCP.

Course Outcomes:

At the end of this course students will be able to

CO1: Utilize the internetworking concepts.

CO2: Apply TCP and UDP protocols in data communication.

CO3: Examine the formats of a frame, a packet and a segment.

CO4: Compare the fundamentals of network traffic and collision avoiding techniques.

CO5: Experiment the concepts of mobile network and transport layers.

Text Books:

1. "Computer Networking: A Top-Down Approach", James F. Kurose and Keith W. Ross, Pearson, 8th Edition, 2016.
2. "TCP/IP Protocol Suite", Behrouz A Forouzan, TMH, 3rd Edition, 2005.
3. "Data communication & Networking", B.A. Forouzan, TMH, 4th Edition,2006.

Reference Books:

1. " High performance TCP/IP Networking", Mahbub Hasan & Raj Jain, PHI -2005.
2. "Internetworking with TCP/IP ", Douglas. E. Comer, Volume I PHI, 6th Edition, Morgan Kaufmann , 2013.
3. "Computer Networks- A Systems Approach", Larry L. Perterson and Bruce S.Davie , 2011.
4. "Mobile Communications", Jochen Schiller, Pearson, 2nd Edition, 2003.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23CSN112 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite: 23CSN104

Course Objectives:

The objectives of the course are to

1. Explain the evolving computer model called cloud computing.
2. Introduce the various levels of services that can be achieved by cloud.
3. Describe the security aspects in cloud.
4. Learn cloud application in python.
5. Understand cloud applications and issues.

UNIT I BASICS OF CLOUD COMPUTING 9 hours

Introduction, Characteristics of cloud computing, Cloud Models, Cloud Based services and applications. Cloud concepts and Technologies: Virtualization, Load balancing, Scalability and Elasticity, Deployment, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management.

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity and Access Management services, Open-Source Private Cloud software.

UNIT II HADOOP AND PYTHON 9 hours

Hadoop MapReduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.

Cloud Application Design: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

Python Basics: Python data Types & Data Structures, Control flow, Function, Modules, Packages, Date/Time Operations.

UNIT III PYTHON FOR CLOUD COMPUTING 9 hours

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python web Application Frame work, Designing a RESTful web API.

Cloud Application Development in Python: Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App.

UNIT IV BIG DATA, MULTIMEDIA AND TUNING 9 hours

Big Data Analytics: Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.

Multimedia Cloud: Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transcoding App.

Cloud Application Benchmarking and Tuning: Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Load Testing & Bottleneck Detection case Study, Hadoop benchmarking case Study.

UNIT V APPLICATIONS AND ISSUES IN CLOUD 9 hours

Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management.

Cloud for Industry, Healthcare & Education: Cloud Computing for Healthcare, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education.

Migrating into a Cloud: Introduction, Broad Approaches to migrating into the cloud, the seven step model of migration into a cloud.

Organizational readiness and Change Management in The Cloud Age: Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, change management maturity models, Organizational readiness self – assessment.

Legal Issues in Cloud Computing: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issues raised by virtualization and data location, commercial and business considerations.

Course Outcomes:

At the end of this course students will be able to

CO1: Ability to create cloud computing environment.

CO2: Ability to design applications for Cloud environment.

CO3: Design & develop backup strategies for cloud data based on features.

CO4: Use and examine different cloud computing services.

CO5: Analyze different cloud programming model as per need.

Text Books:

1. "Cloud computing A hands-on Approach", ArshdeepBahga, Vijay Madisetti, Universities Press, 2016
2. "Cloud Computing Principles and Paradigms:", Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Wiley, 2011.
3. "Distributed and Cloud Computing", Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra, Elsevier, 2011.

Reference Books:

1. "Mastering Cloud Computing", by RajkumarBuyya, Christian Vecchiola, SThamaraiSelvi, McGraw Hill Education, 2nd Edition, 2024.
2. "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud", George Reese, O _Reilly, 2009.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23CSN207 INTERNETWORKING WITH TCP/IP LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisites: 23CSN109

Course Objectives:

The objectives of the course are to

1. Understand how the protocols and services work, while exploring the operation and message sequences for all key data-link, network, and transport layer protocols.
2. Use a protocol analyzer and common IP software tools to document
3. Troubleshoot a TCP/IP network, including basic addressing and setup.

LIST OF EXPERIMENTS:

1. Demonstrate IP Configuration Procedure using Python socket and interface libraries.
2. Write an experiment to assign an IP address with a subnet mask using CIDR notation and verify the network configuration.
3. Write an experiment to install, configure, start, and test the Apache HTTP server.
4. Write an experiment to capture live network traffic and decode Ethernet frames and analyze their structure and fields using scapy or pyshark (a Python wrapper for Wireshark/tshark).
5. Write Python script to parse TCP headers and extract flags, ports, sequence numbers, etc.
6. Demonstrate the procedure to capture packets and decode the TCP header fields using network protocol analyzer.
7. Demonstrate the procedure to configure a DNS Server.
8. Identify, Download & Install open-source tools related to TCP/IP such as Wireshark, Nmap etc.
9. Write a program to implement TCP/IP socket communication in Java.
10. Compile & Test the Test TCP (TTCP), a utility for measuring network throughput.
11. Design and Implement a Simple Client-Server Chat Application Using TCP Sockets.
12. Demonstrate Traffic Analysis Using Wireshark and Nmap.

Course Outcomes:

At the end of this course students will be able to

CO1: Apply the IP concepts.

CO2: Analyze the formats of a frame, a packet and a segment.

CO3: Inspect the network in terms of Packet types, throughput etc.

CO4: Compare techniques to measure performance of TCP networks.

CO5: Analyze TTCP networks performance.

Text Books:

1. "TCP/IP Protocol Suite", Behrouz A Forouzan, TMH, 3rd Edition, 2005.

2. "Data communication & Networking", B.A. Forouzan, TMH, 4th Edition,2006.

Reference Books:

1. ” High performance TCP/IP Networking”, Mahbub Hasan & Raj Jain, PHI -2005.
2. “Internetworking with TCP/IP “, Douglas. E. Comer, Volume I PHI, 6th Edition, Morgan Kaufmann , 2013.
3. “Computer Networks- A Systems Approach”, Larry L. Perterson and Bruce S.Davie , 2011.
4. “Mobile Communications”, Jochen Schiller, Pearson, 2nd Edition, 2003.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech III Year II Semester

23CSN208 CLOUD COMPUTING LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisites: 23CSN104

Course Objectives:

The objectives of the course are to

1. Develop web applications using cloud platforms and technologies.
2. Analyse the design and development processes for building cloud-based applications.
3. Acquire skills for operating and managing large-scale systems in cloud environments.
4. Explore cloud service models (IaaS, PaaS, SaaS) and their practical applications.
5. Learn to integrate scalability, reliability, and security into cloud application development.

LIST OF EXPERIMENTS

1. Install VirtualBox/VMware Workstation with different flavors of Linux or windows OS on top of windows OS.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Install the Hadoop framework and create an application using Map Reduce Programming Model.
5. Design and implement a cloud scheduling algorithm using a suitable cloud tool and evaluate its performance.
6. Simulate and analyze the performance of cloud load balancing algorithms using CloudSim or any other cloud tool.
7. Demonstrate the process of launching an EC2 instance and migrating data or applications on AWS.
8. Demonstrate how to configure and use a VPC to manage EC2 instances in AWS.
9. Demonstrate the process of setting up load balancing for EC2 instances using AWS services.
10. Design and implementation the Web application and launch in AWS Server.
11. Develop a real-time object detection system using OpenCV and deploy it on an edge device such as Raspberry Pi or Arduino Nano BLE with a lightweight AI model using TensorFlow Lite. Evaluate performance in terms of latency and accuracy under constrained hardware.
12. Design and deploy a serverless web application using AWS Lambda, API Gateway, and DynamoDB. The application should perform CRUD operations and demonstrate auto-scaling, event triggering, and logging using CloudWatch.

Course Outcomes:

At the end of this course students will be able to

CO1: Configure various virtualization tools such as Virtual Box, VMware workstation.

CO2: Create and deploy a Virtual Machine in a Cloud environment.

CO3: Measure how to simulate a cloud environment to implement Load Balancer.

CO4: Install and use a generic cloud environment that can be used as a private cloud.

CO5: Design and develop a real-world application in EC2 AWS.

Text Books:

1. "Cloud Computing: Principles and Paradigms", Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, Wiley, 1st Edition, 2013.
2. "Cloud Computing: Theory and Practice", Marinescu, Dan C, Morgan Kaufmann, 2nd Edition, 2017

Reference Books:

1. "Mastering Cloud Computing: Foundations and Applications Programming", Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi, Tata Mcgraw Hill, 1st Edition, 2017.
2. "Cloud Computing: A Practical Approach", Toby Velte, Anthony Velte, Robert Elsenpeter, Mc Graw Hill Education, 1st Edition, 2017.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech III Year I Semester

23ECE501 TINKERING LABORATORY

L	T	P	C
0	0	2	1

Course Description:

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge. These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

Course Objectives:

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning and Impart Skill Development
3. Foster Collaboration and Teamwork
4. Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
5. Impart Problem-Solving mind-set

List of Experiments:

1. Make your own parallel and series circuits using breadboard for any application of your choice.
2. Design and 3D print a Walking Robot
3. Design and 3D Print a Rocket.
4. Temperature & Humidity Monitoring System (DHT11 + LCD)
5. Water Level Detection and Alert System
6. Automatic Plant Watering System
7. Bluetooth-Based Door Lock System
8. Smart Dustbin Using Ultrasonic Sensor
9. Fire Detection and Alarm System
10. RFID-Based Attendance System
11. Voice-Controlled Devices via Google Assistant
12. Heart Rate Monitoring Using Pulse Sensor
13. Soil Moisture-Based Irrigation
14. Smart Helmet for Accident Detection
15. Milk Adulteration Detection System
16. Water Purification via Activated Carbon
17. Solar Dehydrator for Food Drying
18. Temperature-Controlled Chemical Reactor

19. Ethanol Mini-Plant Using Biomass
20. Smart Fluid Flow Control (Solenoid + pH Sensor)
21. Portable Water Quality Tester
22. AI Crop Disease Detection
23. AI-based Smart Irrigation
24. ECG Signal Acquisition and Plotting
25. AI-Powered Traffic Flow Prediction
26. Smart Grid Simulation with Load Monitoring
27. Smart Campus Indoor Navigator
28. Weather Station Prototype
29. Firefighting Robot with Sensor Guidance
30. Facial Recognition Dustbin
31. Barcode-Based Lab Inventory System
32. Growth Chamber for Plants
33. Biomedical Waste Alert System
34. Soil Classification with AI
35. Smart Railway Gate
36. Smart Bin Locator via GPS and Load Sensors
37. Algae-Based Water Purifier
38. Attendance via Face Recognition

Note: The students can also design and implement their own ideas, apart from the list of experiments mentioned above.

Note: A minimum of 8 to 10 experiments must be completed by the students.

Course Outcomes:

After completion of the course, Students will be able to

CO1: Apply the principles of design thinking to identify real-world problems and develop feasible solutions.

CO2: Demonstrate proficiency in using basic tools, components, and digital fabrication technologies (e.g., Arduino, sensors, 3D printing, etc.).

CO3: Develop functional prototypes through iterative design, fabrication, and testing.

CO4: Collaborate effectively in multidisciplinary teams to brainstorm, plan, and execute tinkering projects.

CO5: Document the development process, evaluate outcomes, and communicate project results clearly using oral, visual, and written formats.

Reference Books:

1. "Make: Getting Started with Arduino" by Massimo Banzi, Maker Media Publications.

Online Resources:

1. https://aim.gov.in/pdf/equipment-manual-pdf.pdf

2. https://atl.aim.gov.in/ATL-Equipment-Manual/

3. https://aim.gov.in/pdf/Level-1.pdf

4. https://aim.gov.in/pdf/Level-2.pdf

5. https://aim.gov.in/pdf/Level-3.pdf

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

OPEN ELECTIVE – I

Open Elective – I

23HUM301 INDIAN KNOWLEDGE SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The main objectives of the course is to

1. To introduce the scope, significance, and interdisciplinary nature of Indian Knowledge Systems and their relevance in the modern world.
2. To explore the philosophical and epistemological foundations of Indian Knowledge Systems, including key concepts like Pramāṇa, Dharma, and Rta.
3. To examine the scientific contributions of ancient India in fields such as mathematics, astronomy, medicine, and engineering.
4. To understand Indian perspectives on society, governance, literature, and aesthetics through classical texts and traditions.
5. To appreciate the cultural richness, ethical values, and traditional educational systems that shaped Indian civilization.

UNIT I INDIAN KNOWLEDGE SYSTEM: AN INTRODUCTION 9 hours

Indian Knowledge System: An Overview- Historical evolution and contemporary Relevance- Interdisciplinary approach and integration in education-The Vedic Corpus, The Four Vedas and their components, Oral transmission and cultural continuity--Philosophical Systems, Orthodox (Āstika) and Heterodox (Nāstika) schools, Logic, metaphysics, and epistemology in Indian philosophy -Wisdom through the Ages- Scientific and Mathematical Contributions, Ayurveda, Astronomy, Metallurgy, Mathematics, Key scholars: Charaka, Sushruta, Aryabhata, Bhaskaracharya

UNIT II FOUNDATIONAL CONCEPTS IN INDIAN KNOWLEDGE SYSTEMS 9 hours

Shaping India's intellectual traditions- Ancient Indian linguistics, highlighting phonetics, grammar, and language philosophy-traditional number systems, units of measurement, and their practical applications in science and trade -indigenous frameworks for organizing and classifying knowledge, offering insights into how Indian scholars approached learning, epistemology, and the systemic cultivation of wisdom across disciplines.

UNIT III SCIENCE AND TECHNOLOGY IN INDIAN KNOWLEDGE SYSTEMS 9 hours

India’s classical achievements in mathematics, astronomy, architecture, and science. Learners explore ancient texts and applications—highlighting concepts like zero, planetary motion, and structural design. integration of science with philosophy and sustainability. Through notable scholars and indigenous techniques, how Indian scientific thought continues to influence contemporary innovations-offering wisdom for solving modern challenges.

UNIT IV HUMANITIES AND SOCIAL SCIENCES IN INDIAN KNOWLEDGE SYSTEMS 9 hours

Indian insights on leadership, wellbeing, and governance through ancient texts like the Srimad Bhagavad Gita. Topics include holistic management principles, psychological well-being, ethical governance, and traditional administrative models—emphasizing their relevance to modern society, personal growth, and nation-building.

UNT V CULTURAL, EDUCATIONAL, AND ETHICAL DIMENSIONS OF INDIAN KNOWLEDGE SYSTEMS **9 hours**

Art, Architecture, and Aesthetics-Temple architecture and sculpture-Music, dance, and literary traditions-**Education Systems and Institutions,** Gurukula system and pedagogical practices, Ancient universities: Nalanda, Takshashila-**Ethics and Values in Indian Thought**-Dharma, Karma, Moksha — principles of righteous living, Sustainability, harmony, and spiritual ecology-**Contemporary Relevance and Global Influence,** Indian knowledge systems in modern science and culture, Resurgence through NEP 2020 and academic initiatives

Course Outcomes:

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

CO1: Learners will be able to **describe** the scope and interdisciplinary relevance of Indian Knowledge Systems in contemporary contexts.

CO2: Learners will be able to **analyze** foundational philosophical concepts such as *Pramāṇa*, *Dharma*, and *Rta* within Indian epistemology.

CO3: Learners will be able to **apply** ancient Indian scientific principles to understand traditional practices in mathematics, astronomy, and medicine.

CO4: Learners will be able to **evaluate** classical Indian texts to interpret perspectives on governance, society, and aesthetics.

CO5: Learners will be able to **design** culturally informed ethical frameworks and educational models inspired by traditional Indian systems.

Reference Books:

1. Introduction to Indian knowledge system: concepts and applications
   By B. Mahadevan , Nagendra Pavana , Vinayak Rajat Bhat, PHI publications
2. Bhagavad Gita: As It Is" by A.C. Bhaktivedanta Swami Prabhupada Published by The Bhaktivedanta Book Trust
3. "Indian Philosophy, Volume 1 and 2 by S. Radhakrishnan Published by Oxford university press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre-requisite: 23MAT101, 23MAT102

Course Description:

This course reviews and continues the study of computational techniques for evaluating interpolations, derivatives and integrals; solving system of algebraic equations, transcendental equations, ordinary differential equations and partial differential equations. The course emphasizes on numerical and mathematical methods of solutions with appropriate error analysis.

Course Objectives:

The main objectives of the course is to

4. To introduce computation methods of solving algebraic and transcendental equations.
5. To avail the basics of numerical techniques for solving the system of linear equations.
6. To familiarize the knowledge of interpolation and numerical calculus.
7. To use numerical calculus for solving ordinary differential equations.
8. To introduce the computational techniques for solving partial differential equations.

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 9 hours

Errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial. Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.

UNIT II SOLUTIONS OF SYSTEM OF ALGEBRAIC EQUATIONS 9 hours

LU decomposition, Thomas algorithm for the tridiagonal systems, Norms-Euclidean, mini-maxi, Frobenius and 1-,2- and ∞-norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss-Seidel method, Power method for obtaining eigenvalues and eigenvectors of matrices.

UNIT III INTERPOLATION & NUMERICAL CALCULUS 9 hours

Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature.

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS 9 hours

Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.

UNIT V NUMERICAL SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS 9 hours

Laplace and Poisson equations (five-point formula), Finite difference methods for one-dimensional Heat and Wave equations.

Course Outcomes:

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

CO1: Solve the system of algebraic and transcendental equations.

CO2: Apply the numerical techniques to find the solution to system of equations.

CO3: Calculate and analyze the rate of variations and numerical sum of such changes using numerical calculus relevant to the field of Engineering.

CO4: Find the accurate numerical solutions to ordinary differential equations representing some Engineering problems.

CO5: Compute the solutions for engineering problems represented by partial differential equations.

Text Books:

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.

2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

2. Burden and Faires, Numerical Analysis 7th ed., Thomson Learning, 2001.

3. E. Kreyszig, Advanced Engineering Mathematics, 10th ed., Wiley, 2010.

4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., Mc Graw Hill, 2012.

5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Pre-requisite: 23MAT101, 23MAT102, 23MAT104

Course Description:
Unconstrained and constrained optimization, Linear programming problem, transportation and assignment problems, dynamic programming problem, project management and queuing models.

Course Objectives:
The main objectives of the course is to

1. Understand the optimization techniques for solving engineering problems.
2. Formulate and solve linear programming problem.
3. Obtain the optimal solution for transportation and assignment problems.
4. Avail knowledge to apply the game theory and project management techniques to find the solutions to the complex problems.
5. Understand the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

UNIT I CLASSICAL OPTIMIZATION 9 hours

Introduction to optimization, unconstrained optimization with single variable and multi variable. Constrained multivariable optimization with equality constraints- Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

UNIT II LINEAR PROGRAMMING PROBLEM 9 hours

Linear Programming Problem (LPP), Mathematical formulation, graphical solution, simplex method. Artificial variable technique - Big M-method and two phase simplex method. Duality, dual Simplex method.

UNIT III TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM 9 hours

Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem.

UNIT IV GAME THEORY AND PROJECT MANAGEMENT 9 hours

Formulation of games, Two Person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property. Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT).

UNIT V QUEUING MODELS 9 hours

Introduction to queuing system, Birth and Death processes, Single and multiple server queueing models, Little's formula - Finite Calling Population Queuing Models – Multi-Phase Service Queuing Model.

Course Outcomes:

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

CO1: Understood the importance of unconstrained and constrained optimization to solve engineering problems.

CO2: Get an idea about the linear programming techniques.

CO3: Solve transportation and assignment problems in engineering situations.

CO4: Analyze the problems of network analysis for project management and game theory.

CO5: Apply the Queuing system models to solve problems in engineering & industry.

Text Books:

1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th edition,2013.

2. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

Reference Books:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.

2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.

3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.

4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley& Sons, Singapore, 2nd edition.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY301 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of atomic structure at intermediate (10+2) level is sufficient

Course Description:

Laser usage is rampant in various technological applications. Several fields gaining attention in the usage of lasers. This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

Course Objectives:

The main objectives of the course is to

1. Make the student to understand the detailed principles of various lasers.
2. Profound understanding of different variety of lasers will provide them to think of superior selection and usage of lasers in practical technological applications.
3. Students are aware of latest developments in certain areas of Laser technology which have important applications for societal needs.
4. Explain how material processing is accomplished with lasers. Estimate laser operation parameters for material processing.
5. Exposure about Lasers applications in engineering, communications, spectroscopy and material process etc.

UNIT I INTRODUCTION TO LASER TECHNOLOGY 9 hours

Laser characteristics, The Einstein Coefficients, Absorption and Emission Cross Sections, Spontaneous and Stimulated emission of radiation, Population inversion, Methods of Population Inversion, Laser Rate Equations, stable two minor optical resonators, Mode selection, Gain in the regenerative laser cavity.

UNIT II GASES AND LIQUIDS LASING MEDIUM 9 hours

Energy levels & Radiative properties of Atoms and molecules**;** *Atomic lasers*: He-Ne laser, Argon Ion laser**;** *Molecular Lasers*: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

UNIT III SOLID STATE LASERS 9 hours

Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)

Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only)

UNIT IV PULSED OPERATION OF LASERS 9 hours

Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

UNIT V LASER APPLICATIONS 9 hours

Laser processing of materials: laser cutting, laser drilling, welding; Lasers in metrology- Accurate measurement of length, light wave communications; Laser spectroscopy: Laser fluorescence and Raman scattering.

Course Outcomes:

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

CO1: Understand the principle of phenomenon of laser and identify the operating principle involved in various type of lasers.

CO2: Estimate stability requirements in producing laser light by different types of sources

CO2: CO3: Differentiate or list the various types of lasers and their means of excitation.

CO4: Assess (Identify) which laser would best meet the need for a particular industrial or research task.

CO5: Student can knowledge of latest technological developments in laser technology. Femtosecond laser etc.

Text Books:

1. Laser Fundamentals: William T Silfvast. Cambridge Publication.

2. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan, Springer

3. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer

4. Principles of Laser: O. Svelto

5. Laser Physics: Peter W Miloni, Joseph H Eberly.

Reference Books:

1. Solid State Laser Engineering: Walter Koechner. Springer series in optical sciences.

2. Ultrafast Optics, Andrew M. Weiner

3. Laser spectroscopy: Demtroder

4. Laser Applications: Monte Ross

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY302 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

Nucleation, crystallization, surface energy, various thin film coating processes including both physical vapour deposition such as evaporation, sputtering, pulsed laser deposition and chemical vapour deposition, spray coating, and other methods such as spin-coating, plasma polymerization, Langmuir Blodgett, transport phenomena in thin films, various properties of thin films, techniques and method to characterize thin films, current application of thin film, introduction to fabrication of thin film devices

Course Objectives:

The main objectives of the course is to

1. To provide students with a comprehensive overview on the fundamentals of thin film preparation and characterization.
2. To enable the students to develop a thorough understanding of how core physics can be used to understand thin film deposition processes.
3. To establish the correlation between processing variables and materials characteristics and performance within the framework of key modern technologies.
4. To realize thin film applications to science and technology

UNIT I PHYSICS OF THIN FILMS **8 hours**

Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation.

UNIT II THIN FILM DEPOSITION TECHNIQUES **10 hours**

Physical methods of films deposition-evaporation, e-beam, sputter deposition, pulsed laser, molecular beam epitaxy. Chemical methods of film deposition -Deposition of Inorganic films from Solutions-Chemical vapour deposition - Electrolysis, Anodization, Spray pyrolysis, Other techniques: Langmuir Blodgett and Spin Coating.

UNIT III PROPERTIES OF THIN FILMS **8 hours**

Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films

UNIT IV CHARACTERIZATION OF THIN FILMS **10 hours**

Imaging Techniques (SEM, AFM, TEM) - Structural Techniques (XRD, Raman)-Optical Techniques (UV-Vis-NIR, PL)-Electrical Techniques (Hall Effect, IV, CV)-Magnetic Techniques (EPR, H-V curve)-Mechanical Techniques (Hardness testing)-Thickness measurement (profilometer, ellipsometry).

UNIT V APPLICATIONS OF THIN FILMS **9 hours**

Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors.

Course Outcomes:

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

CO1: Discuss the differences and similarities between different vacuum based deposition techniques, evaluate and use models for nucleating and growth of thin films.
CO2: Asses the relation between deposition technique, film structure, and film properties.
CO3: Know the typical thin film applications.
CO4: Motivate selection of deposition techniques for various applications.

Text Books:

1. Thin Film Deposition: Principles and Practice, *Donald L. Smith*, McGraw Hill, Singapore, 2001.

2. Maissel, L.I and Glang. R, "Handbook of thin film technology", McGraw Hill, 1970.

Reference Books:

1. Thin film phenomena / *Kasturi L. Chopra,* New York: McGraw-Hill, c1969.

2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.

3. An introduction to physics and technology of thin films / *Alfred Wagendristel, Yuming Wang*, Singapore: World Scientific, c1994.

4. Thin film processes, *John L Vossen, Werner Kehn* editors, Academic Press, New York, 1978.

5. Thin film physics / *O.S. Heavens*, London: Methuen, c1970.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY303 WASTE TO SUSTAINABLE ENERGY AND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of Physics and chemistry at the intermediate (10+2) level is sufficient

Course Description:

This course covers waste-to-energy conversion and energy storage technologies, including thermal, biological, and chemical methods. It introduces relevant policies, case studies, and trends to help students design sustainable energy solutions aligned with the circular economy and climate goals.

Course Objectives:

The main objectives of the course is to

1. Understand various methods of energy generation from waste.
2. To explore thermal, biological, and chemical conversion technologies.
3. To examine modern energy storage devices and their integration with waste-to-energy systems.
4. To analyse the techno-economic feasibility of these systems for sustainable development.
5. To develop interdisciplinary skills in waste-to-energy technologies, enhancing student employability in sustainable energy and environmental sectors.

UNIT I INTRODUCTION TO WASTE PROCESSING, TRANSPORT, AND MANAGEMENT **9 hours**

Types of Wastes, Agricultural Residues, and Wastes Including Animal Wastes, Industrial Wastes, Municipal Solid Wastes and Characterization. Waste Processing Types and Composition of Various Types of Wastes- Industrial Waste and Biomedical Waste- Waste Collection and Transportation- Waste Processing- Size Reduction, Separation- Waste Management Hierarchy- Waste Minimization and Recycling of Municipal Solid Waste.

UNIT II THERMAL WASTE CONVERSION TECHNOLOGIES **9 hours**

Combustion, incineration, pyrolysis, gasification, Process parameters, design considerations, Emission control, energy recovery, and Case studies of WTE (Waste to Energy) plants in India and abroad

UNIT III BIOLOGICAL AND CHEMICAL CONVERSION **9 hours**

Bio gasification: Biomethanation process, biogas digester types. Chemical Conversion: Hydrolysis & hydrogenation; solvent extraction of hydrocarbons; solvolysis of wood, bio crude, biodiesel production via chemical process; transesterification methods; Chemicals from biomass.

UNIT IV ENERGY STORAGE SYSTEMS **9 hours**

Introduction to Energy Storage Systems - Types of energy storage- electrical, mechanical, chemical, thermal; Batteries (Li-ion, lead-acid, flow batteries), Supercapacitors and hybrid storage, Hydrogen storage and fuel cells.

UNIT V WASTE MANAGEMENT AND ENERGY RECOVERY **9 hours**

Characteristics and Perspectives of Waste, Unit Operations & Transformation Technologies, Waste Disposal, Hazardous Waste Management & Waste Recycling

Course Outcomes:

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

CO1: To understand various methods of energy recovery from waste.

CO2: To explore thermal conversion technologies.

CO3: To explore biological and chemical conversion technologies

CO4: To examine modern energy storage devices and their integration with waste-to-energy systems.

CO5: To analyse the techno-economic feasibility of these systems for sustainable development.

Text Books:

1. Waste-to-Energy. Technologies and Project Implementation by Marc J. Rogoff And Francois Screve (Auth.) Publisher: William Andrew, 2011/2019
2. Robert C. Brown Thermo-chemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, John Wiley and Sons, 2019.
3. Sergio Capareda, Introduction to Biomass Energy Conversions, CRC Press, 2013.
4. Fundamentals of Energy Storage, J. Jensen, B. Squrensen, John Wiley, NY
5. Techobanoglous, Theisen, and Vigil, "Integrated Solid Waste Management", 2d Ed. McGraw-Hill, New York, 1993.

Reference Books:

1. Industrial and Urban Waste Management in India, TERI Press
2. B. Lal and M. Patwardhan, "Wealth from Waste: Trends and Technologies", TERI Press
3. Municipal Solid Waste to Energy Conversion Processes: Processes Technical, and Renewable comparisons, by Gary C. Young, ISBN:9780470539675, Publisher: John Wiley & Sons, Publication Date: June 2010.
4. Parker Colin, and Roberts, "Energy from Waste – An Evaluation of Conversion Technologies", Elsevier Applied Science, London, 1985.
5. La Grega, M., et al., "Hazardous Waste Management", McGraw-Hill, c. 1200 pp., 2nd ed.,2001

Journals & Reviews:

1. Updated Journals and Reviews of the last 5 Years
2. Home (https://swayam.gov.in) > Courses (https://swayam.gov.in/explorer) > Waste to Energy Conversion, By Prof. P. Mondal | IIT Roorkee

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE301 CHEMISTRY OF POLYMERS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. To understand the basic principles of polymers
2. To understand natural polymers and their applications.
3. To impart knowledge to the students about synthetic polymers, their preparation and importance.
4. To enumerate the applications of hydogel polymers
5. To enumerate applications of conducting and degradable polymers in engineering.

UNIT I POLYMERS-BASICS AND CHARACTERIZATION:- 9 hours

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT II NATURAL POLYMERS & MODIFIED CELLULOSICS 9 hours

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

UNIT III SYNTHETIC POLYMERS 9 hours

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

UNIT IV HYDROGELS OF POLYMER NETWORKS 9 hours

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

UNIT V CONDUCTING AND DEGRADABLE POLYMERS: 9 hours

Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Course Outcomes:

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

CO1: Classify the polymers, explain polymerization mechanism, differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer

CO2: Describe the physical and chemical properties of natural polymers and Modified cellulosics.

CO3: Differentiate Bulk, solution, Suspension and emulsion polymerization, describe fibers and elastomers, Identify the thermosetting and thermo polymers.

CO4: Identify types of polymer networks, describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,

CO5: Explain classification and mechanism of conducting and degradable polymers.

Text Books:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

Reference Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Online Learning Resources

1. https://nptel.ac.in/courses/104105124

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing Nanoscience

UNIT I PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY 9 hours

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation.

UNIT II CATALYSIS AND GREEN CHEMISTRY 9 hours

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites: Catalytic cracking, ZSM-5 catalyst and high silica zeolites, TS1 Oxidation catalyst, Catalytic Converters, Homogeneous catalysis: Hydrogenation of alkenes using wilkinson's catalyst, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide.

UNIT III ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS 9 hours

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT IV EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES 9 hours

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell), Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions(caprolactum), Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry.

UNIT V GREEN PROCESSES FOR GREEN NANOSCIENCE 9 hours

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

Course Outcomes:

Upon completion of this course the students should:

CO1: Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
CO2: Understand and apply catalysis for developing eco-friendly processes.
CO3: Be in a position to use environmental benign solvents where ever possible.
CO4: Have knowledge of current trends in alternative energy sources.
CO5: Apply green chemistry principles in practicing green Nanoscience.

Text Books:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books:

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Online Learning Resources

1. https://nptel.ac.in/courses/104105124

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE303 CHEMISTRY OF ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Objectives:

1. To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2. To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3. To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4. Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5. To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

UNIT I ELECTROCHEMICAL SYSTEMS 9 hours

Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction ,Lead-acid ,Nickel- cadmium, Lithium ion batteries and their applications**.**

UNIT II FUEL CELLS 9 hours

Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT III PHOTO AND PHOTO ELECTROCHEMICAL CONVERSIONS 9 hours

Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT IV SOLAR ENERGY 9 hours

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

UNIT V HYDROGEN STORAGE 9 hours

Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel , and Organic hydrogen carriers.

Course Outcomes:

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

CO1: Solve the problems based on electrode potential, Describe the Galvanic Cell Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer

CO2: Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells, Classify the fuel cell

CO3: Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion.

CO4: Apply the photo voltaic technology, Demonstrate about solar energy and prospects Illustrate the Solar cells, Discuss about concentrated solar power

CO5: Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures
Describe the liquification methods.

Text Books:

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CE301 DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisites: None

Course Description:

The goal of this course is to expose the undergraduate students to different types of disasters and the preparedness needed to mitigate their effects. The course matrix will cover various natural, biological, chemical, and emerging hazards and risks that may cause property loss, loss of lives, and livestock. Thus, the future engineers will understand the social responsibility for the preparedness and mitigation of the damages caused by the disasters.

Course Objectives:

1. To make the students aware of disasters and their impact on living beings.
2. To ensure the students understand vulnerability, disasters, disaster prevention, and risk reduction.
3. To gain a preliminary understanding of approaches for the Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes available in the country for disaster risk mitigation.
5. To make the students aware of development activities and case studies.

UNIT I INTRODUCTION 8 hours

Introduction, Etymology of disaster, Concepts and definitions: disaster, hazard, vulnerability, risks, Resilience, prevention, and mitigation.

UNIT II TYPES OF DISASTERS 10 hours

Types of Disaster; natural disasters (earthquakes, volcanoes, forest fires and explosions, heat and cold waves, floods, draught, cyclones, tsunami, landslides, soil erosion); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.), hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III DISASTER IMPACTS 9 hours

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV DISASTER RISK MITIGATION MEASURES 9 hours

Disaster Risk Reduction (DRR) - Disaster management- four phase approach; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications), DRR programmers in India and the activities of National Disaster Management Authority. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction.

UNIT V IMPACT OF DEVELOPMENTAL ACTIVITIES 9 hours

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization, etc.), sustainable and environmental friendly recovery; reconstruction and development methods. Different GIS software, basic data types and coordinate systems. Case studies.

Course Outcomes:

The students after completing the course will be able to:

CO1: Explain various disaster concepts
CO2: Differentiate between categories of disasters
CO3: Analyze the impact of various types of disasters
CO4: Select disaster risk mitigation measures
CO5: Identify the impact of development activities

Text Books:

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster Management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
6. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CE302 GREEN BUILDINGS

L	T	P	C
3	0	0	3

Pre-requisites: None

Course Description:

The course covers various aspects of bioclimatic architecture like climate-sensitive design, passive solar architecture, Water management, green building materials and construction techniques

Course Objectives:

1. To introduce concepts of sustainability and bioclimatic design in planning, Construction and life of buildings.
2. To equip students with technical knowledge of energy-efficient Green Buildings.
3. To guide students, through projects, to apply concepts and ideas for the design of a green building by introducing them to green initiatives and ratings.
4. To initiate students in basics of functional design and drawing of the various buildings using the above concepts.
5. To understand different evaluation criteria with various green building rating systems

UNIT I GREEN BUILDING CONCEPTS 9 hours

Introduction to bioclimatic architecture- Sustainability in building science and Functional planning- Orientation- Elements of building design and drawing- Building regulations and by-laws
Traditional and Vernacular Architecture- Climate zones- Design Charts- sun path diagram- Solar angles- Indices of thermal comfort- Vernacular buildings in different climate zones.

UNIT II CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN 9 hours

Introduction- various steps in Site planning- Plan for Building envelope- Land form-Topography-vegetation- water bodies; Orientation- S/V ratio- P/A ratio- Walls, Fenestration- Roof and floors- Active and passive solar strategies- Passive solar architecture.

UNIT III THERMAL FLOW IN BUILDINGS 9 hours

Calculation of thermal conductance- Heat flow through different building elements- Ventilation and day lighting- Design and placement of openings- Water management in buildings- Techniques to recycle, reuse and harvest water.

UNIT IV GREEN BUILDING MATERIALS AND CONSTRUCTION 9 hours

Material properties- Energy efficiency using various materials- emerging new materials, Construction techniques- Techniques for roof, wall and foundations.

UNIT V ECONOMY OF GREEN BUILDING 9 hours

Cost of building- operation and maintenance- Green building rating system- Evaluation criteria of LEED- TERI - GRIHA case studies- Case studies in different climate zones.

Course Outcomes:

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

CO1: Use various regulations and by-laws for green building construction.
CO2: Do site planning, active and passive for Green Building.
CO3: Compute thermal flow through different building elements.
CO4: Identify energy efficient building materials and construction techniques for building components.
CO5: Compute cost of building/operation and maintenance, evaluation criteria for different case studies.

Text Books:

1. Krishnan, A., Baker, N., Yannas, S., & Szokolay, S. (Eds.). (2001). Climate responsive architecture, a design handbook for energy efficient buildings. New Delhi: Tata McGraw Hill Publishing Company.
2. TERI & ICAEN (InstitutCatalad'Energia). (2004). Sustainable building design manual (Vol II). New Delhi: The Energy and Resources Institute (TERI) Press

Reference Books:

1. Bureau of Indian Standards. (1995). SP:41, Handbook on functional requirements of Buildings (other than industrial buildings) (First reprint ed.). New Delhi: Bureau of Indian Standards.
2. Indian Green Building Council, LEED-India. (2011). LEED 2011 for India- Green building rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council
3. Koenigsberger, O., ingersoll, T. G., Mayhew, A., & Skozolay, S. V. (2011). Manual of Tropical Housing and Building. Hyderabad: Universities Press
4. Prabhu, Balagopal T S, K Vincent Paul, and C Vijay an. Building Design and Drawing. Calicut: Spades Publishers, 2008
5. Szokolay, S. V. (2008). Introduction to Architectural Science- The Basis of sustainable Design (Second ed.). Architectural Press/Elsevier
6. The Energy and Resources Institute (TERI). (2011). Green Rating for Integrated Habitat Assessment (GRIHA) manual. New Delhi: TERI press
7. Journals: Energy and Buildings, Building and Environment, Other relevant publications.
8. National Building Code, Bureau of Indian Standards: New Delhi. 2005; Building Bye laws and building rules of selected Indian urban and rural areas
9. Swamy, N. K., & Rao, A. K. (2013). Building planning and Drawing, New Delhi, Charothar Publishing House

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23ME301 MATERIALS SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite: 23PHY101 ENGINEERING PHYSICS

Course Objectives:

This course is designed to:

1. Understand the fundamental classification and properties of engineering materials.
2. Explore the structure, properties, and applications of metals and alloys.
3. Gain knowledge on composite materials and their relevance in engineering fields.
4. Learn about the structure and characteristics of ceramics and polymers.
5. Develop an appreciation of smart and advanced materials for modern technologies.

UNIT I CLASSIFICATION OF MATERIALS **9 hours**

Introduction to materials science, Classification: Metals, Ceramics, Polymers, Composites, Semiconductors, Biomaterials, Properties: Mechanical, Electrical, Thermal, Optical, Magnetic, Atomic structure and bonding, Crystal structures and defects, Structure–property relationships, Materials selection charts for engineering design.

UNIT II METALS AND ALLOYS **9 hours**

Types of metals: Ferrous and non-ferrous, Microstructure of metals, Phase diagrams (binary alloys), Heat treatment of steels, Corrosion and prevention methods, Mechanical behavior and testing: Stress-strain, hardness, fatigue, Common engineering alloys and their applications.

UNIT III COMPOSITES **9 hours**

Definition and classification: Particle-reinforced, fiber-reinforced, structural composites, Matrix materials: Polymer, metal, and ceramic matrix, Manufacturing techniques: Hand lay-up, pultrusion, Powder Metallurgy, Slurry Infiltration and Sintering, Properties and performance, Applications in aerospace, automotive, construction, and electronics.

UNIT IV CERAMICS AND POLYMERS **9 hours**

Structure and types of ceramics: Crystalline and amorphous, Properties: Thermal resistance, brittleness, conductivity, Processing of ceramics: Sintering, slip casting, hot pressing, Types of polymers: Thermoplastics, thermosets, elastomers, Polymerization processes: Addition and condensation, Mechanical and thermal properties, Applications in electronics, biomedical, and structural sectors.

UNIT V SMART AND ADVANCED MATERIALS **9 hours**

Definition and need for smart materials, Shape memory alloys, piezoelectric materials, magnetostrictive materials, Electroactive polymers, self-healing materials, photonic crystals, Nanomaterials and carbon-based materials (graphene, CNTs), Biomaterials and biocompatibility, Materials for electronics, aerospace, and green energy systems, Emerging trends and future directions.

Course Outcomes:

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

CO1: Identify and classify materials based on their properties and structure.
CO2: Understand the behaviour and applications of metals and alloys in engineering.
CO3: Compare the types and uses of composites in structural and functional applications.
CO4: Understand the processing and properties of ceramics and polymers.
CO5: Identify the emerging applications of smart and advanced materials in multidisciplinary domains.

Text Books:

1. Callister, W. D., & Rethwisch, D. G. (2020). Materials science and engineering: An introduction (10th ed.). Wiley.
2. Smith, W. F., Hashemi, J., & Prakash, R. (2021). Materials science and engineering (6th ed., SI units). McGraw Hill Education.
3. Upadhyaya, G. S., & Upadhyaya, A. (2022). Materials science and engineering (Revised ed.). Viva Books.

Reference Books:

1. Raghavan, V. (2018). Materials science and engineering (6th ed.). Prentice Hall of India.
2. C. Barry Carter and M. Grant Norton, Ceramic Materials: Science and Engineering, Springer, 3rd Edition, 2023.
3. Bhattacharya, D. (2023). Smart materials and structures (2nd ed.). Oxford University Press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23ME302 SUSTAINABLE ENERGY TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

This course is designed to:

1. Introduce the global and national energy scenario and emphasize the importance of sustainability in energy systems.
2. Explain the principles and technologies associated with solar and wind energy systems.
3. Familiarize students with hydropower, wave, and tidal energy generation systems and their real-world applications.
4. Describe bioenergy and geothermal systems, including design considerations and environmental implications.
5. Evaluate the economics of renewable energy projects and explore integration techniques including storage and smart grids.

UNIT I INTRODUCTION TO SUSTAINABLE ENERGY SYSTEMS 9 hours

Energy demand and supply scenario – global and Indian context, Environmental impacts of conventional energy sources, Concept of sustainability and carbon footprint, Overview of renewable energy sources, Policy frameworks and SDGs.

UNIT II SOLAR AND WIND ENERGY TECHNOLOGIES 9 hours

Solar radiation basics, types of solar collectors (thermal and photovoltaic), Photovoltaic cell operation, efficiency factors, MPPT basics, Solar thermal applications: water heating, drying, Wind resource assessment, turbine types and operation, Onshore vs offshore wind power.

UNIT III HYDROPOWER, WAVE, AND TIDAL ENERGY 9 hours

Types of hydropower plants, turbine types, site selection, Ocean energy: wave and tidal principles, design concepts, Challenges in marine energy utilization, Case studies from India and abroad.

UNIT IV BIOENERGY AND GEOTHERMAL TECHNOLOGIES 9 hours

Biomass types, anaerobic digestion, biodiesel, bioethanol, Biogas plant design and efficiency, Geothermal energy basics, types of geothermal systems, Environmental and economic impacts.

UNIT V ECONOMICS AND INTEGRATION OF RENEWABLE ENERGY 9 hours

Economic analysis: LCOE, payback, IRR, Energy storage technologies: batteries, pumped hydro, Grid integration issues and smart grids, Future trends: hybrid systems, microgrids, hydrogen. Concept of waste to wealth.

Course Outcomes:

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

CO1: Explain the global and Indian energy scenario, sustainability concepts, and the role of renewable energy in achieving SDGs. (L2)

CO2: Analyze the working principles, components, and efficiency factors of solar and wind energy systems. (L3)

CO3: Illustrate the operation and site requirements of hydropower, wave, and tidal energy systems with relevant case studies. (L2)

CO4: Apply basic design and performance analysis for bioenergy and geothermal energy systems considering environmental aspects. (L3)
CO5: Evaluate the techno-economic feasibility of renewable energy systems and their integration into smart grids with energy storage. (L3)

Text Books:

1. Boyle, G. (2021). Renewable energy: Power for a sustainable future (4th ed.). Oxford University Press.
2. Twidell, J., & Weir, T. (2021). Renewable energy resources (4th ed.). Routledge.
3. Kothari, D. P., Singal, K. C., & Ranjan, R. (2020). Renewable energy sources and emerging technologies (3rd ed.). PHI Learning.

Reference Books:

1. Sorensen, B. (2019). Renewable energy: Physics, engineering, environmental impacts, economics & planning (5th ed.). Academic Press.
2. Kalogirou, S. A. (2022). Solar energy engineering: Processes and systems (3rd ed.). Academic Press.
3. Lund, H. (2021). Renewable energy systems: A smart energy systems approach to the choice and modeling of 100% renewable solutions (4th ed.). Academic Press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - I

23EEE301 ELECTRICAL SAFETY PRACTICES AND STANDARDS

	L	T	P	C
Pre-requisite: 23EEE101	**3**	**0**	**0**	**3**

Course Objectives:

1. To introduce the fundamentals of electrical safety, hazards of electric shock, arc, blast, and failure causes.
2. To explain the function and importance of electrical safety components, voltage classification, and protection devices.
3. To impart knowledge on grounding systems, bonding, and arc hazard categorization to ensure workplace safety.
4. To develop awareness about safety practices across various environments including residential, industrial, and special installations.
5. To familiarize students with relevant electrical safety standards, statutory regulations, and compliance requirements.

UNIT I INTRODUCTION TO ELECTRICAL SAFETY: **9 hours**

Fundamentals of Electrical safety-Electric Shock- physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.

UNIT II SAFETY COMPONENTS **9 hours**

Introduction to conductors and insulators- voltage classification -safety against over voltages- safety against static electricity-Electrical safety equipment‘s - Fire extinguishers for electrical safety.

UNIT III GROUNDING **9 hours**

General requirements for grounding and bonding- Definitions- System grounding-Equipment grounding - The Earth - Earthing practices- Determining safe approach distance-Determining arc hazard category.

UNIT IV SAFETY PRACTICES **9 hours**

General first aid- Safety in handling hand held electrical appliances tools- Electrical safety in train stations-swimming pools, external lighting installations, medical locations-Case studies.

UNIT V STANDARDS FOR ELECTRICAL SAFETY **9 hours**

Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate.

Course Outcomes:

CO1: Understand the fundamental principles of electrical safety and the physiological effects of electric shock-L2

CO2: Apply knowledge of electrical safety components and protective devices to mitigate over-voltages and static hazards -L3

CO3: Analyze equipment grounding, system grounding, and arc flash hazard categories in practical installations -L4

CO4: Implement appropriate safety procedures in varied environments such as homes, public spaces, and medical areas- L4

CO5: Evaluate the applicability and compliance of electrical systems with respect to national and international safety standards-L5

Text Books:

1. Massimo A.G.Mitolo, ―Electrical Safety of Low-Voltage Systems‖, McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi, ―Electric Safety - Practice and Standards‖, CRC Press, USA, 2014.

Reference Books:

1. Kenneth G.Mastrullo, Ray A. Jones, ―The Electrical Safety Program Book‖, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, ―Electrical Safety-Related Work Practices‖, Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W., ―Electrical Safety Engineering‖, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, ―Electrical Safety Hand book, McGraw-Hill, New York, USA, 4th edition, 2012.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective-I

23EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Pre-requisite 23EEE101

Course Objectives:

This course enables students to

1. To provide foundational knowledge on MEMS, its historical development, working principles, and scaling effects.
2. To understand the operation of micro sensors and actuators, and their integration into MEMS structures.
3. To explore MEMS materials and comprehend various microfabrication and micromachining techniques.
4. To develop competency in modeling MEMS devices using simulation methods such as FEM for sensor and actuator behavior.
5. To examine various applications of MEMS in different domains including RF, optical, microfluidic, and robotics systems.

UNIT I INTRODUCTION 9 hours

Overview – History and industry perspectives – Working principles – Mechanics and dynamics Scaling law

UNIT II MICRO SENSORS & ACTUATORS 9 hours

Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems.

UNIT III MICRO MANUFACTURING 9 hours

Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

UNIT IV MODELING IN MEMS 9 hours

Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

UNIT V MEMS APPLICATIONS 9 hours

Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Explain the history, structure, operating principles, and scaling challenges of MEMS – L2

CO2: Describe the working of micro sensors and actuators and their roles in MEMS – L2

CO3: Analyze the materials and various microfabrication techniques used in MEMS manufacturing – L4

CO4: Apply modeling techniques like FEM to simulate MEMS device behavior such as gyroscopes and piezoelectric sensors – L3

CO5: Evaluate MEMS applications in RF, fluidics, optics, and robotics through real-world case studies – L5

Text Book(s)

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006

2. G.K. Ananthsuresh et al ,'Micro and Smart Systems', Wiley, India, 2010

Reference Books

1. NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse, 2000

2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000.

3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective – I

23ECE301 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:
This course enables students to

1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids

UNIT I HUMAN PHYSIOLOGY AND BIOMEDICAL TRANSDUCERS 9 hours

Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.

UNIT II BIO-ELECTRODES AND AMPLIFIERS 9 hours

Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.

UNIT III BIOMEDICAL MEASURING INSTRUMENTS 9 hours

Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

UNIT IV MEDICAL IMAGING 9 hours

X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

UNIT V PROSTHESES AND AIDS 9 hours

Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1: Understand the applications of biological transducers in medical field.

CO2: Analyze the design of bio-electrodes and bio-amplifiers.

CO3: Apply suitable measuring instruments to measure various medical parameters.

CO4: Understand and test various imaging techniques used in bio-medical diagnosis.

CO5: Analyze the applications of artificial medical aids.

Text Books:

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.
2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014
2. R.S.Khandpur,"Handbook of Biomedical Instrumentation", 2nd edition, Tata McGraw - Hill, New Delhi, 2005
3. LeslieCromwell,"BiomedicalInstrumentationandMeasurement",Prentice-Hall, New Delhi, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – I

23ECE302 VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET models, CMOS design rules, Design of VLSI Systems, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives:
This course enables students to

1. Study the fundamentals of CMOS circuits and its characteristics
2. Learn the design and realization of combinational digital circuits.
3. Learn the design and realization of sequential digital circuits.
4. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
5. Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR 9 hours

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9 hours

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.
Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9 hours

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.
Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9 hours

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9 hours

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Realize the concepts of digital building blocks using MOS transistor.

CO2: Design combinational MOS circuits and power strategies

CO3: Design and construct Sequential Circuits and Timing systems.

CO4: Design arithmetic building blocks and memory subsystems.

CO5: Apply and implement FPGA design flow and testing.

Text Books:

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson , 2017.

2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits:A Design perspective", Second Edition , Pearson , 2016.

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.

2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

PROFESSIONAL ELECTIVES

Professional Elective - II

23CSN401 IMAGE PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite: 23MAT101

Course Objectives:

The objectives of the course are to

1. Introduce the fundamental concepts of digital image processing and its applications.
2. Provide understanding of image enhancement techniques in both spatial and frequency domains.
3. Study color image processing, morphological operations, and image compression techniques.
4. Enable students to apply image processing methods to real-world problems.

UNIT I INTRODUCTION AND DIGITAL IMAGE FUNDAMENTALS 9 hours

Introduction to Image Processing: Definition and applications (medical, satellite, industrial, mobile); Overview of a typical image processing system; Digital Image Fundamentals: Human Visual System, Image as 2D data, Concepts of resolution, dynamic range; Image Representation: Grayscale vs Color images, Bit-plane slicing; Image Sampling and Quantization: Concepts and effects of downsampling, Quantization and digitization artifacts, Nyquist theorem, aliasing.

UNIT II IMAGE ENHANCEMENT IN SPATIAL DOMAIN 9 hours

Introduction to Image Enhancement; Gray-Level Transformations: Linear and nonlinear transforms (log, gamma), Contrast stretching; Histogram Techniques: Histogram equalization, Histogram matching; Spatial Filtering: Smoothing (mean, Gaussian, median filters), Sharpening (Laplacian, gradient-based methods), Edge enhancement; Special Filters: Mexican Hat Transformation

UNIT III FREQUENCY DOMAIN FILTERING & IMAGE RESTORATION 9 hours

Fourier Transform & Frequency Domain Concepts: 1D & 2D Fourier Transforms, Filtering concepts in frequency domain; Filtering Techniques: Low-pass, high-pass filtering, Laplacian in frequency domain, Homomorphic filtering; Image Restoration Concepts: Noise models (Gaussian, salt-and-pepper), Restoration in spatial & frequency domain, Estimating degradation: inverse filtering

UNIT IV COLOUR IMAGE PROCESSING & MORPHOLOGICAL OPERATIONS 9 hours

Introduction to Color Image Processing: Color fundamentals and perception, Color models (RGB, CMY, HSI, YUV), Pseudo-coloring techniques; Introduction to Morphological Image Processing: Basic operations: erosion, dilation, Opening, closing, Algorithms: hole filling, thinning, skeletons, Connected components labeling

UNIT V IMAGE COMPRESSION 9 hours

Fundamentals of Compression: Redundancy types: coding, spatial, temporal; Lossless Compression Techniques: Huffman coding, Arithmetic coding, LZW coding; Lossy Compression Techniques: Quantization, JPEG standard overview; Error-Free Compression & Practical Examples: Use in document storage, web image optimization.

Course Outcomes:

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

CO1: Analyze fundamental concepts and applications of digital image processing.
CO2: Apply spatial domain techniques for image enhancement and filtering.
CO3: Analyze frequency domain filtering and image restoration methods.
CO4: Apply color image processing techniques and morphological operations.
CO5: Apply image compression methods for practical applications.

Text Books:

1. "Digital Image Processing", Rafael C. Gonzalez, Richard E. Woods, Pearson, 4th Edition, 2018.

Reference Books:

1. "Image Processing, Analysis, and Machine Vision", Milan Sonka, Vaclav Hlavac, Roger Boyle, Cengage Learning, 3rd Edition, 2007.
2. "Digital Image Processing: PIKS Scientific Inside", William K. Pratt, Wiley-Interscience, 4th Edition, 2007.
3. "Fundamentals of Digital Image Processing", A. K. Jain, 1st Edition, Prentice Hall, 1989.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - II

23CSN402 ADVANCED COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite: 23CSN104

Course Objectives:

The objectives of the course are to

1. Understand computer network architectures, protocols, and interfaces.
2. Introduce the OSI reference model and the Internet architecture for network applications.
3. Expose to traditional and modern computer networks including wireless, mobile, and multimedia-based systems.
4. Understand key concepts and practices employed in modern computer networking.

UNIT I NETWORK BASICS AND ARCHITECTURE 9 hours

Network Architecture - Performance: Bandwidth and Latency - High-Speed Networks - Network-Centric View - Error Detection - Reliable Transmission - Ethernet and Multiple Access Networks - Overlay Networks: Routing Overlays, Peer-to-Peer Networks, Content Distribution Networks - Client-Server Networks - Delay-Tolerant Networks

UNIT II SWITCHING AND IPV4 ADDRESSING 9 hours

Circuit-Switched Networks - Datagram Networks - Virtual-Circuit Networks - Message-Switched Networks - Asynchronous Transfer Mode: Evolution, Benefits, Concepts - Broadband ISDN: Layers and Adaptation Layer - IPv4: Address Space and Notations - Classful and Classless Addressing - Network Address Translation (NAT) - Datagram Structure

UNIT III IPV6, ICMP AND CONGESTION CONTROL 9 hours

Fragmentation and Checksum - IPv6 Address Structure and Address Space - IPv6 Packet Format and Extension Headers - ICMP - IGMP - ARP - RARP - Congestion Control and Resource Allocation: Problem and Issues - Queuing Mechanisms - TCP Congestion Control - Congestion-Avoidance Mechanisms - Quality of Service (QoS)

UNIT IV ROUTING AND OPTICAL NETWORKS 9 hours

Internetworking: Intra-Domain and Inter-Domain Routing - Unicast Routing Protocols: RIP, OSPF, BGP - Multicast Routing Protocols: DVMRP, PIM-DM, PIM-SM, CBT, MSDP, MOSPF - Spanning Tree Algorithm - Optical Networking: SONET/SDH Standards - Traffic Engineering: Requirements, Traffic Sizing, Characteristics, Protocols - Time and Delay Considerations - Connectivity - Availability - Reliability - Maintainability - Throughput Metrics

UNIT V MULTIMEDIA NETWORKING AND SECURITY 9 hours

Multimedia Over Internet: Transmission Techniques - IP Multicasting - Voice over IP (VoIP) - Domain Name System (DNS): Name Space, Domain Hierarchy - DNS Resolution and Dynamic DNS - Simple Network Management Protocol (SNMP) - Network Security: IPSec - SSL/TLS - PGP - Firewalls - Datacenter Design - Interconnection Networks

Course Outcomes:

At the end of this course students will be able to

CO1: Demonstrate modern computer network architectures

CO2: Implement switching techniques and IPv4 addressing

CO3: Apply IPv6, ICMP and congestion control mechanisms

CO4: Analyze routing protocols and optical network technologies

CO5: Apply multimedia and security protocols in networks

Text Books:

1. "Computer Networks: A Systems Approach", Peterson L L, Davie B S, Morgan Kaufmann, 5th Edition, 2012.
2. "Data Communications and Networking", Forouzan B A, McGraw Hill, 5th Edition, 2017.
3. "Introduction to Computer Networks and Cyber Security", Wu C H, Irwin J D, CRC Press, 1st Edition, 2014.
4. "Computer Networks", Tanenbaum A S, Wetherall D J, Pearson, 5th Edition, 2014.

Reference Books:

1. "Advanced Computer Networking: Concepts and Applications", Jain S, BPB Publications, 1st Edition, 2018.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - II

23CSN403 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Understand Android history and its fundamentals and know the building blocks of android.
2. Get idea on the creation of android user interface and its testing mechanisms.
3. Identify the usage of threads, broadcast receivers, indents, services and their working methodology.
4. Know about the storage mechanism in android using SQLite and the usage of content providers.
5. Recognize the usage of android widgets and sensors in android-based applications.

UNIT I INTRODUCTION AND INSTALLATION OF ANDROID TOOLS 9 hours

Android Overview, Android Versions, Android Flavors. **Android Stack**: Linux, Native Layer and Hardware Abstraction Layer (HAL), ART, Application Framework: Native C++ Library, Applications: System and User Applications - **Installation and Use of Android Tools:** Installing the Android SDK - Anatomy of an Android Project, XML Introduction, creating user interface using XML, Overview of Android Building Blocks.

UNIT II USER INTERACTION 9 hours

Input Components, Text View, Image View, List View, Menus: Popup, Options and Context Menus, Screen Navigation through App Bar, Recycler View, Material Design, Testing the User Interface: Screen Navigation using Intents: Definition, Usage of Intends, Creation of Indents with example program, Lists and Adapters, Types of Adapters, Examples using Adapters.

UNIT III THREADS, LOADERS AND ASYNCTASK LOADER, BROADCAST RECEIVERS, SERVICES 9 hours

Threading in Android, AsyncTask, Loaders, AsyncTask Loader, Connecting to Internet: JSON - HTTP API, Apache HTTP Client, HTTP URL Connection - Broadcast Receivers: Custom Broadcasts, Broadcasting Intends and their related API, Boot Receiver, Alarms and system services, Examples on alarms and services, Services: Services Life Cycle, Intent Service, Implementing Intent Service, Notifications: Managing Notifications.

UNIT IV SAVING, RETRIEVING AND LOADING DATA 9 hours

Android File systems and Files, Action Bar: Preferences and Action Bar, Shared Preferences, App Settings, Databases on Android, SQLite, Status Contract Class, Update Refresh Service, Cursors, Backups, Content Providers: Role of Content Providers, Content Provider Example Program, Content Resolver.

UNIT V APPLICATIONS WIDGETS, INTERACTION AND SENSORS 9 hours

App Widgets: Creation of Application Widgets, Interaction and Animation: Live Wallpaper and Handlers, Sensors: Sensor API in Android, Motion Sensor, Position Sensor, Environmental Sensor, Sensor Values, Sensor Manager Class, Sensor Class, Sensor Event class, Sensor Event Listener interface, Compass Accelerometer and orientation Sensors.

Course Outcomes:

At the end of this course students will be able to

CO1: Analyze the installation and usage of Android SDK tools.

CO2: Perform UI testing using Espresso framework.

CO3: Implement the process of updating notifications within Android apps.

CO4: Use Content Resolver to interact with content providers and perform CRUD operations.

CO5: Illustrate the Android App Widgets and its usage in Android apps.

Text Books:

1. "Android Programming-The Big Nerd Ranch Guide", Bill Philips, Christ Stewart, Kristin Mariscano, Big Nerd Ranch publishers, 3rd Edition, 2017.
2. "Android Programming for Beginners", John Horton, Packt Publishing, 2nd Edition, 2018.
3. "Learning Android", By Marko Gargenta & Masumi Nakamura, O'Reilly Media, 2nd Edition, 2014.
4. "Android Application Development All in One for Dummies", Barry Burd, Wiley, 2nd Edition, 2015.

Reference Books:

1. "Android application Development-Black Book", Pradeep Kothari, Dream Tech/Wiley India, 2014.
2. "Android Programming – Unleashed", B.M.Harwani, Pearson Education, 2013.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - II

23CSN404 NETWORK ADMINISTRATION

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Understand architecture, protocols, and tools for administering enterprise networks
2. Gain practical skills in configuring network devices and core services
3. Learn performance monitoring, troubleshooting, and security best practices
4. Introduce network virtualization, wireless management, and cloud integration
5. Prepare students for professional roles in network engineering and operations

UNIT I NETWORK ARCHITECTURE AND DEVICE CONFIGURATION 9 hours

Network fundamentals – LAN/WAN/WLAN architectures – OSI & TCP/IP models – Router and switch hardware – CLI basics – VLANs and inter-VLAN routing – Spanning Tree Protocol – basic redundancy protocols

UNIT II CORE NETWORK SERVICES 9 hours

DHCP: scopes, leases, reservations – DNS: zones, record types, forward/reverse resolution – NTP: synchronization – Syslog: centralized logging – Directory services overview (LDAP/AD)

UNIT III NETWORK SECURITY AND ACCESS CONTROL 9 hours

Access Control Lists: standard & extended – VPNs: site-to-site, remote access via IPSec – Firewall fundamentals – NAT and PAT – Secure protocols: SSH, HTTPS, SNMPv3

UNIT IV MONITORING, PERFORMANCE, AND TROUBLESHOOTING 9 hours

SNMP: architecture, MIBs, traps – NetFlow/IPFIX – Packet capture and analysis (Wireshark) – Ping, Traceroute, path diagnostics – QoS basics: classification, policing, queuing – Backup, firmware upgrades

UNIT V WIRELESS, VIRTUALIZATION & AUTOMATION 9 hours

WLAN standards (802.11a/b/g/n/ac/ax) – SSID, channel planning, security (WPA2/3, 802.1X, RADIUS) – Virtual LANs in virtual environments (VMware, Hyper-V) – Introduction to SDN and network programmability – Basic scripting and automation

Course Outcomes:

At the end of this course students will be able to

CO1: Configure and manage routers, switches, VLANs, and inter-VLAN routing

CO2: Deploy and troubleshoot core services including DHCP, DNS, and NTP

CO3: Implement and maintain network security using ACLs, VPNs, and firewalls

CO4: Monitor and analyze network performance using SNMP, NetFlow, and Wireshark

CO5: Manage wireless networks, virtualization, and network automation

Text Books:

1. "CCNA 200-301 Official Cert Guide", Odom W, Cisco Press, 1st Edition, 2020.
2. "CompTIA Network+ N10-008 Study Guide", Lammle T, Sybex, 1st Edition, 2022.
3. "Windows Server Administration Fundamentals", Stanek W, Microsoft Press, 1st Edition, 2010.

Reference Books:

1. "Computer Networking: A Top-Down Approach", Kurose J F, Ross K W, Pearson Education, 7th Edition, 2016.
2. "Cisco Networking Academy Material", Cisco, Online Resource, Accessed 2025.
3. "Computer Networks and Network Security", NPTEL – IIT Madras, Online Course, Accessed 2025.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - II

23CSN405 DevOps

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Introduce the fundamental concepts of DevOps and its misconceptions.
2. Expose about the collaboration concepts of DevOps.
3. Create a basic understanding of DevOps affinity and its misconceptions.
4. Familiarize with DevOps tools and its ecosystem.
5. Understand the DevOps Scaling and growth strategies.

UNIT I INTRODUCTION to DEVOPS 9 hours

A History of Devops, Foundational Terminology and Concepts, Software Development, Development, Release, and Deployment Concepts, Infrastructure Concepts, Cultural Concepts, Devops Misconceptions and Anti-Patterns, Common Devops Misconceptions, Devops vs SRE, Devops Anti-Patterns.

UNIT II COLLABORATION 9 hours

Collaboration: Individuals Working Together, Defining Collaboration, Individual Differences and Backgrounds, Opportunities for Competitive Advantage, Mentorship, Mindsets and Learning Organizations, Communication and Conflict Resolution Styles, Empathy and Trust, Humane Staffing and Resources, Collaboration Misconceptions, Collaboration Troubleshooting.

UNIT III AFFINITY 9 hours

Team building, Teams and Organizational Structure, Finding Common Ground Between Teams, Case Study - United States Patent and Trademark Office, Benefits of Improved Affinity, Requirements for Affinity, Measuring Affinity, Affinity Misconceptions, Affinity Troubleshooting.

UNIT IV TOOLS 9 hours

Tools: Ecosystem Overview, Software Development, Automation, Monitoring, Evolution of the Ecosystem, Tools: Accelerators of Culture, Irrelevance of Tools, The Impacts of Tools on Culture, Selection of Tools, Auditing Your Tool Ecosystem, Elimination of Tools, Case Study – Examining Etsy.

UNIT V SCALING 9 hours

Understanding scaling, Considering Enterprise Devops, Organizational Structure, Team Flexibility, Organizational Lifecycle, Complexity and Change, Scaling for Teams, Case Studies: Growing and Scaling Teams, Team Scaling and Growth Strategies, Scaling for Organizations, Examining Target.

Course Outcomes:

At the end of this course students will be able to

CO1: Analyze the DevOps foundation terminology, misconceptions and anti-patterns.

CO2: Apply the DevOps collaboration strategies.

CO3: Illustrate the DevOps affinity schemes.

CO4: Infer the DevOps tools in a specific problem scenario.

CO5: Utilize the DevOps scaling approaches for teams and organization.

Text Books:

1. "Effective DevOps", Jennifer Davis, Ryn Daniels, O'Reilly Publishers, 1st Edition, 2018.

2. "The DevOps Adoption Playbook", Sanjeev Sharma, Published by John Wiley & Sons, Inc., 1st Edition, 2017.

Reference Books:

1. "Practical DevOps", Joakim Verona, Packt Publishers, 1st Edition, 2016.

2. "The DevOps Handbook", Gene Kim, Jez Humble, Patrick Debois, John Willis, IT Revolution Publishers, 2nd Edition, 2021.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

23CSN406 GRAPH NEURAL NETWORKS

L	T	P	C
3	0	0	3

Prerequisites: Nil

Course Objectives:

The objectives of the course are to

1. Introduce the fundamentals of graph theory and graph-structured data.
2. Explore the concepts of neural networks extended to non-Euclidean domains.
3. Understand architectures and algorithms behind various types of GNNs.
4. Apply GNN models in real-world applications such as recommendation, social networks, and bioinformatics.
5. Build and evaluate GNN models using frameworks like PyTorch Geometric and DGL.

UNIT I FUNDAMENTALS OF GRAPH THEORY AND MACHINE LEARNING ON GRAPHS **9 hours**

Introduction to Graphs: Nodes, Edges, Adjacency Matrix, Types of Graphs: Directed, Undirected, Weighted, Bipartite, Graph Traversal Algorithms (BFS, DFS), Graph Representations for ML (Adjacency List, Matrix, Laplacian), Node, Edge, and Graph-level Prediction Problems, Motivation and Challenges for Learning on Graphs.

UNIT II SPECTRAL AND SPATIAL METHODS FOR GRAPH LEARNING **9 hours**

Spectral Graph Theory Basics, Graph Convolution via Spectral Methods, Chebyshev and First-order Approximations, Spatial Graph Convolutions, Comparison of Spectral vs Spatial GNNs, Graph Laplacian and Eigenvalue Properties.

UNIT III GRAPH NEURAL NETWORK ARCHITECTURES **9 hours**

Graph Convolutional Networks (GCNs), Graph Attention Networks (GATs), GraphSAGE: Sampling and Aggregation, Graph Isomorphism Networks (GIN), Message Passing Neural Networks (MPNNs), Inductive vs Transductive GNN Learning.

UNIT IV APPLICATIONS OF GNNs **9 hours**

Node Classification (e.g., Cora, Citeseer), Link Prediction (e.g., Recommender Systems), Graph Classification (e.g., Molecule Property Prediction), Traffic Forecasting and Social Network Modeling, GNNs in Healthcare and Bioinformatics, Explainability and Interpretability in GNNs.

UNIT V IMPLEMENTATION, OPTIMIZATION, AND RECENT ADVANCES **9 hours**

Overview of PyTorch Geometric and DGL, Data Loading and Preprocessing for Graph Datasets, Model Training, Loss Functions, and Evaluation Metrics, Hyperparameter Tuning in GNNs, Recent Research Trends and Architectures (e.g., Heterogeneous GNNs, Graph Transformers), Challenges and Future Directions in GNNs.

Course Outcomes:

At the end of this course students will be able to

CO1: Analyze the basics of graph structures and their significance in machine learning.

CO2: Compare different types of GNN architectures.

CO3: Apply GNNs to real-world structured data problems.

CO4: Use modern libraries and tools to train and evaluate GNNs.

CO5: Analyze the effectiveness and limitations of GNNs in different domains.

Text Books:

1. "A Comprehensive Survey on Graph Neural Networks", IEEE Transactions on Neural Networks and Learning Systems, Zonghan Wu, Shirui Pan, Fengwen Chen, Guodong Long, Chengqi Zhang, Philip S. Yu, 2021.

2. "Jiliang Tang,Deep Learning on Graphs", Yao Ma, Cambridge University Press, 2021.

Reference Books:

1. "Mining of Massive Datasets", Jure Leskovec, Anand Rajaraman, and Jeffrey D. Ullman, Cambridge University Press, 3rd, 2020.

2. "Graph Representation Learning", William L. Hamilton, Morgan & Claypool Publishers, 2020.

Online Learning Resources:

1. https://pytorch-geometric.readthedocs.io/– PyTorch Geometric Docs.

2. https://cs.stanford.edu/people/jure/ – Stanford GNN Projects.

3. https://www.coursera.org/learn/graph-neural-networks – Coursera GNN Course by Stanford.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

23CSN407 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

Pre-requisite: 23MAT101, 23MAT108

Course Objectives:

The objectives of the course are to

1. Study the concepts of Artificial Intelligence.
2. Learn the methods of solving problems using Artificial Intelligence.
3. Introduce the concepts of Expert Systems.
4. Understand the applications of AI, namely game playing, theorem proving, and machine learning.
5. Learn different knowledge representation techniques

UNIT I INTRODUCTION 9 hours

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT II SEARCHING STRATEGIES 9 hours

Searching- Searching for Solutions, Uniformed Search Strategies:Breadth first search, Depth First Search. Search with Partial Information (Heuristic Search) Hill Climbing, A*, AO* Algorithms, Problem Reduction, Game Playing, Adversial Search, Games, Mini-Max Algorithm, Optimal Decisions in Multiplayer Games, Problem in Game Playing, Alpha-Beta Pruning, Evaluation Functions.

UNIT III REPRESENTATION OF KNOWLEDGE 9 hours

Representation Of Knowledge: Knowledge Representation Issues, Predicate Logic, Logic Programming, Semantic Nets, Frames And Inheritance, Constraint Propagation, Representing Knowledge using Rules, Rules Based Deduction Systems. Reasoning Under Uncertainty, Review of Probability, Bayes' Probabilistic Interferences and Dempstershafer Theory.

UNIT IV LOGIC CONCEPTS 9 hours

Logic concepts: First Order Logic. Inference in First Order Logic, Propositional Vs. First Order Inference, Unification & Lifts Forward Chaining, Backward Chaining, Resolution, Learning from Observation Inductive Learning, Decision Trees, Explanation Based Learning, Statistical Learning Methods, Reinforcement Learning.

UNIT V EXPERT SYSTEMS 9 hours

Expert Systems: Architecture of Expert Systems, Roles of Expert Systems, Knowledge Acquisition Meta Knowledge Heuristics. Typical Expert Systems, MYCIN, DART, XCON, Expert Systems Shells.

Course Outcomes:

After completion of the course, students will be able to

CO1: Identify problems that are amenable to solution by AI methods.

CO2: Identify appropriate AI methods to solve a given problem.

CO3: Formalize a given problem in the language/framework of different AI methods.

CO4: Implement basic AI algorithms.

CO5: Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.

Text Books:

1. "Artificial Intelligence – A Modern Approach", S. Russel and P. Norvig, 2nd Edition, Pearson Education, 2003
2. "Artificial Intelligence (SIE)", Kevin Night and Elaine Rich, Nair B., Mc Graw Hill, 2008.

Reference Books:

1. "Computational Intelligence: a logical approach", David Poole, Alan Mackworth, Randy Goebel, 1st Edition, Oxford University Press, 2004
2. "Artificial Intelligence: Structures and Strategies for complex problemsolving", G. Luger, 4th Edition, Pearson Education, 2001

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

23CSN408 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

Prerequisites: Nil

Course Objectives:

The objectives of the course are to

1. Provide a strong foundation in the principles and techniques of Natural Language Processing (NLP).
2. Introduce classical and deep learning-based approaches to NLP tasks.
3. Build and evaluate models for various NLP applications such as text classification, sentiment analysis, and machine translation.
4. Understand modern tools and libraries used in NLP such as NLTK, SpaCy, and HuggingFace Transformers.
5. Provide insights into the challenges of multilingual NLP and ethical concerns.

UNIT I FUNDAMENTALS OF NATURAL LANGUAGE PROCESSING 9 hours

Introduction to NLP: Definitions, Applications, Challenges, Linguistic Essentials: Syntax, Semantics, Pragmatics, Text Processing: Tokenization, Lemmatization, Stemming, Stopword Removal, Normalization, and N-gram Generation, POS Tagging and Named Entity Recognition, NLP Libraries: NLTK, SpaCy Overview.

UNIT II TEXT REPRESENTATION AND STATISTICAL NLP 9 hours

Bag of Words and TF-IDF, Language Modelling: Unigrams, Bigrams, N-gram Models, Word Embeddings: Word2Vec, GloVe, FastText, Cosine Similarity and Distance Measures, Text Classification using Naive Bayes and SVM, Evaluation Metrics: Accuracy, Precision, Recall, F1.

UNIT III DEEP LEARNING FOR NLP 9 hours

Neural Network Basics for NLP, Recurrent Neural Networks (RNNs) and Limitations, LSTM and GRU Networks, Sequence Labeling: POS Tagging, NER using Bi-LSTM, Text Classification using CNNs and RNNs, Model Evaluation and Hyperparameter Tuning.

UNIT IV TRANSFORMERS AND ADVANCED NLP 9 hours

Attention Mechanism and Self-Attention, Transformer Architecture: Encoder-Decoder Models, Pretrained Language Models: BERT, RoBERTa, GPT, Fine-tuning Transformers for Text Classification, Question Answering and Text Summarization using Transformers, Sentiment Analysis and Zero-shot Classification.

UNIT V APPLICATIONS, ETHICS, AND MULTILINGUAL NLP 9 hours

Machine Translation: Rule-based vs Neural MT, Chatbots and Conversational AI, Information Retrieval and Question Answering, Speech-to-Text and Text-to-Speech Overview, Multilingual NLP and Low-Resource Languages, Bias, Fairness, and Ethics in NLP.

Course Outcomes:

At the end of this course students will be able to

CO1: Demonstrate the fundamentals and challenges of natural language understanding.

CO2: Apply linguistic preprocessing techniques such as tokenization, stemming, POS tagging & parsing

CO3: Implement NLP algorithms for tasks like classification, translation, and information retrieval.

CO4: Develop deep learning models using RNNs, LSTMs for NLP.

CO5: Use NLP tools to analyze and interpret natural language data in real-world scenarios.

Text Books:

1. "Speech and Language Processing", Daniel Jurafsky and James H. Martin, Pearson Education, 2nd Edition, 2014.
2. "Natural Language Processing with Python", Steven Bird, Ewan Klein, Edward Loper, O'Reilly Media, 1st Edition, 2009.
3. "Neural Network Methods in NLP", Yoav Goldberg, Morgan & Claypool, 1st Edition, 2017.

Reference Books:

1. "Introduction to Natural Language Processing", Jacob Eisenstein, MIT Press, 1st Edition, 2019.
2. "Natural Language Processing with PyTorch", Delip Rao and Brian McMahan, O'Reilly, 1st Edition, 2019.
3. "Transformers for Natural Language Processing", Thushan Ganegedara, Packt Publishing, 2nd Edition, 2022.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

23CSN409 CYBER FORENSICS

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Provide digital evidences which are obtained from digital media.
2. Understand the objectives of computer forensics, first of all, people have to recognize the different roles computer plays in a certain crime.
3. Understand snippet from the United States Security Service, the functions computer has in different kinds of crimes.
4. Understand the procedures for acquiring, preserving, and analyzing digital evidence from various digital media.
5. Explore the role of forensic tools and techniques in investigating cybercrimes and ensuring legal admissibility of evidence.

UNIT I INTRODUCTION OF CYBERCRIME 9 hours

Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident

UNIT II FORENSIC DUPLICATION 9 hours

Initial Response and forensic duplication, Initial Response & Volatile Data Collection from Windows system -Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. Duplicate/Qualified Forensic Duplicate of a Hard Drive

UNIT III FORENSICS ANALYSIS AND VALIDATION 9 hours

Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project.

UNIT IV CURRENT FORENSIC TOOLS 9 hours

Current Forensic tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT V WORKING WITH WINDOWS AND DOS SYSTEMS 9 hours

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

Course Outcomes:

At the end of this course students will be able to

CO1: Illustrate the fundamentals of cybercrime.

CO2: Demonstrate knowledge of various network attack types.

CO3: Analyze tools used in cybercrime investigation.

CO4: Use computer forensics fundamentals and tools in investigations.

CO5: Examine legal perspectives related to cybercrime.

Text Books:

1. "Incident Response and computer forensics", Kevin Mandia, Chris Prosise, Tata McGraw Hill, 2006.
2. "Computer Forensics, Computer Crime Investigation", John R. Vacca, Firewall Media, New Delhi.
3. "Computer Forensics and Investigations", Nelson, Phillips Enfinger, Steuart, CENGAGE Learning

Reference Books:

1. "Real Digital Forensics", Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison- Wesley Pearson Education
2. "Forensic Compiling", A Tractitioneris Guide, Tony Sammes and Brian Jenkinson, Springer International edition.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

23CSN410 BIG DATA ANALYTICS

L	T	P	C
2	1	0	3

Pre-requisite: 23CSM104, 23CSM102, 23MAT107, 23CSM101

Course Objectives:

The objectives of the course are to

1. Introduce the fundamentals of big data and its role in AI-driven applications.
2. Explore big data tools and technologies such as Hadoop, Spark, and NoSQL databases.
3. Build scalable AI pipelines for data analytics.
4. Apply AI/ML algorithms for real-time and batch processing environments.
5. Demonstrate use cases of big data in domains like healthcare, finance, and IoT using AI.

UNIT I INTRODUCTION TO BIG DATA AND ANALYTICS ECOSYSTEM 9 hours

Definition and Characteristics of Big Data – Volume, Velocity, Variety, Veracity, Value, Types of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive, Big Data Challenges and Opportunities, Hadoop Ecosystem Overview: HDFS, MapReduce, YARN, NoSQL Databases: Key-Value, Columnar, Document, Graph Models, Data Lake vs. Data Warehouse.

UNIT II BIG DATA TOOLS AND FRAMEWORKS 9 hours

Apache Spark Architecture and RDDs, Spark SQL, DataFrames, and Datasets, Spark Streaming for Real-Time Analytics, Kafka for Data Ingestion and Message Queues, Hive, Pig, and Impala for Big Data Querying, Comparative Analysis of Hadoop vs. Spark.

UNIT III MACHINE LEARNING ON BIG DATA 9 hours

Introduction to MLlib and Scikit-learn, Data Preprocessing for Big Data ML Pipelines, Supervised Learning: Classification and Regression on Large Datasets, Unsupervised Learning: Clustering and Dimensionality Reduction, Model Evaluation and Validation Techniques, Distributed Training and Optimization Techniques.

UNIT IV AI APPLICATIONS ON BIG DATA 9 hours

Predictive Maintenance using Big Data & AI, Fraud Detection in Banking with Machine Learning, AI in Healthcare: Diagnosis, Genomics, Patient Monitoring, Retail and E-commerce Analytics, AI for Smart Cities and IoT Sensor Data Analysis, Evaluation of Real-Time AI Applications on Streaming Data.

UNIT V ADVANCED TOPICS AND CASE STUDIES 9 hours

Deep Learning on Big Data using TensorFlow on Spark, Explainable AI (XAI) in Big Data Environments, Ethical Issues and Data Governance in Big Data AI, Edge Computing and AI for Low Latency Applications, Case Study 1: AI-Powered Big Data in Healthcare, Case Study 2: Big Data AI Solution in Smart Manufacturing.

Course Outcomes:

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

CO1: Analyze the architecture and ecosystem of big data processing systems.
CO2: Analyze large datasets using Hadoop and Spark platforms.
CO3: Apply AI and ML techniques to extract insights from big data sources.
CO4: Design scalable data pipelines using distributed frameworks.
CO5: Develop solutions to real-world problems using AI-powered big data tools.

Text Books:

1. "Big Data: Principles and Paradigms", Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, 1st Edition, Wiley, 2016.
2. "Learning Spark: Lightning-Fast Big Data Analysis", Jules S. Damji, 2nd Edition, O'Reilly, 2020.
3. "Data Science and Big Data Analytics", EMC Education Services, 1st Edition, Wiley, 2015

Reference Books:

1. "Designing Data-Intensive Applications", Martin Kleppmann, 1st Edition, O'Reilly, 2017
2. "Machine Learning with Spark", Rajdeep Dua, Tathagata Das, 1st Edition, Packt Publishing, 2017.
3. "Streaming Systems", Tyler Akidau, 1st Edition, O'Reilly Media, 2018.
4. "Artificial Intelligence for Big Data", Anand Deshpande, 1st Edition, Packt Publishing, 2018.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Enhancement Course

Skill Enhancement Course - I

23CSN601 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

Pre-requisite: NIL

Course Objectives:

This course serves as an introduction to the Python programming language, designed for beginners with little or no prior programming experience. Python is renowned for its simplicity and readability, making it an ideal first language. The course will cover fundamental programming concepts such as variables, data types, control flow (loops and conditionals), functions, and basic file handling. Participants will gain hands-on experience through coding exercises and projects, reinforcing their understanding of Python syntax and best practices.

UNIT I DATA TYPES, EXPRESSIONS AND CONTROL FLOW STATEMENTS — 6 hours

Introduction: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a program to swap two numbers without using a temporary variable.
3. Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

UNIT II LISTS & DICTIONARIES — 6 hours

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Sample Experiments:

4. Write a program to perform the given operations on a list:
   i. Addition ii. Insertion iii. slicing
5. Write a program to perform any 5 built-in functions by taking any list.

Write a program to sum all the items in a given dictionary.

UNIT III Tuples and Sets — 6 hours

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

6. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
7. Write a program to count the number of vowels in a string (No control flow allowed).
8. Write a program to check if a given key exists in a dictionary or not.

UNIT IV FUNCTIONS & STRINGS 6 hours

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Sample Experiments:

9. Write a program to define a function with multiple return values.
10. Write a program to define a function using default arguments.

Write a program to find the length of the string without using any library functions.

UNIT V Files handling in Python 6 hours

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Sample Experiments:

11. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
12. Implement a Python program to print each line of a file in reverse order.

Write a Python program to compute the number of characters, words and lines in a file.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Understand to adept command of Python syntax, deftly utilizing variables, data types, and control structures.

CO2: Interpret Strings, functions, modules, exception handling to engineer robust and efficient code solutions.

CO3: Apply Python programming concepts like Lists and Dictionary to solve a variety of computational problems.

CO4: Build and manipulate fundamental data structures such as tuples and sets.

CO5: Demonstrate file handling concepts in python.

Text Books:

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.

2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024.

Reference Books:

1. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

2. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Enhancement Course - II

23CSN602 DATA SCIENCE USING PYTHON

L	T	P	C
1	0	2	2

Pre-requisite: 23CSN601

Course Objectives:

1. To train the students in solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation.

UNIT I INTRODUCTION TO DATA SCIENCE 6 hours

The life cycle of Data Science- The Art of Data Science - Work with data data Cleaning, data Managing, data manipulation. Establishing computational environments for data scientists using Python with IPython and Jupyter.

1. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random functions.

UNIT II INTRODUCTION TO NUMPY 6 hours

NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions.

2. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
3. Computation on NumPy arrays using Universal Functions and Mathematical methods.
4. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
5. Load an image file and do crop and flip operation using NumPy Indexing.
6. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
7. Create Pandas Series and Data Frame from various inputs.

UNIT III DATA MANIPULATION WITH PYTHON 6 hours

Introduction to pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries, Indexing, Selection, and Filtering, Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership.

8. Import any CSV file to Pandas Data Frame and perform the following:
   (a) Visualize the first and last 10 records
   (b) Get the shape, index and column details.
   (c) Select/Delete the records(rows)/columns based on conditions.
   (d) Perform ranking and sorting operations.
   (e) Do required statistical operations on the given columns.
   (f) Find the count and uniqueness of the given categorical values.
   (g) Rename single/multiple columns.

UNIT IV DATA CLEANING, PREPARATION AND VISUALIZATION 6 hours

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

9. Import any CSV file to Pandas Data Frame and perform the following:
   (a) Handle missing data by detecting and dropping/ filling missing values.
   (b) Transform data using apply () and map () method.
   (c) Detect and filter outliers.
   (d) Perform Vectorized String operations on Pandas Series.
   (e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots

UNIT V MACHINE LEARNING USING PYTHON 6 hours

Introduction Machine Learning: Categories of Machine Learning algorithms, Feature Engineering, Naive Bayes Classification - Linear Regression – K-Means Clustering

10. Write a program to demonstrate Linear Regression analysis with residual plots on a given data set.
11. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
12. Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.

Course Outcomes:

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

CO1: Illustrate the use of various data structures.

CO2: Analyze and manipulate Data using Numpy and Pandas.

CO3: Creating static, animated, and interactive visualizations using Matplotlib.

CO4: Understand the implementation procedures for the machine learning algorithms.

CO5: Identify and apply Machine Learning algorithms to solve real-world problems using appropriate data sets.

Text Books:

1. Wes McKinney, " Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython", O'Reily, 2nd Edition, 2018.

Reference Books:

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.

2. Francois Chollet, Deep Learning with Python, 1/e, Manning Publications Company, 2017.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Enhancement Course - III

23CSN603 UI DESIGN

L	T	P	C
1	**0**	**2**	**2**

Pre-requisite: 23CSN101

Course Objectives:

The objectives of the course are to

1. Implement Flutter Widgets and Layouts
2. Understands Responsive UI Design and with Navigation in Flutter
3. Gain knowledge on Widges and customize widgets for specific UI elements, Themes
4. Understand to include animation apart from fetching data

UNIT I INTRODUCTION AND BASICS 6 hours

Overview of Flutter and Dart; Understanding SDK and development environment setup; Basics of Dart language: syntax, variables, data types, control flow; Introduction to Flutter widgets and UI structure.

1. a) Install Flutter and Dart SDK.
   b) Write a simple Dart program to understand the language basics.
2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
   b) Implement different layout structures using Row, Column, and Stack widgets.

UNIT II RESPONSIVE UI AND NAVIGATION 6 hours

Principles of responsive design; Understanding screen sizes, media queries, and breakpoints; App navigation concepts: stack-based navigation, routes

3. a) Design a responsive UI that adapts to different screen sizes.
   b) Implement media queries and breakpoints for responsiveness.
4. a) Set up navigation between different screens using Navigator.
   b) Implement navigation with named routes.

UNIT III STATE MANAGEMENT AND CUSTOMIZATION 6 hours

Stateful vs stateless widgets: lifecycle and use cases; Overview of state management techniques (setState, Provider); Custom widgets and the importance of reusable components; Styling concepts: themes and custom styles

5. a) Learn about stateful and stateless widgets.
   b) Implement state management using set State and Provider.
6. a) Create custom widgets for specific UI elements.
   b) Apply styling using themes and custom styles.

UNIT IV FORMS AND ANIMATIONS 6 hours

Understanding forms and user input in mobile apps; Validation strategies and error handling; Animation fundamentals: types, easing, timelines

7. a) Design a form with various input fields.
   b) Implement form validation and error handling.
8. a) Add animations to UI elements using Flutter's animation framework.
   b) Experiment with different types of animations (fade, slide, etc.).

UNIT V DATA HANDLING AND TESTING 6 hours

REST APIs: basics and how apps interact with servers; Overview of unit testing and debugging in Flutter; Best practices for testing UI components

9. a) Fetch data from a REST API.
   b) Display the fetched data in a meaningful way in the UI.
10. a) Write unit tests for UI components.
    b) Use Flutter's debugging tools to identify and fix issues.

Course Outcomes:

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

CO1: Set up Flutter/Dart environment and create basic UI using fundamental widgets and layouts.

CO2: Build responsive Flutter apps with effective screen navigation using media queries and routes.

CO3: Manage app state and customize UI with reusable widgets and theming.

CO4: Develop validated forms and enhance UI with animations in Flutter.

CO5: Integrate REST APIs, perform unit testing, and debug Flutter applications efficiently.

Text Books:

1. "Beginning Flutter: A Hands-on Guide to App Development", Marco L. Napoli, 1st Edition, **John Wiley & Sons, 2019**
2. "Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter and Dart 2", Alessandro Biessek, 1st Edition, Packt Publishing, 2019.
3. "Programming Flutter: Native, Cross-Platform Apps the Easy Way", Carmine Zaccagnino, 1st Edition, Pragmatic Bookshelf, 2020

Reference Books:

1. "Dart Apprentice", Jonathan Sande, Matt Galloway, 2nd Edition, Razeware LLC, 2020
2. "Flutter Complete Reference", Alberto Miola, Independently published, 2020

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Enhancement Course - IV

23ENG601 SOFT SKILLS

L	T	P	C
1	0	2	2

Course Objectives:

1. To encourage all round development of the students by focusing on soft skills
2. To make the students aware of critical thinking and problem-solving skills
3. To enhance healthy relationship and understanding within and outside an organization
4. To function effectively with heterogeneous teams
5. To prepare students for job interviews, group discussions, and workplace communication with confidence and clarity.

UNIT I SOFT SKILLS & COMMUNICATION SKILLS 9 hours

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques

Activities:

Intrapersonal Skills-Narration about self-strengths and weaknesses-clarity of thought–self-expression – articulating with felicity

(The facilitator can guide the participants before the activity citing example from the lives of the great, anecdotes and literary sources)

Interpersonal Skills-Group Discussion–Debate–Team Tasks-Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication-Oral Presentations-Extempore-brief addresses and speeches- convincing-negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication–Public speaking–Mock interviews–presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT II CRITICAL THINKING 9 hours

Active Listening–Observation–Curiosity– Introspection–Analytical Thinking–Open- mindedness – Creative Thinking- Positive thinking - Reflection

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues–placing the problem–finding the root cause-seeking viable solution– judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT III PROBLEM SOLVING & DECISION MAKING 9 hours

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion

UNIT IV EMOTIONAL INTELLIGENCE & STRESS MANAGEMENT 9 hours

Managing Emotions–Thinking before Reacting–Empathy for Others–Self-awareness– Self-Regulation – Stress factors – Controlling Stress – Tips.

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT V CORPORATE ETIQUETTE 9 hours

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cellphoneetiquette-Diningetiquette-Netiquette-Jobinterviewetiquette- Corporate grooming tips - Overcoming challenges

Activities

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette-Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.

Case studies may be given wherever feasible for example for Decision Making-The decision of King Lear.

Course Outcomes:

After completion of the course, students will be able to

CO1: List out various elements of soft skills
CO2: Describe methods for building professional image.
CO3: Apply critical thinking skills in problem solving
CO4: Analyse the needs of an individual and team for well-being
CO5: Assess the situation and take necessary decisions

Text Books:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, 2018 ,esuo Hgnihsilbu PlanoitanretnIKI

Reference Books:

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise

Personality Published by Wiley, 2013

4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills(Paperback English)Publisher: Vayu Education of India, 2014

Online Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_ y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
5. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor in Quantum Computing

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Minors

23MDINS101 INTRODUCTION TO QUANTUM COMPUTING

	L	T	P	C
Pre-requisite: None	**3**	**0**	**0**	**3**

Course Description:

This course introduces the basics of quantum mechanics as applied to computing. Students learn about qubits, quantum gates, circuits, and key algorithms like Grover's and Shor's. Concepts such as superposition, entanglement, and quantum communication are explored. Practical exposure is given through programming on platforms like IBM Qiskit.

Course Objectives:

1. Understand quantum mechanics principles in computing.
2. Explore qubits, quantum gates, and circuits.
3. Analyze the advantages of quantum algorithms.
4. Study entanglement, superposition, and interference.
5. Investigate real-world applications and platforms.

UNIT I QUBITS AND QUANTUM FOUNDATIONS 9 hours

Classical Bits vs Qubits, Postulates of Quantum Mechanics, Superposition and Probability Amplitudes, Dirac Notation (Bra-Ket), Bloch Sphere Representation, Measurement in Quantum Systems, Quantum State Collapse.

UNIT II QUANTUM GATES AND CIRCUITS 9 hours

Quantum Logic Gates: Pauli-X, Y, Z; Hadamard (H); Phase (S, T), Controlled Gates: CNOT, Toffoli, Unitary and Reversible Operations, Quantum Circuit Representation, Building Basic Quantum Circuits, Quantum Parallelism and Interference, No-Cloning Theorem and Quantum Gate Simulation.

UNIT III QUANTUM ALGORITHMS 9 hours

Need for Quantum Algorithms, Deutsch and Deutsch-Jozsa Algorithm, Grover's Search Algorithm (Quadratic Speed-up), Shor's Factoring Algorithm (Exponential Speed-up), Simon's Algorithm (Overview), Complexity Comparison: Classical vs Quantum.

UNIT IV ENTANGLEMENT AND QUANTUM COMMUNICATION 9 hours

Quantum Entanglement and Bell States, Quantum Teleportation Protocol, Superdense Coding, Quantum Key Distribution: BB84, E91 Protocols, Decoherence and Quantum Noise, Quantum Error Correction Codes (Bit Flip, Phase Flip, Shor Code).

UNIT V QUANTUM PLATFORMS AND APPLICATIONS 9 hours

Overview of Quantum Programming Platforms: IBM Qiskit, Microsoft Q#, Google Cirq, Quantum Circuit Simulation using Qiskit, Executing Code on Real Quantum Hardware (IBM Q). Quantum Applications in:Cryptography, Machine Learning, Optimization, Chemistry, Building and Testing a Sample Quantum Program.

Course Outcomes:

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

CO1: Explain concepts of quantum mechanics
CO2: Illustrate quantum gates/circuits
CO3: Analyze algorithms (e.g., Shor, Grover)
CO4: Evaluate communication protocols
CO5: Develop quantum programs on IBM Q

Text Books:

1. **Michael A. Nielsen & Isaac L. Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition.
2. **David McMahon** – *Quantum Computing Explained*, Wiley.
3. **Bernhardt, Chris** – *Quantum Computing for Everyone*, MIT Press.

Reference Books:

1. **Mermin, N. David** – *Quantum Computer Science: An Introduction*, Cambridge University Press.
2. **William H. Press et al.** – *Numerical Recipes in C: The Art of Scientific Computing* (for simulation background)
3. **Rieffel&Polak** – *Quantum Computing: A Gentle Introduction*, MIT Press.
4. **Mermin, N. David** – *Quantum Computer Science: An Introduction*, Cambridge University Press.
5. **William H. Press et al.** – *Numerical Recipes in C: The Art of Scientific Computing* (for simulation background)
6. **Rieffel&Polak** – *Quantum Computing: A Gentle Introduction*, MIT Press.

Online Courses & Resources:
IBM Qiskit: IBM Qiskit Textbook:Hands-on, beginner-friendly curriculum for quantum programming
Coursera:*Quantum Mechanics for Scientists and Engineers* by Stanford (Leonard Susskind)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minors

23MDINS102 MATHEMATICAL FOUNDATIONS FOR QUANTUM COMPUTING

	L	T	P	C
Pre-requisite: None	**3**	**0**	**0**	**3**

Course Description:

This course covers the mathematical tools required for quantum computing. It focuses on linear algebra, complex vector spaces, eigenvalues, and probability theory in quantum systems. Students gain skills to model quantum states and analyze measurements. These foundations prepare them for understanding quantum algorithms.

Course Objectives:

1. Cover linear algebra & complex vector spaces.
2. Model quantum states mathematically.
3. Apply probability theory to measurements.
4. Study eigenvalues and transformations.
5. Prepare for algorithm analysis with rigor.

UNIT I FOUNDATIONS OF COMPLEX VECTOR SPACES 9 hours

Complex Numbers: Polar form, Euler's formula, Vectors in $\mathbb{C}^n$, Inner Product Spaces, Dirac Notation (Bra-Ket), Hilbert Space: Definitions and Properties, Orthogonality and Completeness, Norms, Metrics, and Distance in Complex Spaces.

UNIT II MATRIX ALGEBRA AND OPERATORS 9 hours

Matrix Multiplication and Linear Transformations, Special Matrices: Identity, Diagonal, Unitary, Tensor Products of Matrices and Vectors, Kronecker Product Applications, Unitary and Invertible Operators, Quantum Gates as Linear Operators.

UNIT III EIGEN CONCEPTS AND QUANTUM OBSERVABLES 9 hours

Eigenvalues and Eigenvectors, Hermitian Operators and Spectral Theorem, Quantum Observables and Expectation Values, Commutators and Compatibility, Measurement Operators and Matrix Diagonalization, Applications in Quantum Gate Analysis.

UNIT IV QUANTUM MEASUREMENT & PROBABILITY 9 hours

Basics of Probability Theory in Quantum Systems, Born's Rule and Measurement Probabilities, Projection Postulate, Density Matrix Formalism, Mixed States and Pure States, Trace, Partial Trace, and Operator Sums.

UNIT V ADVANCED STRUCTURES IN QUANTUM MATH 9 hours

Group Theory Basics: Symmetry, Permutations, Pauli Group, Clifford Group, and their roles, Fourier Transform in Quantum Context, Gram-Schmidt Orthogonalization, Lie Groups and Lie Algebras, Use of Lie Algebra in Hamiltonian Formulation.

Course Outcomes:

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

CO1: Explain concepts of quantum mechanics
CO2: Illustrate quantum gates/circuits
CO3: Analyze algorithms (e.g., Shor, Grover)
CO4: Evaluate communication protocols
CO5: Develop quantum programs on IBM Q

Text Books:

1. **Nielsen & Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press
2. **Brian C. Hall** – *Quantum Theory for Mathematicians*, Springer
3. **T.S. Blyth & E.F. Robertson** – *Basic Linear Algebra*, Springer

Reference Books:

1. **Roman S.** – *Advanced Linear Algebra*, Springer
2. **Axler, Sheldon** – *Linear Algebra Done Right*, Springer
3. **Shankar, R.** – *Principles of Quantum Mechanics*, Springer
4. **W. Greiner** – *Quantum Mechanics: An Introduction*, Springer

Online Courses & Resources:
MIT OpenCourseWare:*Linear Algebra (Gilbert Strang):*Link
edX:*Mathematics for Quantum Computing* by TUDelft:Link
Khan Academy:*Linear Algebra, Probability & Statistics:*Link
Quantum Country:*Spaced Repetition & Essays on Quantum Math:*Link

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minors

23MDINS201 QUANTUM PROGRAMMING AND SIMULATION LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisties: None

Course Description:

This lab provides hands-on experience with quantum algorithms. Students implement and simulate algorithms such as Deutsch-Jozsa, Grover's search, Shor's algorithm, and teleportation. Both simulation and real hardware platforms are used. The focus is on practical understanding and experimentation.

Course Objectives:

1. To train students in programming quantum circuits using Qiskit, Q#, and related tools.
2. To explore advanced quantum simulations for teleportation, QFT, and hybrid models.
3. To develop practical skills in debugging and optimizing quantum programs.
4. To expose learners to both simulated environments and real quantum devices.
5. To motivate students through project-based learning in quantum applications.

List of Experiments:

1. State Vector Simulation (Qiskit)
2. Bell State Implementation
3. Deutsch-Jozsa Circuit
4. Grover's Search in Qiskit
5. QFT Circuit in Python
6. Shor Algorithm Simulation
7. Quantum Teleportation in Code
8. VQE (Hybrid Circuit)
9. QAOA Simulation
10. Quantum Random Number Generator
11. Comparison: Real vs Simulated Runs
12. Mini-Project: Quantum Password Cracker

Course Outcomes:

CO1: Ability to program and simulate quantum algorithms effectively.
CO2: Proficiency in using platforms like IBM Qiskit and Microsoft Q# for experimentation.
CO3: Understanding of differences between simulated and real hardware execution.
CO4: Skills to implement hybrid quantum-classical solutions such as VQE and QAOA.
CO5: Experience in developing a mini-project showcasing applied quantum computing.

Reference Books:

1. Michael Nielsen & Isaac Chuang – *Quantum Computation and Quantum Information*
2. Eric R. Johnston et al. – *Programming Quantum Computers*
3. David McMahon – *Quantum Computing Explained*
4. Gilbert Strang – *Introduction to Linear Algebra*
5. Sarah Kaiser & Chris Granade – *Learn Quantum Computing with Python and Q#*

Online Learning Resources/Virtual Labs:

IBM Qiskit Textbook: https://qiskit.org/learn
Microsoft Q# Documentation: https://learn.microsoft.com/en-us/azure/quantum/
Coursera: *Introduction to Quantum Computing*
edX: *Quantum Computing Fundamentals, Quantum Algorithms*

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

Minors

23MDINS103 QUANTUM ALGORITHMS

	L	T	P	C
Pre-requisite: None	**3**	**0**	**0**	**3**

Course Description:

This course explores the design and analysis of algorithms in the quantum domain. Students study key algorithms like Deutsch, Grover's search, and Shor's factoring, along with Fourier-based methods. The course highlights the speed-up of quantum methods over classical ones. Implementation on real frameworks like Qiskit is emphasized.

Course Objectives:

1. Understand algorithm design principles in the quantum domain.
2. Use mathematical tools such as linear algebra and probability in algorithm analysis.
3. Implement quantum algorithms and compare them with classical equivalents.
4. Study key applications in cryptography, database search, and optimization.

UNIT I MATHEMATICAL TOOLS FOR QUANTUM ALGORITHMS 9 hours

Review of Complex Numbers & Linear Algebra for Quantum Computing, Inner Product Spaces, Hilbert Spaces, Dirac Notation and Interpretations, Quantum State Vectors and Superposition, Overview of Quantum Gates and Operators, Building Block Concepts for Algorithmic Design.

UNIT II SEARCH AND ORACLE-BASED ALGORITHMS 9 hours

Deutsch's Algorithm: Problem and Solution Strategy, **Simon's Algorithm**: Period-finding and Speed-up Over Classical, **Grover's Search Algorithm**: Amplitude Amplification, Oracle Construction in Grover's Algorithm, Circuit Analysis and Complexity Comparison, Limitations and Applications in Database Search.

UNIT III EIGEN CONCEPTS AND QUANTUM OBSERVABLES 9 hours

Eigenvalues and Eigenvectors, Hermitian Operators and Spectral Theorem, Quantum Observables and Expectation Values, Commutators and Compatibility, Measurement Operators and Matrix Diagonalization, Applications in Quantum Gate Analysis.

UNIT IV FOURIER-BASED & CRYPTOGRAPHIC ALGORITHMS 9 hours

Quantum Fourier Transform (QFT): Theory and Circuit, **Phase Estimation Algorithm**: Foundations and Usage, **Shor's Algorithm**: Integer Factorization and Discrete Logarithms, Modular Arithmetic and Period Finding, Cryptographic Implications of Quantum Algorithms, Efficiency Analysis vs Classical RSA Factorization.

UNIT V ADVANCED & HYBRID QUANTUM ALGORITHMS 9 hours

Variational Quantum Eigensolver (VQE), Quantum Approximate Optimization Algorithm (QAOA), Quantum Machine Learning (QML): Classification & Clustering, Hybrid Quantum-Classical Models, IBM Qiskit&Cirq for Implementation, Building Custom Quantum Algorithms for NISQ Devices.

Course Outcomes:

CO1: Understand quantum algorithm building blocks

CO2: Analyze well-known quantum algorithms

CO3: Apply quantum algorithms to application domains

CO4: Evaluate efficiency and complexity of algorithms

CO5: Create and simulate quantum algorithms

Text Books:

1. **Michael A. Nielsen & Isaac L. Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press
2. **Cristopher Moore & Stephan Mertens** – *The Nature of Computation*, Oxford University Press
3. **Eleanor G. Rieffel& Wolfgang Polak** – *Quantum Computing: A Gentle Introduction*, MIT Press

Reference Books:

1. **Gideon Amir** – *Quantum Algorithms via Linear Algebra*, MIT Press
2. **S. Jordan** – *Quantum Algorithm Zoo*, [Online repository]
3. **T. G. Wong** – *Quantum Algorithm Design Techniques*
4. **Roland, Cerf** – *Quantum Search Algorithms*, Springer

Online Courses & Resources:

edX (MIT)	*Quantum Algorithms for Cybersecurity*	Link
Coursera	*Quantum Computing* by University of London	Link
Qiskit Textbook	*Algorithms & Quantum Machine Learning Modules*	Link
Braket (AWS)	*Quantum Computing Developer Tools & Tutorials*	Link

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minors

23MDINS104 QUANTUM INFORMATION AND COMMUNICATION

	L	T	P	C
Pre-requisite:	**3**	**0**	**0**	**3**

Course Description:

This course introduces quantum information theory and its role in communication. Topics include entropy, fidelity, quantum teleportation, and quantum key distribution. Students analyze security protocols and the challenges of building quantum networks. Practical tools like Qiskit and NetSquid are used for simulation.

Course Objectives:

1. Understand the principles of quantum information theory.
2. Explore quantum entropy, fidelity, and mutual information.
3. Study quantum communication protocols and networks.
4. Analyze quantum key distribution and cryptographic security.
5. Implement protocols like teleportation and superdense coding.

UNIT I QUANTUM INFORMATION BASICS 9 hours

Classical vs Quantum Information, Density matrices and mixed states, Quantum entropy and Shannon entropy, Von Neumann entropy, Quantum data compression.

UNIT II QUANTUM COMMUNICATION PROTOCOLS 9 hours

Quantum teleportation, Superdense coding, Quantum repeaters and communication channels, No-cloning theorem, Quantum channel capacity.

UNIT III FIDELITY, DISTANCE & INFORMATION THEORY 9 hours

Fidelity and trace distance, Quantum mutual information, Holevo bound, Information trade-offs in communication, Channel noise and error modeling.

UNIT IV QUANTUM CRYPTOGRAPHY 9 hours

Principles of quantum cryptography, BB84 and B92 key distribution protocols, Eavesdropping and security analysis, Quantum bit commitment, Post-quantum cryptography relevance.

UNIT V APPLICATIONS & TOOLS 9 hours

Quantum internet: architecture and challenges, Networked quantum systems, Simulation using Qiskit, NetSquid, QuTiP, IBM Q Network and cloud-based setups, Practical implementation of QKD in simulation.

Course Outcomes:

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

CO1: Understand quantum information concepts

CO2: Apply quantum communication protocols

CO3: Analyze fidelity, entropy, and data transfer limits

CO4: Evaluate quantum cryptographic techniques

CO5: Create and simulate quantum communication models

Text Books:

1. **Michael A. Nielsen & Isaac L. Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press
2. Mark M. Wilde – *Quantum Information Theory*, Cambridge University Press
3. John Watrous – *The Theory of Quantum Information*, Cambridge University Press

Reference Books:

1. Peter W. Shor – *Foundations of Quantum Computing* (Lecture notes)
2. Charles H. Bennett & Gilles Brassard – *Original Papers on QKD (BB84)*
3. Stephanie Wehner – *Quantum Communication Networks*, arXiv

Online Courses & Resources:

Coursera	*Quantum Cryptography* by University of Geneva	Coursera Link
edX	*Quantum Information Science I* (Harvard/MIT)	edX Course
Qiskit	*Quantum Information Applications in Qiskit Textbook*	Qiskit Info
QuTech	*Quantum Internet Tutorials & Tools*	QuTech

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minors

23MDINS202 QUANTUM ALGORITHMS LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisties: None

Course Descriptions: This lab provides hands-on experience with quantum algorithms. Students implement and simulate algorithms such as Deutsch-Jozsa, Grover's search, Shor's algorithm, and teleportation. Both simulation and real hardware platforms are used. The focus is on practical understanding and experimentation.

Course Objectives:

1. To provide hands-on practice in implementing quantum algorithms.
2. To understand the working of algorithms like Grover's, Shor's, and Deutsch-Jozsa.
3. To strengthen the link between theoretical knowledge and practical applications.
4. To familiarize students with quantum simulators and real hardware platforms.
5. To encourage problem-solving through quantum circuit design.

List of Experiments

1. Deutsch Algorithm
2. Deutsch-Jozsa
3. Grover's Algorithm
4. QFT Visualization
5. Shor's Algorithm
6. QRNG Implementation
7. Bell State Entanglement
8. Bernstein-Vazirani Algorithm
9. Quantum Teleportation
10. Phase Estimation
11. Circuit Simulation
12. Mini-Project: RSA Key Breaking

Course Outcomes:

CO1: Ability to design and implement basic quantum algorithms.
CO2: Skill to simulate and test quantum circuits using software tools.
CO3: Competence in analyzing the performance of algorithms on quantum platforms.
CO4: Capability to compare classical vs quantum approaches for given problems.
CO5: Practical experience in applying algorithms to real-world inspired use cases.

Reference Books:

1. Michael A. Nielsen & Isaac L. Chuang – *Quantum Computation and Quantum Information*, Cambridge University Press.
2. Eleanor G. Rieffel & Wolfgang Polak – *Quantum Computing: A Gentle Introduction*, MIT Press.
3. David McMahon – *Quantum Computing Explained*, Wiley.

Online Learning Resources/Virtual Labs:
IBM Qiskit Textbook – https://qiskit.org/learn
Coursera – *Introduction to Quantum Computing* (University of Toronto / University of London).
edX – *Quantum Computing Fundamentals and Quantum Algorithms* (MIT / Delft).

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

Minors

23MDINS105 QUANTUM MACHINE LEARNING (QML)

	L	T	P	C
Pre-requisite: Nil	**3**	**0**	**0**	**3**

Course Description:

This course blends quantum computing with machine learning. Students learn quantum data encoding, supervised and unsupervised quantum algorithms, and hybrid models. Case studies such as quantum-enhanced fraud detection and NLP are included. Practical implementation is done using Qiskit and PennyLane.

Course Objectives:

1. Introduce the fundamentals of quantum-enhanced machine learning.
2. Understand quantum data encoding and kernel methods.
3. Explore quantum algorithms for supervised and unsupervised learning.
4. Analyze hybrid quantum-classical architectures.
5. Implement QML models using frameworks like Qiskit and PennyLane.

UNIT I INTRODUCTION TO QML **9 hours**

Need for QML: Why quantum for ML?,Classical vs quantum machine learning, Quantum states as information carriers, Data encoding: amplitude, angle, basis encoding, Introduction to quantum feature space.

UNIT II QML ALGORITHMS – SUPERVISED LEARNING **9 hours**

Quantum classifiers (quantum SVMs, qNN), Quantum perceptron, Variational quantum classifiers (VQC), Quantum kernels, Cost functions in quantum models.

UNIT III QML ALGORITHMS – UNSUPERVISED LEARNING **9 hours**

Quantum k-means and clustering, Quantum PCA, Quantum generative models (QGANs), Dimensionality reduction and similarity metrics, Performance analysis and limitations.

UNIT IV HYBRID MODELS & OPTIMIZATION **9 hours**

Variational Quantum Circuits (VQCs), Hybrid quantum-classical training loops, Barren plateaus and optimization issues, Quantum gradient descent and parameter shift rule, Comparative study of classical and QML models.

UNIT V QML TOOLS AND CASE STUDIES **9 hours**

Implementing QML with Qiskit Machine Learning, PennyLane and TensorFlow Quantum integration, Case studies: quantum-enhanced fraud detection, NLP, Quantum datasets and benchmark models, Project: design a small QML application.

Course Outcomes:

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

CO1: Understand foundations of quantum machine learning

CO2: Apply QML algorithms to datasets

CO3: Analyze quantum kernels, data encoding, and models

CO4; Evaluate hybrid quantum-classical models

CO5: Create and simulate QML models using frameworks

Text Books:

1. Maria Schuld, Francesco Petruccione – *Machine Learning with Quantum Computers*, Springer
2. Peter Wittek – *Quantum Machine Learning: What Quantum Computing Means to Data Mining*, Academic Press

Reference Books:

1. Jacob Biamonte – *Quantum Machine Learning*, Nature, 2017
2. Seth Lloyd – *Quantum algorithms for supervised/unsupervised learning* (Research papers)
3. VojtěchHavlíček – *Supervised Learning with Quantum-Enhanced Feature Spaces*, Nature, 2019

Online Courses & Resources:

edX	*Quantum Machine Learning* by UTS	edX Course
Qiskit	*Qiskit Machine Learning Module*	Qiskit ML
Xanadu	*QML with PennyLane (Free online textbook)*	PennyLane QML Book
Coursera	*Quantum Machine Learning* by University of Toronto	Coursera

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor in Quantum Technology

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Minor

23MDINS106 FOUNDATIONS OF QUANTUM TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course introduces the fundamental principles of quantum mechanics and their application in quantum information science. It covers the mathematical foundations, including linear algebra and complex vector spaces, to describe quantum states and operators. Key topics include superposition, measurement, entanglement, and quantum dynamics, along with the probabilistic nature of quantum systems. The course also explores practical aspects of quantum technologies, such as qubits, quantum logic gates, decoherence, and basic quantum circuit modeling using simulation tools. By the end, students will gain both theoretical understanding and foundational skills for working with quantum systems and emerging quantum technologies.

Course Objectives:

1. Introduce the fundamental quantum mechanics concepts essential for quantum technologies.
2. Build strong mathematical foundations for quantum state modeling.
3. Develop understanding of superposition, entanglement, and measurement.
4. Explain the physical principles behind quantum devices.
5. Prepare students for advanced studies in quantum computation, communication, sensing, and materials.

UNIT I: QUANTUM MECHANICS FOUNDATIONS **9 hours**

Classical vs Quantum systems, Wave-particle duality, Schrödinger equation (Time-dependent and Time-independent), Postulates of Quantum Mechanics, Quantum states and state vectors, Complex Hilbert spaces, Dirac notation (Bra-Ket notation), Probabilistic interpretation of quantum mechanics.

UNIT II: LINEAR ALGEBRA FOR QUANTUM SYSTEMS **9 hours**

Complex vector spaces and inner products, Orthonormal basis and orthogonality, Linear operators and transformations, Unitary operators and Hermitian operators, Tensor products for multi-qubit systems, Eigenvalues and Eigenvectors, Commutators and anti-commutators, Representing quantum states with matrices.

UNIT III: SUPERPOSITION, MEASUREMENT, AND ENTANGLEMENT 9 hours

Principle of superposition, Measurement postulate, Probability amplitudes and Born rule, State collapse upon measurement, Entanglement and Bell states, EPR paradox and non-locality, Density matrices and mixed states, Quantum decoherence.

UNIT IV: OPERATORS AND QUANTUM DYNAMICS 9 hours

Time evolution operators, Hamiltonian and energy eigenstates, Quantum harmonic oscillator (brief overview), Unitary evolution and Schrödinger equation solutions, Quantum tunnelling, Adiabatic theorem basics, Operator algebra in quantum systems, Expectation values and observables.

UNIT V: QUANTUM TECHNOLOGIES BUILDING BLOCKS 9 hours

Basic qubit systems (spin-1/2, photon polarization, superconducting qubits), Two-level quantum systems modelling, Bloch sphere representation, Quantum logic gates fundamentals, Multi-qubit systems: controlled operations, Introduction to decoherence and quantum error correction, Quantum technologies: hardware platforms overview, Basic quantum circuit modeling using simulators (Qiskit or Q# demo examples).

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand postulates of quantum mechanics for quantum technologies

CO2: Apply linear algebra and Dirac notation to quantum state analysis

CO3: Analyze superposition, entanglement, and measurement processes

CO4: Evaluate quantum systems through operators and probability amplitudes

CO5: Create mathematical models for simple quantum systems

Textbooks:

1□. Michael A. Nielsen & Isaac L. Chuang – Quantum Computation and Quantum Information

2□. N. David Mermin – Quantum Computer Science: An Introduction

3□. David McMahon – Quantum Computing Explained (Wiley)

Reference Books

1□. Griffiths, D. – Introduction to Quantum Mechanics

2□. Sakurai, J.J. – Modern Quantum Mechanics

3□. ohnWatrous – The Theory of Quantum Information

4□. V.K. Krishnan – Linear Algebra and its Applications to Quantum Computing

Online Courses & Resources

Platform	**Course Title**
MIT OpenCourseWare	Quantum Physics I, II (MIT OCW 8.04 & 8.05)
edX (Berkeley)	Quantum Mechanics and Quantum Computation

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor

23MDINS107 SOLID STATE PHYSICS FOR QUANTUM TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides a comprehensive understanding of the fundamental materials science and physics concepts essential for quantum technologies. It covers crystal structures, electronic properties, and semiconductor physics relevant to quantum devices, including quantum wells, dots, and superconductors. Students will explore quantum confinement in low-dimensional systems, lattice vibrations, phonon interactions, and their impact on qubit performance. The course also examines advanced materials for quantum technologies, such as topological insulators, NV centers, and photonic crystals, along with fabrication challenges and design strategies for achieving long coherence times.

Course Objectives:

1. Understand fundamental solid-state physics principles relevant to quantum technologies.
2. Study the electronic properties of materials used in quantum hardware.
3. Explore quantum confinement and nanostructures for qubit implementation.
4. Analyze crystal structures, band theory, and defects influencing quantum devices.
5. Build foundations for material selection and engineering for quantum systems.

UNIT I: CRYSTAL STRUCTURE AND ELECTRONIC PROPERTIES 9 hours

Crystal lattices and unit cells, Bravais lattices, Miller indices, Reciprocal lattice and Brillouin zones, Atomic bonding in solids (covalent, ionic, metallic, van der Waals), X-ray diffraction and crystal structure determination, Electronic structure of solids, Free electron theory, Energy bands: metals, semiconductors, and insulators.

UNIT II: SEMICONDUCTOR PHYSICS FOR QUANTUM DEVICES 9 hours

Intrinsic and extrinsic semiconductors, Charge carriers: electrons, holes, effective mass, Carrier concentration and Fermi level, p-n junctions and semiconductor heterostructures, Quantum wells and quantum dots as qubits, Superconductors and Josephson junctions, Semiconductor fabrication basics, Materials for quantum hardware: Si, GaAs, diamond NV centers, topological insulators.

UNIT III: QUANTUM CONFINEMENT AND LOW-DIMENSIONAL SYSTEMS 9 hours

Quantum size effects: nanowires, nanotubes, 2D materials, Quantum dots: discrete energy levels, Quantum Hall effect, Topological quantum materials, Spintronics and spin qubits, Quantum confinement in superconducting qubits, Heterostructure-based quantum devices, Valleytronics and emerging 2D materials (MoS_2 , graphene).

UNIT IV: LATTICE VIBRATIONS AND PHONON INTERACTIONS 9 hours

Lattice vibrations and phonons, Heat capacity and thermal conductivity of solids, Electron-phonon interaction, Decoherence in solid-state qubits due to phonons, Magnetic impurities and Kondo effect, Defects and dislocations in crystals, Dopants and quantum impurity systems, Nuclear spin environments and coherence times.

UNIT V: MATERIALS FOR QUANTUM TECHNOLOGIES 9 hours

Material engineering for superconducting qubits, NV centers in diamond for quantum sensing, Topological materials for robust qubits, Photonic crystal materials for optical qubits, Hybrid quantum systems: coupling different materials, Fabrication challenges and material purity, Advances in quantum materials research, Designing material systems for long coherence time.

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand crystal structures and band theory

CO2: Apply knowledge of semiconductors, insulators, and conductors in quantum materials

CO3: Analyze quantum confinement effects and low-dimensional systems

CO4: Evaluate defects, phonons, and interactions in solid-state systems

CO5: Create models for quantum device material systems

Textbooks:

1□. Charles Kittel – Introduction to Solid State Physics

2. Michael A. Nielsen & Isaac Chuang – Quantum Computation and Quantum Information

3□. Simon L. Altmann – Band Theory of Solids

Reference Books

1□. Ashcroft &Mermin – Solid State Physics

2□. Yu & Cardona – Fundamentals of Semiconductors: Physics and Materials Properties

3□. David Awschalom – Semiconductor Spintronics and Quantum Computation

4□. Dieter Vollhardt – Introduction to the Theory of Many-Body Systems

Online Courses & Resources

Platform	**Course Title**
MIT OpenCourseWare	Solid State Physics (MIT 8.231)
edX	Quantum Materials and Devices (U. Tokyo)
Coursera	Quantum Materials (ÉcolePolytechnique)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor

23MDINS203 QUANTUM DEVICES AND MATERIALS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Nil

Course Objectives:

1. Simulate quantum devices and materials behavior.
2. Explore quantum optics and solid-state quantum systems.
3. Model quantum dots, superconductors, and photonic devices.
4. Perform quantum simulation of condensed matter systems.
5. Build foundational skills for quantum hardware understanding.

List of Experiments (12 Experiments)

1. Simulation of Single-Qubit Optical Devices
2. Modeling Quantum Dots and Energy Level Transitions
3. Simulation of Two-Level Atom and Rabi Oscillations
4. Quantum Harmonic Oscillator: Energy Levels Visualization
5. Spin-1/2 Systems and Magnetic Resonance Simulation
6. Superconducting Qubits Circuit Simulation
7. Josephson Junction Modeling for Quantum Circuits
8. Quantum Photonic Interferometer Simulation
9. Simulation of NV Centers in Diamond for Quantum Sensing
10. Solid-State Quantum Materials Simulation (Band Structures)
11. Modeling Quantum Light-Matter Interactions (Jaynes-Cummings Model)

Platforms & Tools:

1. QuTiP (Quantum Toolbox in Python)
2. Qiskit Nature / Qiskit Metal
3. MATLAB Simulink
4. COMSOL Multiphysics (for materials simulation)
5. Silvaco TCAD (for device-level modeling)

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

Minor

23MDINS108 INTRODUCTION TO QUANTUM COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides a comprehensive introduction to quantum communication principles, technologies, and protocols. It covers the fundamental differences between classical and quantum communication, including quantum entanglement, qubits, and quantum information security. Key topics include Quantum Key Distribution (QKD) protocols, quantum teleportation, and entanglement distribution techniques for secure and long-distance communication. Students will explore quantum networks, quantum internet architecture, and advanced quantum communication applications such as quantum secure direct communication, quantum secret sharing, and post-quantum cryptography. The course also discusses practical implementation challenges, hybrid quantum-classical models, and emerging trends shaping the future of quantum communication.

Course Objectives:

1. Introduce fundamental principles of quantum communication.
2. Study quantum key distribution (QKD) protocols.
3. Analyze quantum teleportation, entanglement swapping, and quantum repeaters.
4. Evaluate quantum security principles and their advantages.
5. Prepare students for designing secure communication protocols for future quantum networks.

UNIT I: INTRODUCTION TO QUANTUM COMMUNICATION 9 hours

Classical communication vs quantum communication, No-cloning theorem and quantum information security, Qubits and qubit transmission channels, Quantum entanglement fundamentals, EPR paradox and Bell's inequalities, Quantum states and measurement, Role of superposition and measurement collapse, Overview of quantum internet and its architecture.

UNIT II: QUANTUM KEY DISTRIBUTION (QKD) PROTOCOLS 9 hours

Classical cryptography limitations, BB84 protocol, B92 protocol, E91 entanglement-based protocol, Decoy-state QKD, Device-independent QKD, Practical implementation challenges in QKD, Experimental QKD systems (fiber, free-space, satellites).

UNIT III: QUANTUM TELEPORTATION AND ENTANGLEMENT DISTRIBUTION

9 hours

Quantum teleportation protocol, Entanglement swapping, Quantum repeaters for long-distance communication, Error sources in quantum teleportation, Resource requirements for teleportation, Entanglement purification techniques, Bell state measurements, Applications of teleportation in distributed quantum computing.

UNIT IV: QUANTUM NETWORKS AND QUANTUM INTERNET **9 hours**

Architecture of quantum networks, Quantum routers and switching, Quantum memories and storage nodes, Distributed entanglement generation and management, Multiparty quantum communication Blind quantum computing, Performance metrics for quantum networks (fidelity, key rate), Challenges in large-scale quantum network deployment.

UNIT V: ADVANCED QUANTUM COMMUNICATION PROTOCOLS AND APPLICATIONS **9 hours**

Quantum secure direct communication, Quantum digital signatures, Position-based quantum cryptography, Quantum secret sharing, Post-quantum cryptography overview, Quantum cloud communication protocols, Building hybrid quantum-classical communication models, Future directions in quantum communication technology.

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand quantum communication concepts

CO2: Apply quantum entanglement to communication protocols

CO3: Analyze QKD protocols and teleportation mechanisms

CO4: Evaluate security of quantum communication

CO5: Design quantum communication networks and protocols

Textbooks:

1. M. Nielsen & I. Chuang – Quantum Computation and Quantum Information

2. Mark M. Wilde – Quantum Information Theory

3. Scarani – Quantum Cryptography: A Primer

Reference Books

1. VedranDunjko – Introduction to Quantum Communication and Cryptography

2. Norbert Lütkenhaus – Practical Security in Quantum Key Distribution

3. David McMahon – Quantum Computing Explained

4. Bouwmeester et al. – The Physics of Quantum Information

Online Courses & Resources

Platform	Course Title
edX	Quantum Cryptography (ETH Zurich)
Coursera	Quantum Communication (Delft University of Technology)
MIT	OpenCourseWare Quantum Information Science (MIT 6.443)
YouTube	Quantum Internet & Quantum Networking Tutorials
IBM Qiskit	Qiskit tutorials on quantum teleportation and QKD

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor

23MDINS109 INTRODUCTION TO QUANTUM SENSING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides a comprehensive introduction to the principles and technologies of quantum sensing and metrology, highlighting how quantum phenomena such as superposition, entanglement, and squeezing enable precision measurements beyond classical limits. Students will explore fundamental concepts like the Standard Quantum Limit, Heisenberg limit, and quantum phase estimation, along with key measurement techniques including quantum interferometry, atomic clocks, magnetometry, and quantum imaging. The course also covers noise sources, decoherence, and error mitigation strategies, and examines cutting-edge applications in navigation, medical imaging, environmental monitoring, and space-based sensing. By the end, learners will gain both theoretical understanding and practical insight into the design and operation of advanced quantum sensor systems.

Course Objectives:

1. Introduce the principles of quantum sensing and metrology.
2. Explain how quantum superposition and entanglement enhance measurement sensitivity.
3. Study applications of quantum sensors across multiple domains.
4. Analyze noise, decoherence, and quantum limits on measurement.
5. Prepare students to design and analyze quantum-enhanced sensors.

UNIT I: INTRODUCTION TO QUANTUM SENSING AND METROLOGY 9 hours

Classical vs quantum sensing, Precision limits: Standard Quantum Limit (SQL), Quantum metrology fundamentals, Heisenberg limit, Quantum phase estimation for precision measurements, Quantum non-demolition measurements, Quantum error correction in sensing, Importance of coherence and entanglement in sensors.

UNIT II: QUANTUM MEASUREMENT PRINCIPLES **9 hours**

Superposition and interference in measurement, Quantum Fisher information, Squeezed states for noise reduction, Photon counting and single-photon detectors, Spin-based measurements (NV centers, trapped ions), Ramsey interferometry, Quantum state tomography, Applications of quantum-enhanced interferometry.

UNIT III: QUANTUM SENSOR TECHNOLOGIES **9 hours**

Atomic clocks (optical & microwave), Gravimeters and accelerometers, Magnetometers (SQUIDs, NV centers), Quantum gyroscopes, Quantum imaging & super-resolution microscopy, Quantum lidar and radar, Force and electric field sensing, Photonic quantum sensing systems.

UNIT IV: DECOHERENCE, NOISE, AND ERROR MITIGATION IN QUANTUM SENSING **9 hours**

Sources of decoherence in quantum sensors, Thermal noise and quantum noise sources, Quantum back-action, Squeezing and noise reduction techniques, Dynamical decoupling techniques, Noise spectroscopy for sensor calibration, Robust error mitigation protocols, Evaluating sensitivity vs noise tradeoffs.

UNIT V: ADVANCED APPLICATIONS AND FUTURE QUANTUM SENSING SYSTEMS **9 hours**

Quantum sensing for biological and medical imaging, Navigation and positioning without GPS, Quantum-enhanced gravitational wave detection (LIGO), Quantum-enhanced environmental monitoring, Sensors for national defense and security, Space-based quantum sensors, Integrated quantum photonic sensing platforms, Design of hybrid quantum-classical sensor systems.

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand the basic principles of quantum sensing

CO2: Apply quantum superposition and entanglement to sensing

CO3: Analyze quantum sensor architectures

CO4: Evaluate sensitivity and error limits in quantum measurements

CO5: Design quantum sensing systems for real-world applications

Textbooks:

1□. Christian L. Degen, F. Reinhard, P. Cappellaro – Quantum Sensing

2□. Giovannetti, Lloyd &Maccone – Advances in Quantum Metrology

3□. David Budker& Derek F. Jackson Kimball – Optical Magnetometry

Reference Books

1□. Kurt Jacobs – Quantum Measurement Theory and its Applications

2□. Helmut Rauch – Neutron Interferometry

3□. M. O. Scully & M. S. Zubairy – Quantum Optics (Chapters on Metrology)

4□. VlatkoVedral – Introduction to Quantum Information Science

Online Courses & Resources

Platform	**Course Title**
edX	Quantum Sensing & Metrology (LMU Munich)
Coursera	Quantum Optics and Sensing (University of Colorado Boulder)
MIT OpenCourseWare	Quantum Measurement and Sensing (MIT)
YouTube	Quantum Sensing Lectures
IBM Qiskit	Tutorials on Quantum Phase Estimation

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor

23MDINS204 QUANTUM COMMUNICATION AND SENSING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Nil

Course Objectives:

1. Simulate and analyze quantum communication protocols.
2. Implement quantum key distribution (QKD) and teleportation.
3. Perform quantum sensing simulations for precision measurements.
4. Evaluate sensor performance with noise and decoherence.
5. Gain hands-on experience with quantum simulation tools.

List of Experiments (12 Experiments)

1. Simulation of Qubits and Bloch Sphere Visualization
2. Implementation of BB84 Quantum Key Distribution Protocol
3. Simulation of B92 and E91 QKD Protocols
4. Quantum Entanglement Generation and Bell Inequality Testing
5. Quantum Teleportation Protocol using Qiskit/Cirq
6. Simulation of Quantum Repeaters and Entanglement Swapping
7. Noise and DecoherenceModeling in Quantum Communication Channels
8. Ramsey Interferometry Simulation for Quantum Sensing
9. Implementation of NV CenterMagnetometry Simulation
10. Quantum Gravimeter and Accelerometer Simulation
11. Quantum Phase Estimation for High-Precision Metrology

Platforms & Tools:

1. IBM Qiskit
2. Google Cirq
3. RigettiPyQuil
4. Quantum Inspire
5. MATLAB / Python with quantum libraries

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

Minor

23MDINS110 QUANTUM OPTICS PREREQUISITES FOR QUANTUM TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course introduces the fundamental principles and applications of quantum optics and photonics. It covers the classical and quantum description of light, electromagnetic field quantization, and light–matter interactions. Topics include coherence theory, quantum noise, and advanced phenomena such as photon antibunching, squeezing, and cavity-QED. The course also explores emerging quantum photonics technologies, including single-photon sources, entangled photon generation, quantum key distribution, and quantum metrology, preparing students for research and experimentation in modern quantum optics.

Course Objectives:

1. Introduce fundamentals of light-matter interaction relevant for quantum technologies.
2. Explain the quantization of electromagnetic fields.
3. Study the role of photons as quantum information carriers.
4. Explore coherent states, squeezed states, and single-photon sources.
5. Prepare for quantum sensing, communication, and photonic quantum computing applications.

UNIT I: CLASSICAL AND QUANTUM DESCRIPTION OF LIGHT 9 hours

Review of electromagnetic waves, Maxwell‘s equations for light propagation, Plane waves, polarization, Poynting vector, Classical interference, diffraction, coherence, Blackbody radiation & Planck's hypothesis, Photoelectric effect, Photons as quantized light energy, Introduction to quantum theory of radiation.

UNIT II: QUANTIZATION OF ELECTROMAGNETIC FIELD 9 hours

Harmonic oscillator quantization, Field quantization in free space, Photon number (Fock) states, Coherent states and classical-quantum correspondence, Vacuum fluctuations and zero-point energy, Single-mode vs multi-mode quantization, Spontaneous and stimulated emission, Quantum field operators and commutation relations.

UNIT III: LIGHT-MATTER INTERACTION **9 hours**

Two-level atom model, Absorption, stimulated emission, spontaneous emission, Einstein coefficients, Rabi oscillations, Jaynes-Cummings model, Resonant and non-resonant interaction, Cavity Quantum Electrodynamics (Cavity-QED), Atom-photon entanglement.

UNIT IV: QUANTUM COHERENCE AND QUANTUM NOISE **9 hours**

Classical vs quantum coherence, First- and second-order coherence functions, Photon antibunching, Hanbury Brown and Twiss experiment, Quantum squeezing of light, Phase-sensitive amplification, Quantum noise, shot noise, and standard quantum limit, Quantum nondemolition measurements.

UNIT V: QUANTUM PHOTONICS APPLICATIONS **9 hours**

Single-photon sources (quantum dots, NV centers, SPDC), Entangled photon pair generation, Photonic qubits and linear optical quantum computing, Quantum key distribution with photons, Photonic integrated circuits, Quantum sensors based on squeezed light, Quantum metrology using entangled photons, Designing experiments for quantum optics labs.

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand quantum nature of light

CO2: Apply Maxwell‘s equations to optical fields

CO3: Analyze interaction of photons with matter

CO4: Evaluate coherence, squeezing, and quantum noise

CO5: Create models for photonic quantum systems

Textbooks:

1 Mark Fox – Quantum Optics: An Introduction

2. Rodney Loudon – The Quantum Theory of Light

3. M. O. Scully & M. S. Zubairy – Quantum Optics

Reference Books

1. Stephen Barnett – Quantum Information

2. Peter Meystre – Elements of Quantum Optics

3. Michel Le Bellac – Quantum Physics

4. D. F. Walls & G. J. Milburn – Quantum Optics

Online Courses & Resources

Platform	Course Title
MIT OpenCourseWare	Quantum Optics (MIT 8.421)
edX	Principles of Photonics (EPFL)
Coursera	Quantum Optics 1 & 2 (U. Rochester)
YouTube	Quantum Optics Lectures (Various universities)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors

Honors

23HDCSN101 INTRUSION DETECTION AND PREVENTION SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Understand when, where, how, and why to apply intrusion detection tools and techniques to improve the security posture of an enterprise.
2. Apply knowledge of the fundamentals and history of intrusion detection to avoid common pitfalls in the creation and evaluation of IDS.
3. Analyze intrusion detection alerts and logs and distinguish attack types from false alarms.
4. Gain an understanding of basic firewall mechanisms and their role in enterprise defense.

UNIT I INTRODUCTION TO INTRUSION DETECTION 9 hours

History of Intrusion Detection - Audit Concepts and Definitions - Internal and External Threats to Data - Types of Attacks - Need and Types of IDS - Host-Based Information Sources - Network-Based Information Sources

UNIT II INTRUSION PREVENTION SYSTEMS AND SNORT 9 hours

Network-Based IDS - Protocol-Based IDS - Hybrid IDS - Intrusion Analysis Models - Thinking About Intrusion - Incident Response: Phases and Processes - Corporate Forensics Issues - Snort Installation Scenarios - Installing Snort - Running Snort on Multiple Interfaces - Snort Command Line Options - Compiling and Installing Snort - Snort File Locations - Snort Operating Modes - Snort Alert Modes

UNIT III SNORT RULES AND ARCHITECTURE 9 hours

Snort Rule Headers - Rule Options - Snort Configuration File - Plugins - Preprocessors - Output Modules - Using Snort with MySQL - Using ACID and SnortSnarf - Agent Development for Intrusion Detection - Architecture Models of IDS and IPS

UNIT IV FIREWALL TECHNOLOGIES AND PROTOCOLS 9 hours

Introduction to Internet Firewalls - Internet Services and Security Strategies - Packet and Protocol Structures - Anatomy of a Packet - IP and Related Protocols - Application Layer Protocols - Non-IP Protocols - Low-Level Protocol Attacks - Firewall Technologies - Packet Filtering - Proxy Services - Network Address Translation (NAT) - Virtual Private Networks (VPN)

UNIT V FIREWALL DESIGN AND ARCHITECTURES 9 hours

Firewall Architecture Overview - Firewall Design Considerations - Packet Filtering Mechanisms - Proxy-Based Systems - Bastion Hosts - UNIX/Linux Bastion Hosts - Windows NT/2000 Bastion Hosts

Course Outcomes:

At the end of this course students will be able to

CO1: Demonstrate knowledge of Intrusion Detection

CO2: Apply the security posture of an enterprise by applying intrusion detection mechanisms

CO3: Develop new Intrusion Detection Systems at the lower level

CO4: Analyse the various attack types and differentiate them from false alarms

CO5: Apply the Firewall System

Text Books:

1. "Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID", Rehman R, Prentice Hall, 1st Edition, 2003.
2. "Intrusion Detection & Prevention", Endorf C, Schultz E, Mellander J, Tata McGraw-Hill, 1st Edition, 2004.
3. "Building Internet Firewalls", Zwicky E D, Cooper S, Chapman D B, O'Reilly, 2nd Edition, 2000.

Reference Books:

1. "Intrusion Detection and Correlation: Challenges and Solutions", Kruegel C, Valeur F, Vigna G, Springer, 1st Edition, 2005.
2. "Network Intrusion Detection", Northcutt S, Novak J, New Riders Publishing, 3rd Edition, 2002.
3. "A Textbook on Grid Application Development and Computing Environment", Fahringer T, Prodan R, Khanna Publishers, 6th Edition, 2012.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCSN102 CLOUD SECURITY

L	T	P	C
3	0	0	3

Pre-requisite: 23CSN112

Course Objectives:

The objectives of the course are to

1. Infer the cloud security and privacy issues.
2. Familiarize with the Threat Model and Cloud Attacks.
3. Understand the Data Security and Storage.
4. Analyse Security Management in the Cloud.
5. Implement security solutions and best practices to protect cloud-based systems and services.

UNIT I OVERVIEW OF CLOUD COMPUTING 9 hours

Overview of Cloud Computing: Definitions and Characteristics, Cloud Service Models, Cloud Deployment Models, Cloud Service Platforms. Introduction to Cloud Security: Introduction, Cloud Security Concepts, CSA Cloud Reference Model, NIST Cloud Reference Model, NIST Cloud Reference Model.

UNIT II CLOUD SECURITY AND PRIVACY ISSUES 9 hours

Cloud Security and Privacy Issues: Introduction, Cloud Security Goals/Concepts, Cloud Security Issues, Security Requirements for Privacy, Privacy Issues in Cloud. Infrastructure Security: The Network Level, The Host Level, The Application Level, SaaS Application Security, PaaS Application Security, IaaS Application Security.

UNIT III THREAT MODEL AND CLOUD ATTACKS 9 hours

Threat Model and Cloud Attacks: Introduction, Threat Model - Type of attack entities, Attack surfaces with attack scenarios, A Taxonomy of Attacks, Attack Tools – Network - level attack tools, VM - level attack tools, VMM attack tools, Security Tools, VMM security tools.

UNIT IV DATA SECURITY AND STORAGE 9 hours

Information Security Basic Concepts, an Example of a Security Attack, Cloud Software Security Requirements, Rising Security Threats. Data Security and Storage: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security.

UNIT V SECURITY MANAGEMENT IN THE CLOUD 9 hours

Evolution of Security Considerations, Security Concerns of Cloud Operating Models, Identity Authentication, Secure Transmissions, Secure Storage and Computation, Security Using Encryption Keys, Challenges of Using Standard Security Algorithms, Variations and Special Cases for Security, Issues with Cloud Computing, Side Channel Security Attacks in the Cloud. Security Management in the Cloud- Security Management Standards, Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management.

Course Outcomes:

At the end of this course students will be able to

CO1: Illustrate the fundamental concepts of cloud computing and cloud models.

CO2: Distinguish the various cloud security and privacy issues.

CO3: Analyse the various threats and Attack tools.

CO4: Interpret the Data Security and Storage.

CO5: Analyse the Security Management in the Cloud.

Text Books:

1. "Cloud Security Attacks, Techniques, Tools, and Challenges", Preeti Mishra, Emmanuel S Pilli, R C Joshi, Graphic Era., CRC press, 1st Edition, 2022.
2. "Cloud Security and Privacy", Tim Mather, Subra Kumaraswamy, and Shahed Lati, O'Reilly Media, Inc.1st Edition, 2019.

Reference Books:

1. "Cloud Computing with Security Concepts and Practices", Naresh Kumar Sehgal Pramod Chandra, P. Bhatt John M. Acken, Springer nature Switzerland AG, 2nd Edition 2020.
2. "Essentials of Cloud Computing" by K. Chandrasekaran Special Indian Edition CRC press, 1st Edition, 2016.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCSN201 CLOUD SECURITY LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite:Nil

Course Objectives:

The objectives of the course are to

1. Understand and configure security features in popular cloud platforms.
2. Evaluate access control models and policies in cloud environments.
3. Analyse and mitigate threats and vulnerabilities in cloud-based applications.
4. Implement encryption, identity, and access management in cloud systems.
5. Use tools and techniques for monitoring and securing cloud infrastructures.

LIST OF EXPERIMENTS

1. Perform the setup of a secure cloud-based virtual machine. Demonstrate how to configure SSH access, disable password authentication, and apply basic hardening practices in AWS, Azure, or GCP.
2. Demonstrate how to create IAM users, groups, roles, and policies in a cloud platform. How do you enforce least-privilege access using custom policies.
3. Implement Multi-Factor Authentication (MFA) for a cloud user account and demonstrate enabling logging for user activities. How do these features enhance security visibility.
4. Encrypt cloud-based storage and network traffic using built-in encryption services. Show how to configure encryption at rest and in transit using keys or certificates.
5. Configure a Virtual Private Cloud (VPC) with private/public subnets, and apply security groups and firewall rules. Demonstrate restricting access to a specific IP range.
6. Deploy a web application behind a Web Application Firewall (WAF). Simulate attacks (e.g., SQL injection, XSS) and show how WAF mitigates them.
7. Use Nessus or OpenVAS to scan a cloud-based VM for vulnerabilities. Generate a report and suggest remediation for critical issues.
8. Secure a containerized application using Docker best practices and Kubernetes RBAC. How do you limit container permissions and secure secrets in a K8s deployment.
9. Demonstrate the use of cloud compliance and auditing tools (e.g., AWS Config, Azure Policy, GCP Policy Intelligence). How can these tools detect and correct policy violations.
10. Install and configure an IDS (e.g., OSSEC or Snort) on a cloud VM. Simulate unauthorized access and observe the system's detection and alerting capability.
11. Use a CSPM tool (e.g., Prisma Cloud, Azure Defender, or GCP Security Command Center) to assess cloud resources. What critical issues were flagged and how did you resolve them.
12. Capstone Project: Secure a deployed full-stack web app on a cloud platform. Present the complete security architecture including IAM, encryption, WAF, compliance tools, and monitoring. Justify each security decision.

Course Outcomes:

At the end of this course students will be able to

CO1: Configure basic security controls in cloud environments.

CO2: Demonstrate identity and access management in cloud platforms.

CO3: Perform vulnerability assessments and apply threat mitigation in the cloud.

CO4: Implement secure communication and data protection in cloud infrastructure.

CO5: Use monitoring tools to detect and respond to cloud security incidents.

Text Books:

1. "Cloud Security and Privacy", Tim Mather, Subra Kumaraswamy, and Shahed Latif, O'Reilly, 2009.
2. "Architecting Cloud Computing Solutions", Kevin L. Jackson and Scott Goessling, Packt Publishing, 2018.

Reference Books:

1. "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Ronald L. Krutz, Russell Dean Vines, Wiley, 2010.
2. "AWS Certified Security Specialty Exam Guide", Stuart Scott, Adam Book, Packt Publishing, 2024.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

Honors

23HDCSN103 CYBER LAWS AND ETHICS

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Understand the evolution and significance of cyber laws in the digital era.
2. Study the key provisions and applicability of the Information Technology Act, 2000.
3. Identify the roles of regulatory authorities in enforcing cyber laws in India.
4. Learn procedures for cybercrime reporting and understand legal standards and evidentiary issues.
5. Explore cyber ethics and ethical concerns related to AI and blockchain technologies.

UNIT I INTRODUCTION 9 hours

Introduction: History of Internet and World Wide Web, Need for cyber law, Cybercrime on the rise, Important terms related to cyber law. Cyber law in India: Need for cyber law in India, History of cyber law in India, Information Technology Act, 2000, Overview of other laws amended by the IT Act, 2000, National Policy on Information Technology 2012.

UNIT II OVERVIEW OF THE INFORMATION TECHNOLOGY ACT, 2000 9 hours

Applicability of the Act, Important provisions of the Act: Digital signature and Electronic signature, Digital Signature under the IT Act, 2000, EGovernance Attribution, Acknowledgement and Dispatch of Electronic Records, Certifying Authorities, Electronic Signature Certificates, Duties of Subscribers, Penalties and Offences, Intermediaries.

UNIT III REGULATORY AUTHORITIES 9 hours

Regulatory Authorities: Department of Electronics and Information Technology, Controller of Certifying Authorities (CCA), Cyber Appellate Tribuna, Indian Computer Emergency Response Team (ICERT), Cloud Computing, Case Laws.

UNIT IV CYBER CRIME REPORTING 9 hours

Legal Issues and Organizations Standards: Law Enforcement / Criminal Prosecutions – Standard of Due Care – Evidentiary Issues, Organizations and Standardizations.

UNIT V CYBER ETHICS 9 hours

The Importance of Cyber Law, Significance of Cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Course Outcomes:

At the end of this course students will be able to

CO1: Apply the need and scope of cyber laws in digital environments.

CO2: Analyze key provisions of the IT Act and the role of digital signatures.

CO3: Identify and apply the functions of regulatory authorities under cyber law.

CO4: Demonstrate the reporting process for cybercrimes.

CO5: Analyze types of cybercrimes and apply legal remedies as per the IT Act.

Text Books:

1. "Indian Cyberlaw On Cyber Crimes", PavanDuggal. 3rd edition, 2023.

2. "Cyber Ethics 4.0, Christoph Stuckelberger", Pavan Duggal, Globethic, 2018.

Reference Books:

1. "Computer Security Basics (Paperback)", Debby Russell and Sr. G.T. Gangemi, 2nd Edition, O' Reilly Media, 2006.

2. "Information Security policies and procedures: A Practitioner's Reference", Thomas R. Peltier, 2nd Edition Prentice Hall, 2004.

3. "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", Kenneth J. Knapp, IGI Global, 2009.

4. "Information Security Fundamentals", Thomas R Peltier, Justin Peltier and John blackley, 2nd Edition, Prentice Hall, 1996.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCSN104 NETWORK MANAGEMENT SYSTEMS AND OPERATIONS

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Understand the principles of network management, different standards, and protocols used in managing complex networks
2. Explore the automation of network management operations and utilize readily available network management systems
3. Recognize the importance and applications of network management systems

UNIT I INTRODUCTION 9 hours

Analogy of Telephone Network Management - Data and Telecommunication Networks - Distributed Computing Environments - TCP/IP-Based Networks: The Internet and Intranets - Communication Protocols and Standards - Communication Architectures, Protocol Layers and Services - Case Histories of Networking and Management - Importance of Topology - Filtering and Load Impact - Common Network Problems - Challenges for IT Managers - Network Management Goals - Network Provisioning - Network Operations and NOC - Network Installation and Maintenance - Network and System Management - Network Management System Platform - Future of Network Management

UNIT II BASIC FOUNDATIONS – STANDARDS, MODELS, AND LANGUAGE 9 hours

Network Management Standards - Network Management Model - Organization Model - Information Model - Management Information Trees - Managed Object Perspectives - Communication Model - ASN.1 Terminology and Conventions - ASN.1 Data Types and Object Names - Example of ASN.1 from ISO 8824 - Encoding Structures - Macros - Functional Model

UNIT III SNMPV1 NETWORK MANAGEMENT 9 hours

Managed Network Overview - History of SNMP - Internet Organizations and Standards - SNMP Model - Organizational Model - SNMP System Overview - Structure of Management Information - Managed Objects - Management Information Base (MIB) - SNMP Communication Architecture - SNMP Administrative Model - SNMP Specifications - SNMP Operations - SNMP MIB Groups - Functional Model

UNIT IV SNMP MANAGEMENT – RMON 9 hours

Remote Monitoring (RMON) - RMON SMI and MIB - RMON1 Textual Conventions - RMON1 Groups and Functions - Control and Data Table Relationships - RMON1 Common and Ethernet Groups - RMON Token Ring Extension Groups - RMON2 Management Information Base - RMON2 Conformance Specifications

UNIT V NETWORK MANAGEMENT APPLICATIONS 9 hours

Configuration Management - Fault Management - Performance Management - Data Monitoring - Problem Isolation - Performance Statistics - Event Correlation Techniques - Rule-Based Reasoning - Model-Based Reasoning - Security Management - Accounting Management - Report Management - Policy-Based Management - Service Level Management

Course Outcomes:

At the end of this course students will be able to

CO1: Demonstrate the requirements of network management standards, technologies, and tools
CO2: Implement various commercial and open-source network management systems
CO3: Apply the data provided by a Network Management System (NMS) and suggest suitable actions
CO4: Analyse the challenges faced by network managers
CO5: Demonstrate the applications and utilities of network management systems

Text Books:

1. "Network Management – Principles and Practice", Subramanian M, Pearson Education, 2nd Edition, 2010.
2. "Network Management", Morris, Pearson Education, 1st Edition, 2008.

Reference Books:

1. "Principles of Network and System Administration", Burgess M, Wiley DreamTech, 1st Edition, 2008.
2. "Network Management Concepts and Practices: A Hands-On Approach", Burke J R, PHI, 1st Edition, 2008.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCSN202 NETWORK MANAGEMENT SYSTEMS AND OPERATIONS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Nil

Course Objectives:

The objectives of the course are to

1. Understand the functioning of network management tools, protocols, and architectures
2. Provide practical exposure to SNMP, RMON, and real-time monitoring tools
3. Configure and manage devices using command-line and GUI-based interfaces
4. Analyze traffic and performance using network analyzers
5. Simulate and troubleshoot various network management scenarios

LIST OF EXPERIMENTS:

1. Installation and setup of SNMP agents and managers using tools such as Net-SNMP or Solar Winds and configuration of SNMP communication between agent and manager.
2. Monitoring system metrics like CPU, memory, and disk usage using SNMP v1/v2/v3 queries.
3. Exploring and querying MIB (Management Information Base) objects using both command-line and GUI-based SNMP tools.
4. Configuring RMON to observe traffic statistics using groups such as statistics, history, and alarms.
5. Capturing and analyzing network traffic using Wireshark with protocol filters and inspection tools.
6. Creating and managing VLANs, routing, and ACLs using Cisco Packet Tracer or GNS3 simulation.
7. Configuring network devices (switches/routers) using Command-Line Interface (CLI) for IP, routing, NAT, and VLAN.
8. Monitoring bandwidth utilization using tools like PRTG, MRTG, or Zabbix for multiple interfaces.
9. Simulation and isolation of network faults, such as device or link failure, and demonstrating fault detection and recovery.
10. Configuration of Syslog server for centralized logging and filtering logs based on severity levels.
11. Develop an intelligent alerting system using SNMP and Python that polls network devices, monitors performance thresholds (CPU/memory), and generates automated email or desktop alerts when thresholds are breached.
12. Design a web-based dashboard that visualizes real-time network device health and status by integrating Zabbix or PRTG APIs, displaying key metrics like uptime, traffic load, and error counts using graphical indicators and history charts.

Course Outcomes:

At the end of this course students will be able to

CO1: Apply to Install and configure network management software and services

CO2: Apply SNMP tools to monitor and manage networks

CO3: Analyse network traffic and diagnose performance issues

CO4: Demonstrate proficiency in using network simulation tools

CO5: Apply troubleshooting skills to resolve network faults and bottlenecks

Reference Books:

1. "Network Management: Principles and Practice", Mani Subramanian, Pearson, 2nd Edition, 2010

Online Learning Resources / Virtual Labs:

1. Official documentation of Net-SNMP, Wireshark, and Zabbix
2. NPTEL Courses on Network Management and Computer Networks
3. Cisco Packet Tracer Tutorials and Labs

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination