MOHAN BABU UNIVERSITY
Sree Sainath Nagar, Tirupati – 517 102

SCHOOL OF ENGINEERING

B.Tech. Computer Science and Engineering (Artificial Intelligence and Machine Learning)

CURRICULUM AND SYLLABUS
(For 2022-23 Admitted Students)

FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM (FFCBCS)

MOHAN BABU UNIVERSITY

Vision

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

Mission

- ❖ Develop industry-focused professionals with a global perspective.

- ❖ Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity.

- ❖ Create confluence of research, innovation, and ideation to bring about sustainable and socially relevant enterprises.

- ❖ Uphold high standards of professional ethics leading to harmonious relationship with environment and society.

SCHOOL OF COMPUTING

Vision

To lead the advancement of computer science research and education that has real-world impact and to push the frontiers of innovation in the field.

Mission

- ❖ Instil within our students fundamental computing knowledge, a broad set of skills, and an inquisitive attitude to create innovative solutions to serve industry and community.

- ❖ Provide an experience par excellence with our state-of-the-art research, innovation, and incubation ecosystem to realise our learners' fullest potential.

- ❖ Impart continued education and research support to working professionals in the computing domain to enhance their expertise in the cutting-edge technologies.

- ❖ Inculcate among the computing engineers of tomorrow with a spirit to solve societal challenges.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Vision

To become a Centre of Excellence in Artificial Intelligence and Machine Learning by imparting high quality education through teaching, training and research

Mission

❖ To impart quality education in Computer Science and Engineering with specializations in Artificial Intelligenceand Machine Learning by disseminating knowledge through contemporary curriculum, competent faculty and effective teaching-learning methodologies.

❖ Nurture research, innovation and entrepreneurial skills among students and faculty to contribute to the needs of industry and society.

❖ Inculcate professional attitude, ethical and social responsibilities for prospective and promising Engineering profession.

❖ Encourage students to engage in life-long learning by creating awareness of the contemporary developments in Computer Science and Engineering Artificial Intelligence and Machine Learning.

B.Tech. Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of B.Tech.CSE (Artificial Intelligence and Machine Learning) will:

PEO1. Pursuing higher studies in core or allied areas of Computer Science, Artificial Intelligence, Machine Learning, Data Science or Management

PEO2. Employed in reputed Computer and I.T organizations or Government, to have a globally competent professional career in Computer Science and Engineering, Artificial Intelligence, Machine Learning, Data Science domain or be successful Entrepreneurs.

PEO3. Able to demonstrate effective communication, engage in teamwork, exhibit leadership skills, ethical attitude, and achieve professional advancement through continuing education.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of B.Tech. CSE (Artificial Intelligence and Machine Learning) Program will be able to:

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the

consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the Program, the graduates of B.Tech. CSE (Artificial Intelligence and Machine Learning)program will be able to:

PSO1. Apply knowledge of computer science engineering, Use modern tools, techniques and technologies for efficient design and development of computer-based systems for complex engineering problems.

PSO2. Develop and apply Artificial Intelligence techniques to perform human intelligence tasks such as vision, language processing and speech recognition.

PSO3. Develop intelligent systems by applying data analytics, machine learning algorithms and techniques for solving problems from inter-disciplinary domains.

PSO4. Design and deploy networked systems using standards and principles, Apply suitable models, tools and techniques for secured information communication.

B.Tech. Computer Science and Engineering (Artificial Intelligence and Machine Learning)

Basket Wise - Credit Distribution

S. No.	Basket	Credits (Min.- Max.)
1	SCHOOL CORE	50-54
2	PROGRAM CORE	45-61
3	PROGRAM ELECTIVE	12-18
4	SPECIALIZATION ELECTIVE	24-36
5	UNIVERSITY ELECTIVE	9-12
TOTAL CREDITS		**Min. 160**

School Core (50-54 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22MM102453	Physics for Computing	3	-	2	-	4	-
22EE102401	Basic Electrical and Electronics Engineering	3	-	2	-	4	-
22CS102001	Programming for Problem Solving	3	-	2	-	4	-
22AI105001	Design Thinking	-	1	2	-	2	-
22AI111001	Internship	-	-	-	-	2	-
22AI108001	Capstone Project	-	-	-	-	10	-
Language Basket (Min. 4 Credits to be earned)							
22LG102401	English for Professionals	2	-	2	-	3	-
22LG105402	Soft Skills	-	-	2	-	1	-
22LG101403	German Language	2	-	-	-	2	-
22LG101404	French Language	2	-	-	-	2	-
Mathematics Basket (Min. 12 Credits to be earned)							
22MM101401	Matrix Theory and Linear Algebra	3	-	-	-	3	-
22MM101403	Calculus and Transformation Techniques	3	-	-	-	3	-
22MM101405	Numerical Methods, Probability and Statistics	3	-	-	-	3	-
22MM101407	Number Theory and Algebra	3	-	-	-	3	-
22MM101408	Statistics for Engineers	3	-	-	-	3	Numerical Methods, Probability and Statistics

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
Introduction to Computer Science (Min. 2 Credits to be earned)							
22AI105002	Disruptive Technologies	-	1	2	-	2	-
22AI105003	Free and Open Source Software	-	1	2	-	2	-
22CB105001	Computer Hardware and System Essentials	-	1	2	-	2	-
Programming Languages (Min. 5 Credits to be earned)							
22AI104001	Object Oriented Programming through C++	3	-	2	4	5	Programming for Problem Solving
22AI104002	Object Oriented Programming through Java	3	-	2	4	5	Programming for Problem Solving
Management Basket (Min. 5 Credits to be earned)							
22CM101401	Principles of Business Economics and Accountancy	3	-	-	-	3	-
22MG101401	Essentials of Leadership	2	-	-	-	2	-
22MG101402	Organizational Behaviour	2	-	-	-	2	-
22MG101403	Project Management	2	-	-	-	2	-
Mandatory Courses (Min. 8 Credits to be earned - Earned Credits will not be considered for CGPA)							
22LG107601	Professional Ethics and Human Values	2	-	-	-	2	-
22CE107601	Environmental Science*	2	-	-	-	2	-
22CE107602	Disaster Mitigation and Management	2	-	-	-	2	-
22CE107603	Rural Technology	2	-	-	-	2	-
22LG107603	Spoken English	-	1	2	-	2	English for Professionals
22LG107602	Essential Life Skills for Holistic Development	2	-	-	-	2	-
22AB107601	NCC/NSS Activities	-	-	-	-	2	-

Course Code	Title of the Course	Lecture L	Tutorial T	Practical P	Project based Learning S	Credits C	Pre-requisite
22AB107602	Yoga	-	-	-	-	2	-
22MG107401	Innovation, Incubation and Entrepreneurship	2	-	-	-	2	-
22EE107001	Intellectual Property Rights	2	-	-	-	2	-
22EE107002	Fundamentals of Research Methodology	2	-	-	-	2	-

 * Compulsory Course

Program Core (45-61 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22CS101001	Digital Logic Design	3	-	-	-	3	-
22CS102002	Python Programming	3	-	2	-	4	-
22AI101001	Discrete Mathematical Structures	3	-	-	-	3	Matrix Theory and Linear Algebra
22CS102003	Data Structures	3	-	2	-	4	Programming for Problem Solving
22CS101002	Computer Organization and Architecture	3	-	-	-	3	-
22CS101003	Software Engineering	3	-	-	-	3	Object Oriented Programming through C++/Java
22CS102004	Design and Analysis of Algorithms	3	-	2	-	4	Data Structures
22AI102001	Operating Systems	3	-	2	-	4	Object Oriented Programming through C++/Java
22CS102005	Database Management Systems	3	-	2	-	4	-
22AI101002	Theory of Computation	3	-	-	-	3	-
22CS102006	Computer Networks	3	-	2	-	4	Object Oriented Programming through C++/Java
22CS104001	Web Technologies	3	-	2	4	5	Object Oriented Programming through C++/Java
22CS102008	Compiler Design	3	-	2	-	4	Theory of Computation
22AI102002	Artificial Intelligence	3	-	2	-	4	Python Programming
22ME101023	Optimization Techniques	3	-	-	-	3	-
22AI102008	Machine Learning	3	-	2	-	4	Numerical Methods, Probability and Statistics
22AI102009	Pattern Recognition Techniques	3	-	2	-	4	Numerical Methods Probability and Statistics
22AI102003	Artificial Neural Networks	3	-	2	-	4	Python Programming
22AI105004	Python for Data Analysis	-	1	2	-	2	Python Programming

Program Elective (12 - 18 Credits)

Couse Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22CS102010	Programming Languages / Platform Based Development	Advanced Java Programming	3	-	2	-	4	Object Oriented Programming through Java
22CS102009		Linux Programming	3	-	2	-	4	Programming for Problem Solving, Operating Systems
22CS105001		R Programming	-	1	2	-	2	-
22CS102011		Programming in C# and .NET Framework	3	-	2	-	4	-
22CS104002		MERN Stack Development	3	-	2	4	5	Web Technologies
22CS104003		Mobile Application Development	3	-	2	4	5	Web Technologies
22CS101008		Software Architectures	3	-	-	-	3	Software Engineering
22CS101009		Service-Oriented Architecture and Microservices Architecture	3	-	-	-	3	Software Engineering
22CS102007	Graphics and Visualization	Computer Graphics and Multimedia	3	-	2	-	4	Calculus and Transformation Techniques
22AI101003		Digital Image Processing	3	-	-	-	3	Calculus and Transformation Techniques
22CS102012		Game Development	3	-	2	-	4	Programming in C# and .NET Framework
22AI102010		Augmented Reality	3	-	2	-	4	Programming with C# and .Net
22AI102011		Virtual Reality	3	-	2	-	4	Programming with C# and .Net
22CS101005	Computing	Distributed Systems	3	-	-	-	3	Operating Systems
22CS101006		High Performance Computing	3	-	-	-	3	Programming for Problem Solving, Computer Organization and

Couse Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
								Architecture
22CS101011		Edge Computing	3	-	-	-	3	Cloud Computing
22CB101002	Security	Cyber Security Essentials	3	-	-	-	3	-
22CB101001		Cryptography and Network Security	3	-	-	-	3	Computer Networks
22AI102007	Data Science	Data Visualization	3	-	2	-	4	Python Programming
22AI102006		Data Science	3	-	2	-	4	Python Programming
22AI102005	Big Data	Data Mining	3	-	2	-	4	Numerical Methods, Probability and Statistics
22AI102004		Big Data Technologies	3	-	2	-	4	Database Management Systems
22CS102016	Cloud Computing	Cloud Computing	3	-	2	-	4	Operating Systems, Computer Networks
22AI102012		Data Engineering on Cloud	3	-	2	-	4	Cloud Computing
22CB102004	Internet of Things	Internet of Things	3	-	2	-	4	Computer Networks
22EC101050		Industrial Internet of Things	3	-	-	-	3	-

Specialization Elective (24 - 36 Credits)

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22AI101004	Artificial Intelligence	Multi-Agent Systems	3	-	-	-	3	Artificial Intelligence
22AI101005		Markov Decision Processes	3	-	-	-	3	Artificial Intelligence
22AI101006		Knowledge Representation and Reasoning	3	-	-	-	3	Artificial Intelligence
22AI102013		Graph Algorithms	3	-	2	-	4	Discrete Mathematical Structures
22AI101007		Information Theory	3	-	-	-	3	-
22AI102014		Nature Inspired Algorithms	3	-	2	-	4	Optimization Techniques
22AI102015	Machine Learning	Feature Engineering for Machine Learning	3	-	2	-	4	Python Programming
22AI101008		Bayesian Data Analysis	3	-	-	-	3	Machine Learning
22AI102016		Reinforcement Learning	3	-	2	-	4	Machine Learning
22AI102017		Approximation Algorithms	3	-	2	-	4	Design and Analysis of Algorithms
22AI101009		Predictive Analytics	3	-	-	-	3	Machine Learning
22AI102018		Deep Learning	3	-	2	-	4	Machine Learning
22AI101010		Generative Deep Learning	3	-	-	-	3	Deep Learning
22AI104003		MLOPs	3	-	2	4	5	Machine Learning
22AI101011	Applied Artificial Intelligence and Machine Learning	AI for Robotics	3	-	-	-	3	Artificial Intelligence
22AI102019		Computer Vision	3	-	2	-	4	Digital Image Processing
22AI102020		Text Analytics	3	-	2	-	4	Machine Learning
22AI102021		Machine Learning for Security	3	-	2	-	4	Machine Learning, Computer Networks
22AI101012		Social Network Analysis	3	-	-	-	3	Machine Learning
22AI102022		Bio-Medical Image Processing	3	-	2	-	4	Digital Image Processing
22AI101013		Video Analytics	3	-	-	-	3	Digital Image Processing

For IBM Collaborative Program (Min. 24 Credits shall be earned)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22AI102101	Advanced Python Programming	3	-	2	-	4	-

Note:
1. If a student registered for IBM Collaborative Program, then they shall earn 24 Credits from the IBM Sub-Basket.
2. After completion of 24 credits from IBM Sub-Basket, if any student wish to take more Credits under Specialization Elective, then the student can choose the remaining credits from other knowledge areas of Specialization basket. The student is not eligible to opt equivalent courses while exercising this option.

University Elective (9-12 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22EC101701	AI in Healthcare	3	-	-	-	3	-
22CM101701	Banking and Insurance	3	-	-	-	3	-
22AI101701	Bioinformatics	3	-	-	-	3	-
22BS101701	Biology for Engineers	3	-	-	-	3	-
22LG101701	Business Communication and Career Skills	3	-	-	-	3	-
22CE101701	Civil Engineering and The Society	3	-	-	-	3	-
22SS101701	Constitution of India	3	-	-	-	3	-
22CM101702	Cost Accounting and Financial Management	3	-	-	-	3	-
22CB101701	Cyber Laws and Security	3	-	-	-	3	-
22EE101701	Electrical Safety and Safety Management	3	-	-	-	3	-
22MG101701	Entrepreneurship for Micro, Small and Medium Enterprises	3	-	-	-	3	-
22CE101702	Environmental Pollution and Control	3	-	-	-	3	-
22EC101702	Essentials of VLSI	3	-	-	-	3	-
22CB101702	Introduction to Ethical Hacking	3	-	-	-	3	-
22CB101703	Forensic Science	3	-	-	-	3	-
22SS101702	Gender and Environment	3	-	-	-	3	-
22ME101701	Global Strategy and Technology	3	-	-	-	3	-
22EE101704	Green Technologies	3	-	-	-	3	-
22ME101702	Human Resource Management	3	-	-	-	3	-
22SS101703	Indian Economy	3	-	-	-	3	-
22SS101704	Indian History	3	-	-	-	3	-
22SS101705	Indian Tradition and Culture	3	-	-	-	3	-
22EC101703	Instrumentation in Industries	3	-	-	-	3	-
22EC101704	Introduction to Nanotechnology	3	-	-	-	3	-
22AI101702	Introduction to Artificial Intelligence	3	-	-	-	3	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22AI101703	Introduction to Data Science	3	-	-	-	3	-
22AI101704	Introduction to Machine Learning	3	-	-	-	3	-
22CS101701	Introduction to Python Programming	3	-	-	-	3	-
22CB101704	Introduction to Internet of Things	3	-	-	-	3	-
22ME101703	Management Science	3	-	-	-	3	-
22ME101704	Managing Innovation and Entrepreneurship	3	-	-	-	3	-
22ME101705	Material Science	3	-	-	-	3	-
22LG101702	Personality Development	3	-	-	-	3	-
22CE101703	Planning for Sustainable Development	3	-	-	-	3	-
22EC101705	Principles of Communication Engineering	3	-	-	-	3	-
22EE101702	Reliability and Safety Engineering	3	-	-	-	3	-
22CE101704	Remote Sensing, GIS and GPS	3	-	-	-	3	-
22CE101705	Smart Cities	3	-	-	-	3	-
22EC101706	Smart Sensors for Engineering Applications	3	-	-	-	3	-
22LG101703	Stress Management and Well Being	3	-	-	-	3	-
22EE101703	Sustainable Energy Systems	3	-	-	-	3	-
22CS101702	Web Design Fundamentals	3	-	-	-	3	-
22SS101706	Women Empowerment	3	-	-	-	3	-

Note:

1. If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under University Elective.
2. The student can choose courses from other disciplines offered across the schools of MBU satisfying the pre-requisite other than the above list.

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM102453	**PHYSICS FOR COMPUTING**	3	-	2	-	4

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on wave optics, Quantum mechanics and its applications, Semiconductor diodes, optoelectronic devices, and Fiber optics.

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

CO1.   Apply the concepts of light waves to interpret the concepts of Interference, Diffraction, and Polarization.

CO2.   Demonstrate the basic knowledge of the quantum behaviour of matter in its microstate.

CO3.   Analyze the band structure of solid materials using quantum physics.

CO4.   Understand the basic concepts of semiconductors in the functioning of various optoelectronic devices.

CO5.   Demonstrate the concepts of electromagnetic wave propagation in optical fibers.

CO6.   Work independently and in teams to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	1	-	-	-	-	-
CO2	3	2	-	1	-	-	-	-	-	-	-	-
CO3	3	2	-	1	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	1	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	1	1	1	-	-
Course Correlation Mapping	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**-**

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

COURSE CONTENT

Module 1:   WAVE OPTICS   *(10 Periods)*

Interference: Introduction - Interference in thin films (reflected light) - Newton's rings - Determination of wavelength.
Diffraction: Introduction - Fraunhofer diffraction - Single slit diffraction (qualitative) - Double slit diffraction (qualitative).
Polarization: Introduction - Polarization by reflection - and double refraction - Nicol's prism - Half wave and Quarter wave plate - Engineering applications of interference - diffraction and polarization.

Module 2:   INTRODUCTION TO QUANTUM MECHANICS   *(08 Periods)*

Principles of Quantum Mechanics: Introduction – de Broglie's hypothesis for matter waves - Davison and Germer's experiment - Schrödinger's one dimensional wave equation (time independent) - significance of wave function – Fermi Dirac distribution and effect of temperature (qualitative treatment).

Module 3:   QUANTUM PHYSICS AND BAND THEORY OF SOLIDS: *(08 Periods)*

Applications of Quantum Physics: Particle in a 1 D box (Eigen Value and Eigen Function) – 3 D Analysis (Qualitative) - Tunnelling Effect (Qualitative) - Kronig Penney model (qualitative treatment) - origin of energy bands formation in solids.

Module 4:   SEMICONDUCTORS AND OPTOELECTRONIC DEVICES   *(11 Periods)*

Introduction - Intrinsic semiconductors - Density of electrons in intrinsic semiconductor - Intrinsic carrier concentration - Fermi energy - Electrical conductivity of intrinsic semiconductors - Extrinsic semiconductors - Density of charge carriers in Extrinsic semiconductors (qualitative) - Drift and Diffusion currents - Direct and Indirect band gap semiconductors - Hall effect - pn junction
Optoelectronic devices: Light Emitting Diode (LED) - Photodiode - Semiconductor diode laser

Module 5: FIBER OPTICS   *(08 Periods)*

Introduction to fiber optics - Total Internal Reflection - Critical angle of propagation - Acceptance angle - Numerical Aperture – V number (qualitative) - Classification of fibers based on Refractive index profile, modes - Applications of optical fibers – Fiber optic Sensors (temperature, displacement).

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS: (Minimum 10 experiments shall be conducted)

1. Estimation of the wavelength of the given laser by using a diffraction grating.

2. Predict the particle size using LASER by using the diffraction phenomenon.

3. Determine the thickness of thin wire using the wedge shape method.

4. Determination of the radius of curvature of the lens/wavelength of monochromatic source by using Newton's ring method

5. Find the numerical aperture of a given optical fiber and hence estimate its acceptance angle.

6. Calculate the number of charge carriers and Hall coefficients of a given semiconductor using the Hall Effect.

7. Find the forward and reverse resistance of a given p-n junction diode from its I-V characteristics curves.

8. Predict the energy gap of a semiconductor by varying the temperatures.
9. Estimation of threshold voltages of different LEDs.
10. Study the characteristics of Photodiode and determine its dark current.
11. Estimation of the magnetic field along the axis of a circular coil carrying current with Stewart Gee's method.
12. Determination of wavelength of light by plane diffraction grating using spectrometer by minimum deviation method.

RESOURCES

TEXTBOOKS:

1. M.N. Avadhanulu, P.G. Kshirsagar, and T.V.S Arun Murthy, *A Textbook of Engineering Physics*, S. Chand Publications, 11th edition, 2019.
2. R.K. Gaur and S.L. Gupta, *Engineering Physics*, Dhanpat Rai Publications (P) Ltd, 2015.
3. P.K. Palaniswamy, *Engineering Physics*, Scitech Publications India Private Limited, 2nd edition, 2009.
4. Serway and Jewett, *Physics for Scientists and Engineers with Modern Physics*, 6th Edition, Thomson Brooks, 2007.

REFERENCE BOOKS:

1. K. Thyagarajan, *Engineering Physics*, McGraw-Hill Education (India) Pvt. Ltd, 2016.
2. V. Rajendran*, Engineering Physics,* Tata McGraw Hill Publications Ltd, 7th Edition, New Delhi, 2014.
3. N.K. Verma, *Physics for Engineers,* PHI Pvt. Ltd., 2014.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/115102023
2. https://nptel.ac.in/courses/117102061
3. https://archive.nptel.ac.in/courses/122/107/122107035
4. https://nptel.ac.in/courses/115107095

WEB RESOURCES:

1. http://www.freepdfbook.com/engineering-physics-mcgraw-hill/
2. https://www.vedantu.com/revision-notes/cbse-class-12-physics-notes-chapter-10-wave-optics
3. https://salmanisaleh.files.wordpress.com/2019/02/physics-for-scientists-7th-ed.pdf
4. https://www.researchgate.net/publication/344758634_Short_Notes_on_Engineering_Physics

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI105001	**DESIGN THINKING**	-	1	2	-	2

Pre-Requisite	-
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on design thinking process, evaluation of requirement specification and reflections on design experience. This course also focuses on demonstration of five phases of design thinking such as empathize, define, ideate, prototyping, testing and validation with design thinking tools and frameworks.

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

CO1. Investigate the requirements of a problem by conducting surveys.

CO2. Create meaningful and actionable problem statements for creative problem solving.

CO3. Construct blueprints to visualize user attitudes and behavior for gaining insights of customers.

CO4. Design prototypes of innovative products or services for a customer base.

CO5. Develop relevant products or services by choosing good design and applying empathy tools for experiencing user requirements.

CO6. Work independently and communicate effectively in oral and written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	3	-	2	-	-	-	-	-	-	-	-	2	-	-	-
CO2	1	-	1	3	-	-	-	-	-	-	-	-	2	-	-	-
CO3	-	2		3	-	-	-	-	-	-	-	1	2	-	-	-
CO4	-	2	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO5	-	3	-	1	1	-	1	2	-	-	-	-	2	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	2	-	2	-	-	-
Course Correlation Mapping	1	3	2	3	1	-	1	2	3	3	2	1	2	-	-	-

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

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

Introduction to Design Thinking – Design thinking Process, Definition, Importance, Phases of Design Thinking, Canva Tool.

1. Conduct survey and identify the problem by either individual or group and frame a problem statement using AEIOU (Activities, Environment, Interactions, Objects, Users) framework.

2. Identify demographic or focus group for problem statement and create persona and explicitly define the characteristics of persona using Canva tool.

Emphathize - Role of empathy in design thinking, Purpose of Empathy Map, Empathy Tools – Customer Journey Map, Personas, Coggle Tool.

3. Build a Customer Journey Map (CJM-Before-During-After) and identify touch points for any mock scenario or persona created during last experiment and frame 2-3 questions using HMW (How Might We).

4. Create an Empathy Map using Coggle design thinking tool.
   Sample Empathy Map:

EMPATHY MAP *Example (Buying a TV)*
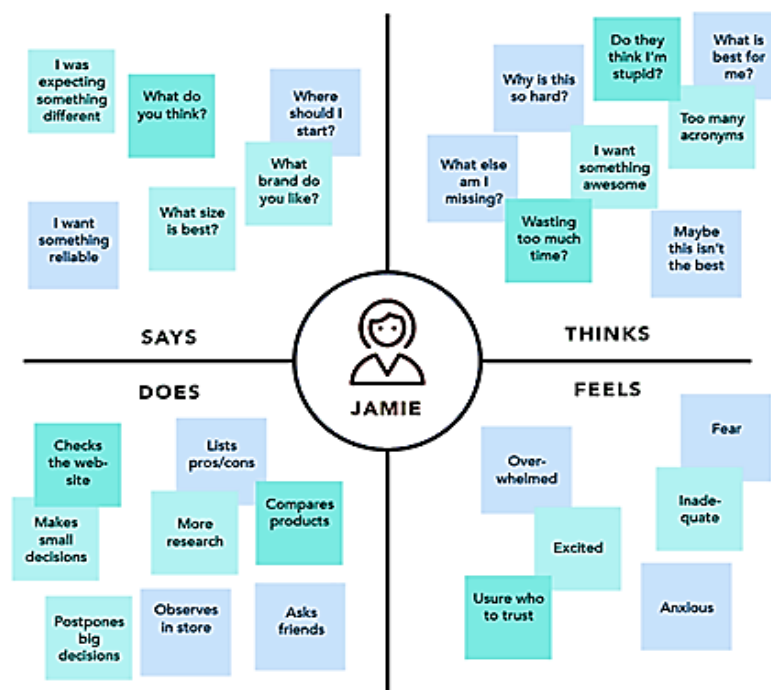
Ideation - Importance of visualizing and empathizing before ideating, Applying the method**,** Ideation Tools - Story board, Brainstorming, Mind Map, SCAMPER.

5. **Story boarding design ideas:** Consider a mock scenario and create user stories and storyboards to transform information about user needs into design concepts using any story board tool.

6. Create Mind Map for your problem statement using Coggle.
    Sample Mind Map:
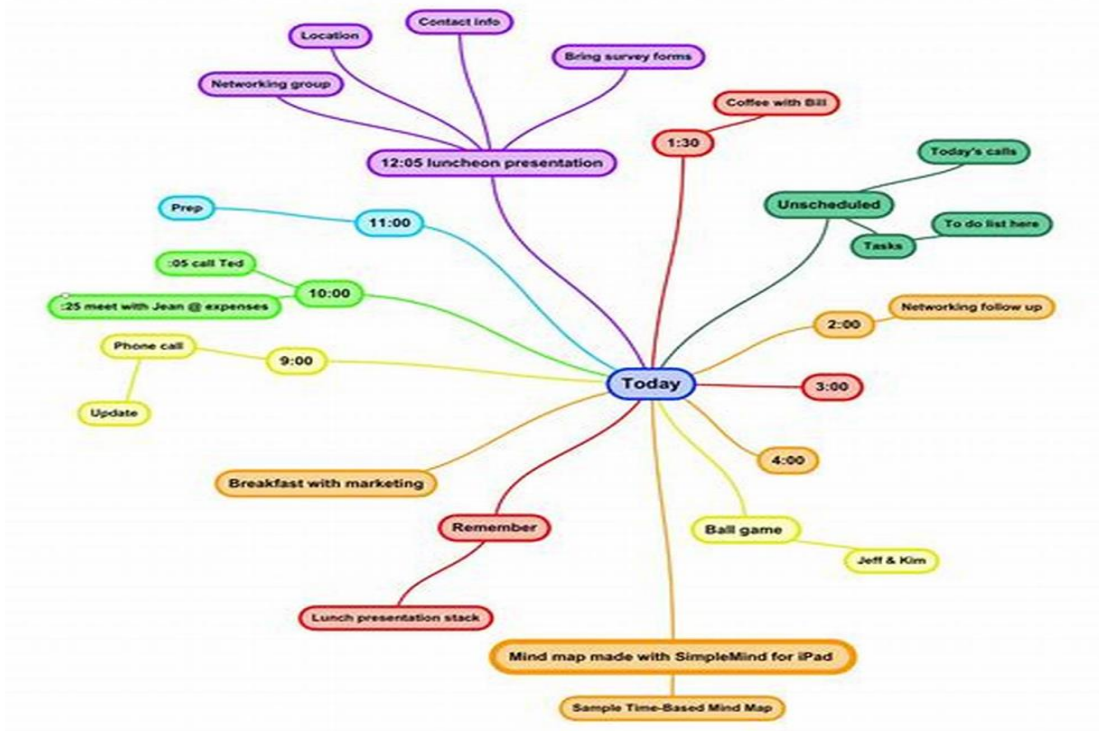
7. Perform Brain Storming Session with your team and record using the SCAMPER framework and finalize the best three innovative ideas.

Prototyping and Testing – Definition, Prototype examples, Need for Prototyping, Fidelity for prototypes, Process of prototyping, Introduction to Marvel POP Software**,** Testing prototypes with users.

8. Create an application prototype for product recommendation using **Marvel POP Software**.

9. Create a **low-fidelity paper prototype** by sketching out the product design and adding relevant functionality.

10. Test the prototype created in Exercise 9 by interacting with each member of the team, walking them through the design and gathering feedback. Use feedback grid with the following quadrants: what worked, what could be improved, questions, and ideas.

What worked?	What could be improved?
Questions	Ideas

RESOURCES

REFERENCES:

1. Michael G. Luchs, Scott Swan , Abbie Griffin, *Design Thinking – New Product Essentials from PDMA,* Wiley,2015.
2. Vijay Kumar, *101 Design Methods: A Structured Approach for Driving Innovation in Your Organization,* 2012.
3. Kathryn McElroy, *Prototyping for Designers: Developing the best Digital and Physical Products,* O'Reilly,2017.
4. S. Salivahanan, S. Suresh Kumar, D. Praveen Sam, *Introduction to Design Thinking*, Tata Mc Graw Hill, First Edition,2019.

SOFTWARE/TOOLS:

1. Canva (https://www.canva.com/)
2. Coggle (https://coggle.it/)
3. Marvel POP

VIDEO LECTURES:

1. https://nptel.ac.in/courses/109/104/109104109/
2. https://nptel.ac.in/courses/110106124/
3. https://www.youtube.com/watch?v=q654-kmF3Pc&t=0s
4. https://www.youtube.com/watch?v=TNAdanuvwtc
5. https://www.youtube.com/watch?v=U-hzefHdAMk
6. https://www.youtube.com/watch?v=zbLxs6te5to

WEB RESOURCES:

1. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
2. https://www.ibm.com/design/thinking/page/toolkit
3. https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we
4. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking
5. https://www.mindtools.com/pages/article/newCT_02.htm

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG105402	**SOFT SKILLS**	-	-	2	-	1

Pre-Requisite -
Anti-Requisite -
Co - Requisite -

COURSE DESCRIPTION: This course deals with an understanding of the fundamental soft skills and their practical social and workplace usage. It helps participants to communicate effectively and to carry themselves confidently and in harmony with their surroundings. They also learn how to identify and overcome the barriers in interpersonal relationships, and to employ oral and written communication, teamwork, leadership, problem-solving, and decision-making skills, to gain the best results.

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

CO1. Demonstrate knowledge of career skills by analyzing the strategies of Goal Setting, Thinking Skills, interpersonal skills, and etiquette.

CO2. Analyze various situations by applying Assertive communication and Non-verbal forms in developing Interpersonal Skills.

CO3. Apply appropriate managerial strategies by analyzing the conflicts in various situations.

CO4. Demonstrate various communication styles by analyzing and applying Thinking Skills in diverse teams as an individual and a team member and during Interviews and Group Discussions.

CO5. Analyze and apply appropriate strategies of emotional intelligence and adaptability skills for personal and professional success.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	-	2	-	2	-	-	-	-	2
CO2	3	3	2	-	2	-	2	-	-	2	-	2
CO3	2	2	2	-	3	-	2	-	-	-	-	2
CO4	3	2	2	-	2	-	2	-	3	2	3	2
CO5	2	2	2	-	3	-	3	-	-	2	-	3
Course Correlation Mapping	**3**	**2**	**2**	**-**	**3**	**-**	**2**	**-**	**3**	**2**	**3**	**2**

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

COURSE CONTENT
*Any ten modules are mandatory among the following:

Module 1:   BODY LANGUAGE
Body language basics, Types of Body Language, Facial Expressions and their messages, Eye Contact Insights, Body Posture, Hand gestures, and finger movements

Module 2:   ASSERTIVENESS
Communication Styles, Benefits, Asserting yourself, Tips, and Role Play

Module 3:   GOALSETTING
Seven Steps of Goal Setting, Self-Motivation, Personal Goal Setting,and Setting Career Goals

Module 4:   THINKING SKILLS
Positive Thinking, Creative Thinking, Lateral Thinking, Logical Thinking,and Intuitive Thinking

Module 5:   TEAM BUILDING
Learning Activities, Management Essentials, and Team Building Scenarios

Module 6:   CONFLICT MANAGEMENT
Ways of Resolving Conflict, Personality Types and Conflict, Conflict Resolution Process, and Team Conflict

Module 7:   EMOTIONAL INTELLIGENCE
Definition, understanding emotions,Identifying emotional intelligence, and self-assessment

Module 8:   ADAPTABILITY SKILLS
Understanding organizational communication, Identifying adaptability skills, and self-assessment.

Module 9:   GROUP DISCUSSIONS
Types of GD, Dos, and Don'ts, Dynamics of GD,Intervention,and Summarization Techniques

Module 10:   INTERVIEW SKILLS
Planning, Opening Strategies, Answering Strategies,Teleconferencing,Videoconferencing, Practice questions,and Dress code

Module 11:   INTERPERSONAL SKILLS
Starting a Conversation, Responding to a Conversation, Conversation Examples, Body Language,and Role Play

Module 12:   ETIQUETTE
Basic Social Etiquette, Telephone Etiquette, Dining Etiquette, Conference Etiquette, and Email Etiquette

RESOURCES

REFERENCES:

1. Soft skills Lab Manual, MB University.
2. Dr. K. Alex, *Soft Skills*, S. Chand & Company LTD, Latest Edition, New Delhi, 2018.
3. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw, Hill Publishing Company Limited, 3rd Edition, New Delhi, 2012.
4. S.P. Dhanavel, *English and Soft Skills*, Orient Black Swan Private Limited, 2010.

SOFTWARE/TOOLS:

1. K-VAN Solutions.
2. Learning to Speak English 8.1, The Learning Company, 4 CDs.
3. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
4. Language in Use 1, 2 & 3.
5. Cambridge Advanced Learner's Dictionary, 3rd Edition.
6. Let's Talk English, Regional Institute of English South India

VIDEO LECTURES:

1. http://nptel.ac.in/courses/106102064
2. http://nptel.ac.in/courses/106106127/

WEB RESOURCES:

1. http://psydilab.univer.kharkov.ua/resources/ucheba/softskills/Chapter_1_Introduction.PDF
2. https://learning.tcsionhub.in/courses/tcs,ion/introduction,to,soft,skills/
3. https://goo.gl/laEHOY (dealing with complaints)
4. http://www.adm.uwaterloo.ca/infocecs/CRC/manual/resumes.html
5. https://goo.gl/FEMGXS
6. http://www.career.vt.edu/interviewing/TelephoneInterviews.html
7. http://job,search,search.com/interviewing/behavioral_interviews
8. https://www.thebalancecareers.com/what,are,soft,skills,2060852

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101401	**MATRIX THEORY AND LINEAR ALGEBRA**	3	-	-	-	3

Pre-Requisite   --

Anti-Requisite   --

Co-Requisite   --

COURSE DESCRIPTION: This course provides a discussion on matrix factorizations, linear systems, Eigenvalues and Eigenvectors, vector spaces, linear transformations, and orthogonality.

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

CO1. Demonstrate the concepts of matrix factorizations and solutions of the linear system.

CO2. Determine the Eigenvalues and Eigenvectors of the matrix and implement the concept of Eigen values and decompositions of a matrix in intelligent systems.

CO3. Apply the concepts of vector spaces and linear transformation on problems of computational systems.

CO4. Use the inner product spaces for the study of orthogonality and to construct orthonormal basis.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3		3	2	-	-	-	-	-	-	-	2	2	-	-
CO2	2	3		2	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	-	2	1	-	-	-	-	-	-	-	2	2	-	-
CO4	2	3		3	2	-	-	-	-	-	-	-	2	2	-	-
Course Correlation Mapping	**3**	**3**	-	**3**	**2**	**-**	**-**	**-**	-	**-**	-	-	2	2	-	-

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

COURSE CONTENT

Module 1:   MATRICES AND LINEAR SYSTEM OF EQUATIONS   *(10 Periods)*

Elementary Row-operations, Elementary Matrices, Echelon form, Rank of a matrix by row-reduction, Solutions of system of linear equations by row reduction, Matrix Factorization, LU factorization, LDU factorization.

Module 2:   EIGEN VALUES, EIGEN VECTORS AND   *(09 Periods)*
**   DIAGONALIZATION**

Characteristic equation of a matrix, Eigenvalues and Eigenvectors of matrices, Similarity of matrices, Diagonalization by using Eigenvalues, Cayley-Hamilton Theorem (Without Proof), Evaluation of matrix powers.

Module 3   VECTOR SPACES   *(10 Periods)*

Vector spaces, Sub-spaces, Four fundamental subspaces of a matrix, Span, Linearly independent and dependent, Basis, construction of Basis, dimensions, Finite dimensional vector space.

Module 4   LINEAR TRANSFORMATION   *(08 Periods)*

Linear transformation, Kernal and range of linear transformation, Basic properties, Invertible linear transformation, Matrix of linear transformation.

Module 5   INNER PRODUCT SPACES   *(08 Periods)*

Inner product, Norm, Distance, Inner product space, Orthogonal and orthonormal basis, Gram-Schmidt orthogonalization, Singlular Value Decomposition for square matrices.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Let Breakfast consists of orange juice, cereal, and eggs with the following nutritional information:

	OJ	Cereal	Eggs
Protein	0%	10%	20%
Vitamin C	20%	15%	0%
Calories	100	120	100

   If you must have 30% protein, 30% Vitamin C and 300 calories for your breakfast, How many servings of OJ, Cereal, and Eggs should you have?
2. Solve for the Eigen values and Eigen vectors of 2x2 matrix on paper and larger matrices using MATLAB.
3. Check that the complex numbers $\square = \{x + iy / i^2 = -1, x, y \in \Re\}$, satisfy all of the conditions in the definition of vector space over $\square$. Make sure you state carefully what your rules for vector addition and scalar multiplication.

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

RESOURCES

TEXT BOOKS:

1. Peter Selinger, Matrix theory and linear algebra, 1st Edition, creative commons license, 2018.
2. Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Linear Algebra, Pearson Education, 5th Edition, 2022.

REFERENCE BOOKS:

1. Kuladeep Sing, *Linear Algebra step by step*, 1st edition, Oxford University press, 2014.
2. David Poole, *Linear Algebra: A Modern Introduction*, Brooks/Cole, 2nd edition, 2005.
3. Edgar G. Goodaire, *Linear Algebra*, Cambridge University Press, 1st Edition, 2014.
4. M. Thamban Nair and Arindama Singh, *Linear Algebra*, Springer, 1st Edition, 2019.
5. Hans Schneider and George Phillip Barker, *Matrices and Linear Algebra*, Dover Publications, 2nd Edition, 1989.
6. Jim Defranza, Daniel Gagliardi, *Introduction to Linear algebra with applications*, Mc GrawHill, 2009.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/111106051
2. https://nptel.ac.in/courses/111106135

WEB RESOURCES:

1. https://catalogimages.wiley.com/images/db/pdf/9781119570271.excerpt.pdf
2. https://web.northeastern.edu/dummit/docs/linalgprac_5_eigenvalues_and_diagonalization.pdf
3. https://web.auburn.edu/holmerr/2660/Textbook/vectorspace-print.pdf
4. https://textbooks.math.gatech.edu/ila/linear-transformations.html
5. https://linear.axler.net/InnerProduct.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22EE102401	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	3	-	2	-	4

Pre-Requisite   --

Anti-Requisite   Fundamentals of Electrical Technology.

Co-Requisite   --

COURSE DESCRIPTION: This course is designed to provide an overview on the fundamentals of electrical and electrical engineering concepts and hands-on experience for non-electrical graduating students. The course addresses the fundamentals concepts of electrical circuits, operational aspects of motors, transformers and general electrical wiring systems. The course also emphasis on the illumination design, back-up supplies like UPS and Batteries, sensors and transducers, and principles of fundamental electronic devices and their applications.

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

CO1.   Analyze the electrical circuits by applying the principles of electrical circuits.

CO2.   Understand the operation of various motors used in domestic application, transformers and general wiring schemes.

CO3.   Understand the operational aspects of UPS, batteries and design the appropriate lighting system for various industrial and domestic applications.

CO4.   Understand the principle of various sensor and transducers to sense/measure various non-electrical parameters.

CO5.   Understand the fundamentals of basic electronic devices, their characteristics and applications of electronic devices.

CO6.   Work independently or in teams to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	-	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	1	-	-	-	-	-	-
CO3	3	2	2	-	-	1	1	-	-	-	-	-
CO4	3	1	-	-	-	1	-	-	-	-	-	-
CO5	3	1	-	1	2	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-
Course Correlation Mapping	3	2	1	1	2	1	1	-	3	3	-	-

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

COURSE CONTENT

Module 1:   Fundamentals of Electric Circuits   *(10 Periods)*

Classification of network elements; Voltage-Current relations for passive elements; Kirchhoff's laws; Series-Parallel connection; Mesh and Nodal analysis (With DC Independent Sources only).

AC sources–Single loop generator, Phasor representation, Voltage, Current, Impedance, Power factor and Apparent power.

Module 2:   Electrical Systems   *(09 Periods)*

Motors: Types of motors, working principle and applications—DC motor, Three Phase Induction motor, Synchronous motor, Stepper motor.

Single Phase Transformer: Construction, principle of operation; EMF equation.

Electrical wiring: Methods of electrical wiring systems; Earthing procedure, Switch fuse unit (SFU), Operation of MCB and Relays.

Module 3:   Utilization of Electrical Systems   *(09 Periods)*

Illumination: Light sources, Terminologies, Laws of illumination; Types of lamps, Lighting calculations; Interior Lighting - Industrial lighting; Exterior lighting- Street lighting and Flood lighting.

Uninterruptible Power Supply (UPS) - Components in UPS, Functionality and Calculation of ratings for UPS components to a specific load.

Emergency supply: Batteries -Types of batteries, Elementary calculations for energy consumption for a specified application.

Module 4:   Sensors and Transducers   *(08 Periods)*

Sensors- Light sensor, Voltage sensor, Temperature and Humidity sensor, Motion detection sensors, Wireless bluetooth sensors and Distance measurement with Ultrasound sensor.

Transducers -Basic requirements of transducers, Passive transducers - Strain gauge, Hall-Effect transducer, LVDT and Active transducers- Piezoelectric and Thermocouple, Data acquisition system (overview and concept only).

Module 5:   Fundamentals of Electronics Engineering   *(09 Periods)*

Half wave and full wave rectifier, Zener diode, characteristics, application – Regulator. BJT—operation; Introduction to Operational amplifier: Inverting and non-inverting amplifier. Application—Adder, Comparator, Integrator and Differentiator; Analog to Digital Convertors—Flash type and Successive approximation types; Digital to Analog converters—Weighed resistor and R-2R types.

                                        Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Verification of Kirchhoff's laws (Mesh and Nodal Analysis).

2. Performance evaluation by brake test on DC Shunt Motor.

3. Performance evaluation of a 1-Phase Transformer by Load test.

4. Practicing plate and pipe earthing system.

5. Operation and testing of Fuse, MCB and Relays.

6. Design and estimation of wiring for a typical house: One lamp controlled by one switch, Two lamp controlled by two switch and stair case wiring.

7. Calibration of LVDT for linear displacement measurement.

8. Analyze the characteristics of Resistance Temperature Detector (RTD) sensor.

9. Analyze the characteristics of piezoelectric sensor.

10. Investigate ripple factor and load regulations of rectifier with and without filters.

11. Design of inverting and non-inverting amplifiers using op-amp.

12. D-A converter (R-2R ladder) using Op-Amp 741 with required voltage levels.

TEXT BOOKS:
1. Ashfaq Hussain, *Fundamentals of Electrical Engineering*, Dhanpatrai& Co. (P) Ltd., 3rd Edition, New Delhi, 2009.
2. R. L. Boylestad and Louis Nashelsky, *Electronics Devices and Circuits*, PHI, 11th edition, 2009.

REFERENCE BOOKS:
1. Wadhwa, C. L. *Basic Electric Engineering*. 4th Edition, New Age International Private limited.
2. D. Patranabis, *Sensors and Transducers*, PHI Learning Private Limited, 2nd Edition, 2003.
3. A .K. Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation,* Dhanpat Rai & Co., 19th Edition, 2015.
4. C.L. Wadhwa, *Generation, Distribution and Utilization of Electrical Energy*, New Age International Private Limited, 2015.

VIDEO LECTURES:
1. https://nptel.ac.in/courses/108108076
2. https://nptel.ac.in/courses/108105061
3. https://nptel.ac.in/courses/108108147
4. https://nptel.ac.in/courses/108101091

WEB RESOURCES:

1. https://www.electrical4u.com/electric-circuit-or-electrical-network/
2. https://www.electronicshub.org/dc-circuits-basics/
3. https://www.electrical4u.com/working-of-electric-motor/
4. https://electricalbaba.com/what-is-ups-working-types-of-ups-explained/
5. https://www.lrc.rpi.edu/resources/publications/pdf/illuminationfund.pdf
6. https://www.sitsitamarhi.ac.in/wp-content/uploads/2020/04/file_5e8ef00b06190.pdf
7. https://www.electronics-tutorials.ws/io/io_1.html
8. https://www.homemade-circuits.com/making-ups-tutorial/
9. https://www.engineersgarage.com/introduction-to-uninterruptible-power-supply-ups-and-its-design-part-1-17/
10. https://www.dfliq.net/blog/the-basics-of-electrical-components/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CS101001	**DIGITAL LOGIC DESIGN**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   Switching Theory and Logic Design

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on Foundations in the operation of digital gates, Concepts of Boolean algebra, Minimization of logic circuits, Design and implementation of combinational and sequential logic circuits, Design digital systems using Programmable logic.

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

CO1.   Apply knowledge of binary systems, logic gates and Boolean functions to represent a given problem using Boolean logic.

CO2.   Minimize and implement Boolean functions to build combinational logic circuits.

CO3.   Design combinational and sequential logic circuits for digital systems.

CO4.   Design digital systems using programmable logic to solve engineering problems.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

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

COURSE CONTENT

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

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

Module 2:   GATE LEVEL MINIMIZATION   *(09 Periods)*

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

Module 3:   COMBINATIONAL LOGIC   *(09 Periods)*

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

Module 4:   SEQUENTIAL LOGIC   *(10 Periods)*

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

Module 5:   PROGRAMMABLE LOGIC   *(07 Periods)*

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

Total Periods: 45

EXPERIENTIAL LEARNING

1.   Design the digital circuit system of the vehicle with two photocell sensors, which work as inputs. Simulate the virtual circuit using NI Multisim software considering the following specifications:
   a)   Each side (right of left) of that sensor circuit which communicate with each motor to output the signals so the vehicle can correct the direction along the track and drive. The track is outlined by two LED strip lights, as an input source, on both ends adhered on the ground about one feet apart. For instance, when the vehicle is close to the LED strip lights on the right-side track, the right side of the photocell sensor detects the bright lights, and it sends a positive signal to the left motor. That is, the input of the left photocell logic is 0 (off) because the left sensor does not detect the light and the right photocell logic is 1 (on). The output of the left and right motors in this case are represented as logics 1 and 0 respectively, which makes only the left motor spins to steer to the left side moving away from the right side of LED strip.
   b)   Once the vehicle moves off the light, the both sides of the motors will operate and the vehicle would move straight forward until it encounters another LED strip light. In the case of the left side, the opposite would happen. The left sensor detects the LED strip light on the left side track. Thus, only the right motor will run to make the vehicle to steer to the right side.
   c)   Since two LED strips are far (about 30 cm) apart, both the left and right photocell will not detect the light at the same time. However, it can be defined as negative output for both motors to follow the logics and therefore the vehicle will stop moving.

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

RESOURCES

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th edition, Pearson, 2018.

REFERENCE BOOKS:

1. A. Anand Kumar, Switching Theory and Logic Design, 3rd edition, PHI Learning Private Limited, India, 2016.

2. Charles H. Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design, 7th edition, Cengage Learning, 2015.

3. Alan B. Marcovitz, Introduction to Logic Design, 3rd edition, McGraw Hill, 2010.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/108106177

2. https://nptel.ac.in/courses/106105185

3. https://www.youtube.com/watch?v=RZo--xYfTR4

4. https://www.youtube.com/watch?v=3vEV55D103g

5. https://www.youtube.com/watch?v=axGvxdUpEIE

6. https://www.youtube.com/watch?v=QEFW4DcyOC0

7. https://www.youtube.com/watch?v=wIeqYG4c6Ho

WEB RESOURCES:

1. https://www.rapidtables.com/convert/number/base-converter.html

2. https://learnabout-electronics.org/Digital/dig10.php

3. https://www.tutorialspoint.com/computer_logical_organization/digital_counters.htm

4. https://www.electronics-tutorial.net/programmable-logic-devices/complex-programmable-logic-device/

5. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/comp_networks_sm/labs/exp1/procedure.php

6. https://unacademy.com/course/logic-gates-and-boolean-algebra-iit-jee/GUT1BCXY

7. https://byjus.com/jee/basic-logic-gates/

8. https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/reader/ch1to12.pdf

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SCHOOL CORE

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Course Code	Course Title	L	T	P	S	C
22CE107601	**ENVIRONMENTAL SCIENCE**	2	-	-	-	2

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

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

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

CO1. Analyze natural resources to solve complex environmental problems and natural resource management considering society, environment and sustainability.

CO2. Analyze ecosystems and biodiversity to solve complex environmental problems by following environmental ethics considering society, environment and sustainability besides communicating effectively in graphical form.

CO3. Analyze various types of pollution and their control measures to solve environmental problems through appropriate tools and techniques following latest developments considering society, ethics, environment and sustainability.

CO4. Analyze social issues and its impact on environment, environmental acts to solve complex environmental problems considering society, environment and sustainability besides communicating effectively in graphical form.

CO5. Analyze human population and its impact on environment to solve complex environmental problems through team work and using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3		2		1	1				1	
CO2	3	3		2		1	1	1		1		
CO3	3	3		2	1	1	1	1				1
CO4	3	3		3		1	1	1		1		
CO5	3	3		2	1	1	1	1	1			
Course Correlation Mapping	3	3	-	3	1	1	1	1	1	1	1	1

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

COURSE CONTENT

Module 1:   NATURAL RESOURCES   *(07 Periods)*

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

Module 2:   ECOSYSTEMS AND BIODIVERSITY   *(07 Periods)*

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids – Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem.
Biodiversity: Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity – In-situ and ex-situ.

Module 3   ENVIRONMENTAL POLLUTION AND CONTROL   *(06 Periods)*

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

Module 4   SOCIAL ISSUES AND THE ENVIRONMENT   *(06 Periods)*

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

Module 5   HUMAN POPULATION AND THE ENVIRONMENT   *(04 Periods)*

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

Total Periods: 30

EXPERIENTIAL LEARNING

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

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

RESOURCES

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

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

VIDEO LECTURES:

1. http://nptel.ac.in/courses/109/104/109104047

2. https://www.youtube.com/watch?v=mIPBPG-5dUw

WEB RESOURCES:

1. https://nptel.ac.in/courses/122102006

2. https://www.flame.edu.in/academics/ug/program-structure/major-minor-courses/environmental-studies

3. https://www.tutorialspoint.com/environmental_studies/environmental_studies_environment.htm

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG102401	**ENGLISH FOR PROFESSIONALS**	2	-	2	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with listening strategies, reading comprehension, grammar, vocabulary, pronunciation, Written, Verbal and Non-verbal communication, Channels of communication, Barriers to communication, Modes of technology-based communication, and Technical Communication

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

CO1. Understand the basics of Reading, Writing, Listening, and Speaking skills.

CO2. Analyze the rules of English grammar in speaking and writing.

CO3. Demonstrate knowledge of English pronunciationin speaking.

CO4. Apply the knowledge of reading strategies and vocabulary in communication.

CO5. Apply the strategies of writing in preparing a report.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	3	-	2
CO2	-	3	2	-	-	-	-	-	-	3	-	2
CO3	3	2	-	-	-	-	-	-	-	3	-	2
CO4	-	-	-	-	3	-	-	-	-	3	-	2
CO5	-	-	-	-	3	-	-	-	-	3	-	2
Course Correlation Mapping	3	2	2	-	3	-	-	-	-	3	-	2

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

COURSE CONTENT

Module 1: SUPER HEROES – THE SCIENCE BEHIND SUPER HEROES   *(06 Periods)*

Reading for Comprehension, Grammar, Speaking, Listening, Vocabulary, Writing, Verbal and Non-verbal communication.

Module 2: ALIENS – THE CYLINDER OPENS   *(06 Periods)*

Reading for comprehension, Grammar, Vocabulary, Writing, Listening, and Channels of communication.

Module 3: INVENTORS – THE RAMAN EFFECT   *(06 Periods)*

Reading comprehension, Listening, Writing, Grammar, Speaking, Pronunciation, and communication barriers.

Module 4: HEALTH AND NUTRITION – WHAT SHOULD YOU BE EATING   *(06 Periods)*

Reading comprehension, Listening, Speaking, Grammar,Writing, Pronunciation, and Modes of technology-based communication.

Module 5: NEW-AGE ENTREPRENEURS – HOW A CHINESE BILLIONAIRE BUILT HER FORTUNE   *(06 Periods)*

Reading comprehension, Vocabulary, Listening, Grammar, Writing, and Technical Communication

Total Periods: 30

EXPERIENTIAL LEARNING

PART-A
Any six modules among the following:

1. Conversation starters and role play

2. Reading comprehension

3. Listening comprehension

4. Vocabulary Building (business and job-related vocabulary)

5. Describing people, places, objects, and Events

6. Phonetics - Accent/ Rhythm/ Intonation

7. Tenses

8. Proposal Writing

PART-B
Any four modules among the following:

1. Communicating effectively is important to become successful in any business. Prepare a Case study of successful business personnel regarding communication competence.

2. Prepare a PowerPoint presentation on an orator and analyze the voice dynamics.

3. People face situations to convince or agree with the points they have. The college arranges a 5-day tour program to Goa. Prepare a video on persuasive talk and convince parents to get permission.

4. Write an article on the famous clichés of our time.

5. Prepare a poster on the effects of social media on youth.

6. Give a short talk on the importance of inventors and their role in present socio, political and economic changes.

7. Prepare a collage of entrepreneurs' pictures and their achievements.

8. NASA released recent photos of the universe with the help of the James Webs Space Telescope. Write down the expected impact on the existing theory on planets and the universe.

9. Obesity is the most common problem for people. List out the reasons for the problem and prepare food habits to overcome.

10. Epics of India deals with superheroes of those days. Compare the weapons used in the battles of Mahabharata with modern weapons.

11. Write a report on your recently invented product so that it should be sold as a hot cake in the market.

12. Illustrate the essential rules for good precis writing.

RESOURCES

TEXTBOOK:
1. N.P. Sudharshana&C.Savitha, *"English for Technical Communication"*, Cambridge University Press. 2016.

REFERENCE BOOKS:
1. Kline, J. A. *Speaking effectively: Achieving excellence in presentations. Upper Saddle River,* NJ: Pearson/Prentice Hall, 2004.
2. Kuiper. S, *Contemporary business report writing,* Cincinnati, OH: Thomson/South, Western, 3rd Edition, 2007.
3. Locker, K. O. & Kaczmarek, *S*. K. Business communication: Building critical skills, New York: McGraw, Hill/Irwin, 3rd Edition, 2007.
4. Mascull. B, *Business vocabulary in use: Advanced. Cambridge,* Cambridge University Press, 2004.
5. Matthews, C. B. and Matthews, *Quicksteps to winning business presentations: Make the most of your PowerPoint presentations*, McGraw Hill, 2007.
6. Marsh. C, *Strategic writing: Multimedia writing for public relations, advertising, sales and marketing, and business communication*, Pearson/Ally and Bacon, 2005.
7. Munter. M, and Russell. L, *Guide to presentations*, Pearson/Prentice Hall, 2nd Edition, 2008.
8. Reardon. K. K, *The skilled negotiator: Mastering the language of engagement*, Jossey, Bass, 2004.
9. Stiff. J. B, *Persuasive communication*, Guilford Press. Engagement, Jossey, Bass, 2nd Edition, 2003.

VIDEO LECTURES:

1. https://learnenglish.britishcouncil.org/general,english/video,zone/the,day,elizabeth,became,queen
2. https://www.youtube.com/watch?v=CscHc8qSn1A

WEB RESOURCES:

1. https://galgotiacollege.edu/assets/pdfs/study,material/Notes,english.pdf

2. https://lecturenotes.in/subject/183

3. https://www.fluentu.com/blog/english/professional,english/

4. https://learnenglish.britishcouncil.org/business,english

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101403	**CALCULUS AND TRANSFORMATION TECHNIQUES**	3	-	-	-	3

Pre-Requisite   Nil
Anti-Requisite   Transformation Techniques and Linear Algebra
Co-Requisite   Nil

COURSE DESCRIPTION: This course consists of topics in Calculus and Transformation Techniques with applications to various engineering problems. It covers the topics, Mean Value Theorems, Taylor's and Maclaurin's Theorems. It includes functions of two or more variables together with their applications. This course is designed to train students with the basic integral transform techniques.

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

CO1.   Make use of mean value theorems to solve engineering problems.

CO2.   Identify the maxima and minima of multivariable functions.

CO3.   Determine Laplace transform of different functions arising in engineering problems.

CO4.   Apply Laplace transform and its inverse to solve initial and boundary value problems.

CO5.   Determine the Fourier series and Fourier transforms of various functions.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	1	1	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	1	1	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	-	2	1	-	-	-	-	-	-	-	-	2	-	-
CO4	3	3	-	3	1	-	-	-	-	-	-	-	-	2	-	-
CO5	3	3	-	3	1	-	-	-	-	-	-	-	-	2	-	-
Course Correlation Mapping	**3**	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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

COURSE CONTENT

Module 1:   SINGLE VARIABLE CALCULUS   *(08 Periods)*

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof) related problems.

Module 2:   MULTIVARIABLE CALCULUS   *(07 Periods)*

Introduction to function of several variables, Jacobian and its properties, Functional dependence, Maxima and minima of functions with two variables, Lagrange's multiplier method.

Module 3   LAPLACE TRANSFORMS   *(10 Periods)*

Definition of Laplace transform, Existence conditions, Laplace transforms of standard functions, Linearity property, First and second shifting theorems, Change of scale property, Laplace transforms of derivatives and integrals, Multiplication by t^n, Division by t, Laplace transform of periodic functions (without proofs), Laplace transforms of unit step function and unit impulse function.

Module 4   INVERSE LAPLACE TRANSFORMS   *(10 Periods)*

Definition of inverse Laplace transform, Linearity property, First and second shifting theorems, Change of scale property, Inverse Laplace transforms of derivatives and integrals, Multiplication by s, Division by s, Convolution theorem (without proofs), Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

Module 5   FOURIER SERIES AND FOURIER TRANSFORMS   *(10 Periods)*

Fourier series: Determination of Fourier coefficients, Euler's formulae, Convergence of Fourier series (Dirichlet's conditions), Fourier series in$(-\pi, \pi)$, Half range sine and cosine expansions, Parseval's identity in $(0, \pi)$.

Fourier Transforms: Complex Fourier transform, Fourier sine and cosine transforms, Inverse Fouriertransforms.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Obtain the Taylor series of any Single variable function (Algebraic or Transcendental) and then plot the graph of the function given using MAPLESOFT or MATLAB.

2. A 100-gm mass is suspended from a spring with constant 50 N/m. It is set into motion by raising it 10 cm above its equilibrium position and giving it a velocity of 1 m/s downward. During the subsequent motion a damping force acts on the mass and the magnitude of this force is twice the velocity of the mass. If an impulse force of magnitude 2 N is applied vertically upward to the mass at t = 3 s, find the position of the mass for all time**.**

3. Differentiate the Fourier and Laplace transforms of any time domain function with an example**.**

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

RESOURCES

TEXT BOOKS:

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.

2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th edition, 2011.

REFERENCE BOOKS:

1. B. V. Ramana, *Higher Engineering Mathematics*, Tata McGraw hill, 1st edition, 2017.

2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/111105121(Calculus)
2. https://nptel.ac.in/111106139/ (Laplace Transform)
3. https://nptel.ac.in/courses/111106111/ (Fourier Series and Fourier Transforms)

WEB RESOURCES:

1. http://www.efunda.com/math/math_home/math.cfm

2. http://www.sosmath.com/
3. http://www.mathworld.wolfram.com/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CS102001	**PROGRAMMING FOR PROBLEM SOLVING**	3	-	2	-	4

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

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

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

CO1. Demonstrate knowledge on C programming constructs to develop programs.

CO2. Design algorithms using problem-solving techniques for given problems.

CO3. Apply functions and Arrays to enhance reusability and data manipulation.

CO4. Develop programs using pointers for efficient memory management.

CO5. Apply structures, unions and file handling concepts to develop societal applications.

CO6. Work independently or in team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	3	2	3	-	-	-	-	-	-	-	3	-	-	-
CO3	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-	-
CO4	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-	-
CO5	3	3	3	2	3	3	-	-	-	-	-	-	3	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	3	-	-	-
Course Correlation Mapping	**3**	**2**	**3**	**2**	**3**	**3**	-	-	**3**	**3**	-	-	**3**	-	-	-

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

COURSE CONTENT

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

Basics of C Programming: Introduction, Structure of a C program, Concept of a variable, Data types in C, Program statement, Declaration, Storing the data in memory, Tokens, Operators and expressions, Lvalues and Rvalues, Type conversion in C.
Input and Output: Basic screen and keyboard I/O in C, Non-formatted input and output, formatted input and output functions.

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

Control Statements: Specifying test condition for selection and iteration, Writing test expression, Conditional execution and selection, Iteration and repetitive execution, goto statement, Special control statements, Nested loops.
Introduction to Problem Solving: Algorithms, Flowcharts, Problem solving aspect, Top-down design, Implementation of algorithms, program verification and efficiency of algorithms.

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

Arrays and Strings: One-dimensional array – Declaration, Initialization, Accessing elements, operations; Multi-dimensional arrays – Declaration, Initialization, Working with 2D arrays; Strings – Declaration, Initialization, Printing strings, String input, Character manipulation, String manipulation; Arrays of strings – Initialization, manipulating string arrays.
Functions: Concept of function, Using functions, Call by value mechanism, working with functions, passing arrays to functions, Scope and extent, Storage classes, Recursion.

Module 4: POINTERS   *(08 Periods)*

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

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

User-Defined Data Types: Structures - Declaration, Accessing the members, Initialization, typedef and its use, Arrays of structures, Arrays within structure, Structures and pointers, Structures and functions; Unions, Enumeration types, Bitfields.
Files: Using files in C, Working with text and binary files, Direct File Input and Output, Files of records, Random access to files of records.

Total Periods: 45

EXPERIENTIAL LEARNING

1.   a)   Write a C program to perform the arithmetic operations on two integer numbers.

     b)   Write a program to evaluate the following expressions by reading the necessary values from the keyboard.

     i. $(ax + b)/(ax - b)$ ii. $2.5 \log x + \cos 32^0 + | x^2 + y^2|$
     iii. $ax^5 + bx^3 + c$ iv. ae^{kt}

2.   a)   Write a C program to find the roots of a quadratic equation.

     b)   In a town, the percentage of men is 52. The percentage of total literacy is 48 and the total percentage of literate men is 35 of the total population. Write a C program to find the total number of illiterate men and women if the population of the town is 7000.

3. a) Write a C Program to compute an electricity bill based on the following slab rates.

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

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

b) An insurance company computes the premium amount based on the following;

i. If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city, and is a male then the premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.

ii. If a person satisfies all the above conditions and is female then the premium is Rs.3 per thousand and the policy amount cannot exceed Rs.1 lakh.

iii. If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then premium is Rs.6 per thousand and the policy cannot exceed Rs. 10000.

iv. In all other cases the person is not insured.

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

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

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

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

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

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

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

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

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

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

   b) Write a C program that uses function to perform the following:
      i) Addition of Two Matrices   ii) Multiplication of Two Matrices

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

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

7. a) Write a C program to generate all the prime numbers between 1 and *n*, where *n* is a value entered by the user. Define a separate function to generate prime numbers.

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

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

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

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

9. a) Write a C program that performs the following operations:
      i. Reading a complex number   ii. Writing a complex number
      iii. Addition of two complex numbers   iv. Multiplication of two complex numbers
   (**Note:** Represent complex number using a structure.)

   b) Define a structure to store employee details include *Employee-Number, Employee-Name, Basic-pay, Date-of-Joining.* Write a C program for the following.
      i. A function to store 10 employee details.
      ii. A function to implement the following rules while revising the basic pay.
         If Basic-pay<=Rs.5000 then increase it by 15%.
         If Basic-pay> Rs.5000 and <=Rs.25000 then it increase by10%.
         If Basic-pay>Rs.25000 then there is no change in Basic-pay.
      iii. A function to print the details of employees whohave completed 20 years of service from the Date-of-Joining.

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

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

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

RESOURCES

TEXT BOOKS:

1. PradipDey and Manas Ghosh, *Programming in C*, Second Edition, Oxford University Press, New Delhi, 2013.

2. R. G. Dromey, *How to Solve it by Computer*, First Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. Byron S Gottfried and Jitender Kumar Chhabra, *Programming with C*, Fourth Edition, McGraw Hill Education, 2019.

2. Yashavant Kanetkar, *Let Us C*, Fifteenth Edition, BPB Publications, 2017.

3. E. Balagurusamy, *Programming in C*, Seventh Edition, McGraw Hill Education Pvt, Ltd, New Delhi, 2017.

4. Behrouz A. Forouzan and Richard F. Gilberg, *Computer Science: A Structured Programming Approach Using C*, Third Edition, Cengage Learning, 2008.

SOFTWARE/TOOLS:

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

VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/106105171/L03.html

2. https://nptel.ac.in/courses/106104128

WEB RESOURCES:

1. Learn C Programming - https://www.programiz.com/c-programming

2. Learn C Programming - https://www.tutorialspoint.com/cprogramming/index.htm

3. C Programming Exercises, Practice, Solution - https://www.w3resource.com/c-programming-exercises/

4. Basic programming exercises and solutions in C - https://codeforwin.org/2015/05/ basic-programming-practice-problems.html

5. C Programming Exercises, Practice, Solution - https://www.w3resource.com/c-programming-exercises/

6. Basic programming exercises and solutions in C - https://codeforwin.org/2015/05/basic-programming-practice-problems.html

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI105002	**DISRUPTIVE TECHNOLOGIES**	-	1	2	-	2

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Google AI tools for speech recognition, language detection and Python API to build Machine Learning Models. This course also focuses on demonstration of Cloud Services and tools, Internet of Things with Arduino and simulation of robots using robotics development platform.

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

CO1. Use Google AI tools for speech recognition and language detection.

CO2. Construct Machine Learning Modelsusing Python API to solve Classification problems.

CO3. Use Cloud Services and tools for effective collaboration and data sharing

CO4. Design an interface to embedded systems using real time sensors with Arduino.

CO5. Design and simulate robot using robotic simulation platforms for societal applications.

CO6. Work independently and communicate effectively in oral and written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	3	2	-	-	-	-	-	-	-	3	-	-
CO2	2	3	3	3	3	2	-	-	-	-	-	-	-	3	-	-
CO3	2	-	-	-	3		-	-	-	-	-	-	3	-	-	-
CO4	2	-	3	-	2	2	2	-	-	-	-	-	-	-	-	3
CO5	2	-	3	-	-	2	-	-	-	-	-	-	3	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	2	3	3	3	3	2	2	-	3	3	-	-	3	3	-	3

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

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

Artificial Intelligence – Introduction, Applications, Trends, Technologies, Relevant Libraries/API; Machine Learning – Introduction, Applications, Python Libraries/API.

1. Speech Recognition: Read an audio file with Python and use the Google Speech Recognition API to perform conversion of Speech to Text.

2. Language Detection: Detect the language of the text using Language Detection Library (langdetect) ported from Google's languagedetection.

3. Object Detection: Detect multiple objects present in an image using Detection-Facebook's API.

4. Build a classification model using Decision Tree learning algorithm. Use Iris dataset and scikit-learn python library to build the model.

Cloud Computing – Introduction, Applications, Services - PaaS, IaaS, SaaS, Virtualization, Application Deployment.

5. Create Windows virtual machine using VMware workstation under IaaS.

6. Create online survey forms, questionnaires and analyse the result of survey using Zoho under SaaS.

7. Develop a web application and deploy the same on Amazon Simple Storage Service.

Internet of Things - Introduction, Applications, Arduino IDE, Servo Motor, Sensors, ECG System.

8. Design and simulate Servo motor interfacing with Arduino.

9. Design and simulate Flame Sensor interfacing with Arduino.

10. Design and implement an IoT ECG (Electrocardiogram) System to recordhearts electrical activity.

Robotics - Introduction, Applications, understanding robotics development platform to model, Program and Simulate robots.

11. Design a Two Wheel line following robot integrated with infrared sensors.

12. Design a collision avoidance robot in multi obstacle based environment.

RESOURCES

REFERENCES:

1. Sebastian Raschka, Vahid Mirjalili, Python Machine Learning, Packt Publishing, 3rd Edition, 2019.

2. Simon Monk, Programming Arduino, Second Edition, McGraw-Hill Education,2016.

SOFTWARE/TOOLS:

1. Python – Google SpeechRecognition API,Google langdetect API, Scikit-learn
2. Virtual Box and Virtual PC Software
3. Arduino Kit, Python/C
4. CoppeliaSim

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=lKra6E_tp5U
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
3. https://www.youtube.com/watch?v=H_ustCy4Ks8
4. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
5. https://www.youtube.com/watch?v=xq_JKhbYWKk
6. https://www.youtube.com/watch?v=uBLcAz7obwA

WEB RESOURCES:

1. https://gsuite.google.com/learning-center/products/#!/
2. https://pypi.org/project/langdetect/
3. https://cloud.google.com/translate/docs
4. https://scikit-learn.org/stable/modules/generated/sklearn.tree.DecisionTreeClassifier.html
5. Understanding Amazon Web Services, https://aws.amazon.com/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI105003	**FREE AND OPEN SOURCE SOFTWARE**	-	1	2	-	2

Pre-Requisite   Programming for Problem Solving

Anti-Requisite   -

Co-Requisite   Object Oriented Programming through Java

COURSE DESCRIPTION: This course covers the basic programming constructs of Go language. It emphasizes the concepts including string handling and implementation of HTTP protocols in Go language. The course also provides hands on training on application development using MIT app inventor and GIT commands related to repositories.

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

CO1. Create source code repositories using GitHub.

CO2. Create communication between client to server and develop interactive software applications using GO language.

CO3. Develop basic mobile applications using MIT App inventor.

CO4. Work independently and communicate effectively in oral and written Forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	3	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	3	3	-	3	-	-	-	-	-	3	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-	-
CO4	3	-	3	-	3	-	3	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	3	2	2	3	3	-	3	-	-	-	-	-	3	-	-	-

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

EXPERIENTIAL LEARNING

List of Experiments:

GIT HUB

Theory Topics: Git Basics, Git repositories, local repositories, remote repositories, Secure shell encryption algorithm.

1. Configuration of Git using gitconfig, gitlog and gitaliases commands.
2. Initializing the local repositories using Git commands: add, commit and status.
3. Moving the local repository to the Git hub using the commands remote, push and pull.
4. Creation of remote access to Github using SSH key.
5. I/O management system with Github using branch and merge techniques.

Go Programming Language

Theory Topics: Variables, Data types, Conditional statements, Looping statements, strings.

1. Peano numbers are a simple way of representing the natural numbers using only a zero value and a successor function. Ex. 0->1->2->3->5…. Write a GO program to generate Peano integers.
2. Write a GO program to check if two trees are equivalent if they both have the same topology and if the objects contained in corresponding nodes are equal.
3. Hypertext Transfer Protocol (HTTP) is an application-layer protocol for transmitting hypermedia documents. It was designed for communication between web client and web servers. Write a program to configure HTTP server for establishing a simple client – server communication.
4. Code the solutions to a few string-related hacker rank problems.
   Ex: Prints the text of each line that appears more than once in the standard input, preceded by its count.

Build Apps with MIT App Inventor

Theory Topics: Frames, Blocks, embedding audio & video

1. Develop the   Hello Codi App by using MIT App Inventor with the components: Blocks Editor, audio, video, clock timer.
2. Develop a Digital Doodle Application using MIT App Inventor.

RESOURCES

REFERENCES

GIT Hub

1. Scott chacon, Ben Straub, *Pro Git*, Second Edition, APress open, 2014.

Go Programming Language

1. Alan A. A. Donovan, Brain W. Kernighan, *The Go Programming Language,*First Edition, Addison-Wesley, New York, 2005.

2. https://gophercises.com/.

MIT App Inventor
   1. http://appinventor.mit.edu/

SOFTWARES/TOOLS used:

1. System Software: Git hub, Go Compiler & MIT App Inventer.

VIDEO LECTURES:

1.   https://onlinecourses.swayam2.ac.in/aic20_sp37/preview

2.   https://www.coursera.org/courses?query=github

3.   https://www.youtube.com/c/Freecodecamp

4.   https://www.simplilearn.com/tutorials/git-tutorial/git-tutorial-for-beginner

WEB RESOURCES:

1.   https://docs.github.com/en

2.   https://go.dev/doc/tutorial/getting-started

3.   https://appinventor.mit.edu/explore/ai2/tutorials

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CB105001	**COMPUTER HARDWARE AND SYSTEM ESSENTIALS**	-	1	2	-	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

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

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

CO1. Identify different hardware components on personal computer and peripheral devices.

CO2. Create network architecture using TCP and UDP protocols for data transmission.

CO3. Devise the solutions for the problems occurred in personal computer in Operating Systems.

CO4. Implement the functionalities of different peripheral devices and networks by configuring multi-functional devices.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	1	1	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	3	-	1	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	3	1	2	-	-	-	-	-	-	-	-	-	-	3
CO4	3	2	3	1		-	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

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

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

HARDWARE CONFIGURATION

Peripherals of the computer

1. Implement the following activities:
   a) Configure settings using BIOS/UEFI tools on a PC.
   b) Identify different components of mother board
   c) Analyze various RAM types, PC extensions cards and storage devices

2. Implement the following activities:
   a) Identify various CPU's, cooling methods and PC connection interfaces
   b) Identification of various power supply, display devices and common PC Connectors
   c) Install and configure common peripheral devices and SOHO multi-function device

PC Networking using Packet Tracer

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

3. a) Identify various types of network cables and connectors and characteristics

   b) Implement the following characteristics of TCP/IP
   i)IPv4 and IPv6 ii)Client side DNS Settings

4. a) Identify following TCP and UDP Ports
   i)21-FTP   ii)443-HTTPS   iii)80-HTTP   iv)Telnet

   b) Analyze the following TCP and UDP protocols
   i)SMD   ii)SNMP   iii)DHCP

5. a) Configure the following network types
   i) LAN   ii) WAN   iii) WLAN

   b) Configure network architecture using the following
   i) HUB   ii) Switch   iii) Router

OPERATING SYSTEMS

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

6. Installation of Windows Operating System

7. Installation of Application and Device Drivers management

TROUBLESHOOTING

Introduction to trouble shooting, Hardware and Software Trouble shooting

8. a) Study the common problems related to the following
   i) Mother Board   ii) RAM   iii) CPU   iV) Power

   b) Troubleshoot the following failures
   i) Read/Write Failure   ii) Slow Performance   iii) Failure to boot

9. Trouble Shoot the following symptoms of Video, projector and display issues
   i) VGA Mode   ii) No Image of Screen   iii) Dead Pixels   iv) Color patterns

10. Trouble shoot the following issues of wired, wireless and mobile devices
    i) No Connectivity   ii) IP conflict   iii) Ghost Cursor iv) Stiking Keys

RESOURCES

REFERENCES:

1. David Anfinson, Allan Johnson and Kathleen Czurda, *IT Essentials v7 Companion Guide*, CISCO Press, 2020

2. Brian W. Kernighan, *Understanding the Digital World: What You Need to Know about Computers, the Internet, Privacy, and Security*, Second Edition, Princeton University Press, 2021

3. Kavin Wilson, *Exploring Computer Systems: The Illustrated Guide to Understanding Computer Systems, Hardware &Networks*, Elluminent Press, 2019

SOFTWARE/TOOLS:

1. Windows 8/10 operating systems

2. Cisco Packet Tracer

VIDEO LECTURES:

1. https://www.edx.org/course/computer-hardware-and-operating-systems

2. https://www.coursera.org/learn/computer-hardware-software

WEB RESOURCES:

1. https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/configuration/15-s/ir-15-s-book.pdf

2. https://www.certexams.com/comptia/a+/cert-notes-aplus-networking.htm

3. https://www.rcboe.org/cms/lib/GA01903614/Centricity/Domain/4399/Network%20n10-007.pdf

4. https://www.tutorialsweb.com/CertNotes/CompTIA-cert/A+/aplus-prac-10.htm

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22AI101001	**DISCRETE MATHEMATICAL STRUCTURES**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on discrete mathematics to make students to think logically and mathematically and apply these techniques in solving problems. Topics include mathematical logic, functions, relations, deterministic algorithms and analysis techniques based on counting methods, recurrence relations, trees and graphs.

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

CO1. Apply mathematical logic and truth tables to validate precise statements.

CO2. Understand the concepts of sets, relations and functions.

CO3. Analyze and apply the concepts of mathematical induction, counting principles and properties of algebraic structures to solve computational Problems.

CO4. Formulate problems and solve recurrence relations using substitution method and generating functions.

CO5. Apply trees and graphs to solve the problems in computer applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	-	-	2	2	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	-	3	2	-	-	-	-	-	-	-	3	-	-	-
CO4	3	2	-	3	2	-	-	-	-	-	-	-	3	-	-	-
CO5	3	-	-	3	2	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

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

COURSE CONTENT

Module 1: MATHEMATICAL LOGIC AND NORMAL FORMS   *(08 Periods)*

Mathematical Logic: Introduction, Statements and Notation, Connectives, Well- formed formulae, Truth tables, Tautology, Equivalence, Implications.

Normal forms: Disjunctive normal form, Conjunctive normal form, Principle disjunctive normal form, Principle conjunctive normal form.

Module 2: RELATIONS AND FUNCTIONS   *(08 Periods)*

Relations: Cartesian product of sets, Relations, Properties of binary relations, Equivalence, Compatibility and Partial ordering relations, Hasse diagram and related applications, Lattices as partially ordered sets, Definition and examples, Properties of Lattices.

Functions: Types of functions, Composition of functions and inverse of functions

Module 3: INDUCTION, COUNTING AND ALGEBRAIC STRUCTURES   *(09 Periods)*

Induction, Counting: Mathematical Induction – The Basics of Counting - The Pigeonhole Principle - Principle of Inclusion-Exclusion.

Algebraic Structures: Algebraic systems, Examples and general properties, Semi groups and Monoids, Groups, Subgroups, Homomorphism, Isomorphism

Module 4: GENERATING FUNCTIONS AND RECURRENCE RELATIONS   *(11 Periods)*

Generating Functions: Generating functions of sequences, Calculating coefficients of generating functions.

Recurrence Relations: Recurrence relations, Solving recurrence relations by substitution and generating functions, The method of characteristic roots, Solutions of homogeneous recurrence relations.

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

Graphs: Basic concepts of Graph theory, Planar and Complete graph, Matrix representation of Graphs, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest path algorithms.

Trees: Introduction to Trees, Properties of Trees, Spanning Trees, Depth-First Search, Breadth-First Search, Minimum Spanning Trees.

Total Periods: 45

EXPERIENTIAL LEARNING

The following is the sample. Faculty shall frame according to the course domain.

1. Let a > 1 be a positive integer. Pretend you want to divide n people into some number of teams, each of size a or a + 1. Show that this is possible provided n is larger than values in the Fibonacci polynomial $a^2 - a - 1 = a(a-1) - 1$.

2. Identify the relations on the set of bits B = {0, 1} that are partial orders and those that are equivalence relations.

3. Pretend you are writing traffic accident software and want to categorize accidents by the day of the week on which they occur. Pretend there are n accident reports to categorize.

   (a) What is the size of the sample space? That is, in how many ways can the n accident reports be distributed over 7 days?

   (b) In how many ways can all n accidents occur on one single day?

   (c) In how many ways can all n accidents occur on only two days?

   (d) Let's looks at the other end: In how many ways can all n accidents occur on seven, and no less, days.

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

RESOURCES

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

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

VIDEO LECTURES:
1. https://nptel.ac.in/courses/106106183
2. https://nptel.ac.in/courses/106106094
3. https://nptel.ac.in/courses/111107058

WEB RESOURCES:
1. https://www.coursera.org/learn/discrete-mathematics
2. https://people.cs.pitt.edu/~milos/courses/cs441/
3. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf
4. https://edurev.in/studytube/Propositional-Logic-Discrete-Mathematical-Structur/8e588945-d315-41f0-a31e-0dc45829eb04_v

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CE107603	**RURAL TECHNOLOGY**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

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

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

CO1. Compare various technologies for rural development by solving rural problems through different schemes by considering ethics, society, environment and sustainability.

CO2. Analyze non-conventional energy sources using appropriate tools and techniques to solve rural energy problems considering society, environment and sustainability besides communicating effectively in graphical form.

CO3. Select appropriate technologies in different areas of rural development to solve rural issues following latest developments considering society, environment and sustainability.

CO4. Relate water conservation, health, safety and rural employment issues for community development to solve rural problems through appropriate technologies considering ethics, society, environment and sustainability.

CO5. Analyze the impact of IT, public and private partnership on rural development to solve complex rural problems using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	3	2	1	1	1	-	-	-	-
CO2	2	3	-	2	2	1	1	-	-	1	-	-
CO3	2	3	-	2	2	1	1	-	-	-	-	1
CO4	2	3	-	2	2	1	2	1	-	-	-	-
CO5	2	3	-	3	2	1	1	1	-	-	-	-
Course Correlation Mapping	**2**	**3**	**-**	**3**	**2**	**1**	**2**	**1**	**-**	**1**	**-**	**1**

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

COURSE CONTENT

Module 1:   INTRODUCTION TO RURAL DEVLOPMENT   *(06 Periods)*

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

Module 2:   NON CONVENTIONAL ENERGY   *(06 Periods)*

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

Module 3   TECHNOLOGIES FOR RURAL DEVELOPMENT   *(06 Periods)*

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

Module 4   COMMUNITY DEVELOPMENT   *(06 Periods)*

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

Module 5   IT IN RURAL DEVELOPMENT   *(06 Periods)*

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

Total Periods: 30

EXPERIENTIAL LEARNING

1. Visit a nearby village and know the status of small scale industries which are implanted and to be established based on the availability of the local resources.

2. Visit a local village and make an awareness program on energy utilization using biomass products.

3. Make a awareness program in the villages for the rural development in terms of home-made products.

4. Construct rain water harvesting structures in nearby villages where water scarcity is more and prepare a document.

5. Develop a small IT application the village area which will be used for the growth of the village.

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

RESOURCES

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

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

VIDEO LECTURES:

1. http://nptel.ac.in/courses/109/104/109104047

2. https://www.youtube.com/channel/UCEZxAQu3ZBulN-pYMYO2i_A/videos

3. https://www.youtube.com/watch?v=HnrIB-QmvIQ

WEB RESOURCES:

1. en.wikibooks.org/wiki/Technologies_for_Rural_Development/Complete

2. https://www.oecd-ilibrary.org/sites/ae6bf9cd-en/index.html?itemId=/content/component/ae6bf9cd-en

3. https://crdt.iitd.ac.in/

Course Code		L	T	P	S	C
22LG107601	**PROFESSIONAL ETHICS AND HUMAN VALUES**	2	-	-	-	2

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

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

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

CO1. Demonstrate the principles of ethics, professional values, and social responsibility.

CO2. Analyze the problems in the implementation of moral autonomy and use ethical theories in resolving moral dilemmas.

CO3. Develop suitable strategies to resolve problems that arise in practicing professional ethics and Industrial standards.

CO4. Function as a member, consultant, manager, advisor and leader in multi-disciplinary teams.

CO5. Provide solutions to complex problems associated with professional ethics using analysis and interpretation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	2	2	2	2	-	-	-	1	1	1	1
CO2	2	3	2	-	2	2	2	2	2	-	-	-	1	1	1	1
CO3	2	-	3	-	2	2	2	2	2	-	-	-	1	1	1	1
CO4	2	-	-	-	-	2	2	2	2	-	3	-	1	1	1	1
CO5	2	2	3	2	-	3	2	2	2	-	-	-	1	1	1	1
Course Correlation Mapping	2	3	3	2	2	2	2	2	2	-	3	-	1	1	1	1

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

COURSE CONTENT

Module 1: PROFESSIONAL ETHICS *(06 Periods)*

Scope and aim of ethics, Senses of ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus, and controversy.

Module2: PROFESSIONAL IDEALS AND VIRTUES *(06 Periods)*

Theories on virtues and ideals, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest, Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

Module 3: SOCIAL EXPERIMENTATION *(06 Periods)*

Experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards and Problems with the law of engineering.

Module 4: RESPONSIBILITIES AND RIGHTS *(06 Periods)*

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights, and discrimination.

Module 5: HARMONY WITH PROFESSIONALETHICS *(06 Periods)*

Acceptance of human values; Ethical Human Conduct; Basis for Humanistic Education, Constitution, and Universal Order; Competence in professional ethics; Case studies: Holistic technologies, Management Models and Production Systems; Transition from the present state to Universal Human Order: socially and ecologically responsible engineers, technologists and managers - enriching institutions and organizations.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Demonstrate orally using your experiences of what is naturally acceptable in a relationship – Feeling of respect or disrespect and what is naturally acceptable is to nurture or exploit others.

2. Identify community partners and discuss with a community partner or organization. Prepare a report by identifying and analysing the issues or opportunities.

3. Field experiences may be directed to include a range of time-intensive endeavours that require varying levels of student interaction. Prepare a report on visiting a Juvenile home.

4. Students read a speech in the classroom by former United Nations Secretary-General Kofi Annan on human values.

5. Students are encouraged to bring a daily newspaper to class or to access any news related to the need for human values and note down the points.

6. Bring out the relevance of engineering ethics theory and practice with relevance to current trends.

7. Professional ideals and virtues are important to everyone. Prepare a case study on the professional ideals and virtue of any one of the famous sports personalities from India.

8. Compare the present to the past in engineering experimentations concerning the change in professionalism.

9. Make a study on occupational crime and the role of modern technology in finding solutions.

10. Prepare a case study on how to maintain harmony with different cultural people using professional ethics.
    (It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXTBOOKS:

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

REFERENCE BOOKS:

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

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=jfGIq_EiXzI
2. https://www.youtube.com/watch?v=QFHOtH54oUc
3. https://www.youtube.com/watch?v=JJshY11nX14
4. https://www.youtube.com/watch?v=TyP09S0UEzA
5. https://www.youtube.com/watch?v=0QMwjV_ZVtc

WEB RESOURCES:

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

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CS102002	**PYTHON PROGRAMMING**	3	-	2	-	4

Pre-Requisite Programming for Problem Solving

Anti-Requisite -

Co-Requisite -

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

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

CO1. Demonstrate knowledge on Python constructs, sequences, sets and dictionaries to solve basic computational problems.

CO2. Apply the concepts of regular expressions for searching patterns in strings.

CO3. Develop and use Python modules to provide solutions to problems.

CO4. Apply the knowledge of file operations in Python for file processing.

CO5. Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism and exception handling.

CO6. Work independently to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-	-
CO4	3	2	2	2	3	-	-	-	-	-	-	-	3	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-	-
CO6	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

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

COURSE CONTENT

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

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

Module 2:   CONTROL STRUCTURES   *(08 Periods)*

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

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

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

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

Sets: Set creation, Set operations.

Dictionaries: Operations on dictionaries, Dictionary methods, Sorting elements using lambdas.

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

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

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

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

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

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

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

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1) Design a python script to the perform the various computations for the amount payable by the customer for Challenger Computers Store. A customer buying two numbers of SSD device, one SSD device cost is Rs. 3575/-. The stores offer 15% of the total cost. The customer has to pay 9% CGST, and 9% SGST. Prepare the Net Amount to be payable by the customer.

2) Design a python script to compute and generate the electricity bill as per the following slab rates. Collect the meter reading inputs, such as current unit and previous unit.

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

3) Design a python script to display the sum of numbers divisible by 4. The code must allow the user to accept a number and add it to the sum if it is divisible by 4. It should repeatedly accepting numbers as long as the user wants to provide an input using an appropriate iterative statement and should display the final sum.

4) Food Corner home delivers vegetarian and non-vegetarian combos to its customer based on order. A vegetarian combo costs Rs.120 per plate and a non-vegetarian combo costs Rs.150 per plate. Their non-veg combo is really famous that they get more orders for their non-vegetarian combo than the vegetarian combo. Apart from the cost per plate of food, customers are also charged for home delivery based on the distance in kms from the restaurant to the delivery point. The delivery charges are as mentioned below:

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

Given the type of food, quantity (no. of plates) and the distance in kms from the restaurant to the delivery point, write a python program to calculate the final bill amount to be paid by a customer. The below information must be used to check the validity of the data provided by the customer.
- Type of food must be 'V' for vegetarian and 'N' for non-vegetarian.
- Distance in kms must be greater than 0.
- Quantity ordered should be minimum 1.
- If any of the input is invalid, bill amount should be considered as -1.

5) a) A list has the AP City Names [Tirupati, Kurnool, Kadapa]. Design a python script and perform the operations like, add 3 more AP City names Chittoor, Nellore, Guntur, insert Hyderabad in 3rd position, delete any two city names, update all city names as in Uppercase. Displays the list data, whenever an operation completes.

   b) Design a python script for given an integer tuple, for each element in the tuple, check whether there exists a smaller element on the next immediate position of the tuple. If it exists print the smaller element. If there is no smaller element on the immediate next to the element then print -1.
   Example: Input: 4 2 1 5 3   Output: 2 1 -1 3 -1

6)   a) Sets n1 has the data {1, 3, 5, 7, 9}, n2 has the data {9, 5, 6, 8}, wd1=set(["Mon", "Tue", "Wed", "Thu", "Fri", "Sat", "Sun"]), wd2=set(["Mon", "Tue", "Wed"]). Design a python script to perform intersection, difference, and symmetric difference operations on the sets n1 and n2, and to perform superset, and subset operations on the sets wd1, and wd2.

      b) The dictionary city_pin has the data {'Tirupati': 517101, 'Hyderabad': 500002, 'Chittoor': 517001,'Nellore': 524001}. Design a python script using lambda function to sort the dictionary on city name and produce the output and sort the dictionary on pincode and produce the output.

      c) The string has the data, Wel_str = "Welcome to AI ML DS". Design a python script to search the pattern "AI" using regular expression search and display the three location numbers of the pattern. First shows the pattern starts location, second shows the pattern end location, and the last shows pattern span locations.

7)   a) Design a python script for the mathematical puzzle, Towers of Hanoi. The puzzle has three rods and n disks. To move the entire stack to another rod, obeying the three rules (i) Only one disk can be moved at a time, (ii) Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e., a disk can only be moved if it is the uppermost disk on a stack, (iii) No disk may be placed on top of a smaller disk.

      b) Design a python script to display the numbers that do not appear in the Fibonacci series of n numbers where n is given by the user. (If n is 8 then up to 8 Fibonacci numbers has to be printed Ex: 1 1 2 3 5 8 13 21 and in this series missing numbers should be traced and printed, Ex: missing numbers are: 4 6 7 9 10 11 12 14 15 16 17 18 19.

8)   a) Design a function Learner_Age_Days with two formal parameters name, age and it computes Learner's age in days, then displays learners name and age in days.

       (i) Design a driver code to call the function using positional arguments, keyword arguments

       (ii) Apply the necessary changes in Learner_Age_Days function, and design a driver code to call the function using default arguments.

      b) Design a python script using lambda and filter functions to construct an odd numbers list from numbers 1 to 10, and construct a negative numbers list from range of numbers -7 to 7 and to find the biggest number from a numbers list.

9)   a) Design a python script to create a new file Collect_Literals_Phython.txt, collect the data from the keyboard about the contents of collection literals list, tuple, sets, dictionaries details, then write all the data into that file, and then close that file. Afterwards Open the Collect_Literals_Phython.txt file in read mode, read the entire contents of the file Collect_Literals_Phython.txt, then display all the contents of that file in monitor.

      b) The file feat_python1.txt has the contents of features of the Python programming language. Design a python script to open that file feat_python1.txt in read mode, open the new file in feat_python2.txt in write mode, then read entire contents of the file feat_python1.txt, then copy all the contents of that file into the new file feat_python2.txt

10)   a) Construct a Python script to implement the below requirements. Create a base class Basic_Info with data members name, rollno, gender and two member functions getdata() and display(). Derive a class Physical_Fit from Basic_Info which has data members height and weight and member functions getdata() and display(). Display all the information using object of derived class.

      b) Design a Python script to implement the below specifications, compute, and produce required output. Define a class REPORT with the following specification

Private members

Admno	:	4-digit admission number
Name	:	20 characters
Marks	:	A list of 5 floating point values
Average	:	average marks obtained

GETAVG() a function to compute the average obtained in five subjects.

Public members

READINFO() function to accept values for Adno, Name, Marks. Invoke the function GETAVG ().

DISPLAYINFO() function to display all data members of report on the screen. You should give function definitions. Write driver code to demonstrate all the functions.

11) a) The below scenarios will create Logical Error/Exception, and it will forcibly stop the execution in middle of the program. Design a Python Script the to handle these operations exceptions effectively, and avoid to stop the script execution in the middle.

    i. The variable num has the data 100, the value of num dividing by the value 0.

    ii. To importing a library file matheqn, this library file not available in Python.

    iii. A num_List has the values[10,20,30].To print the fifth value of num_List[5]

    iv. A dictionary has the data, Dict_Univ = {'1':"MBU", '2':"Tirupathi", '3':"CSE"}. to print the fifth key value Dict_Univ[5]

  b) Design a python script to collect the 10 students Python course mark. Check that entered mark is negative, then throw a user defined exception called Negative, otherwise store into the mark in the List Python_mark[].

RESOURCES

TEXT BOOKS:

1. R. Nageswara Rao, *Core Python Programming*, 3rd Edition, Dreamtech Press, 2021.

2. Paul J. Deitel, Harvey Deitel, Python for Programmers with Big Data and Artificial Intelligence Case Studies, Pearson, 2019.

REFERENCE BOOKS:

1. Charles Dierbach, *Introduction to Computer Science using Python: A Computational Problem Solving Focus*, Wiley India, 2016.

2. Christian Hil, Learning Scientific Programming with Python, 2nd Edition, Cambridge University Press, 2020.

SOFTWARE/TOOLS:

1. Python 3.10

2. Jupyter Notebook/JupyterLab/IDLE/Google CoLab

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

2. https://www.coursera.org/specializations/python

3. https://www.coursera.org/learn/python-for-applied-data-science-ai

4. https://www.youtube.com/watch?v=WGJJIrtnfpk

5. https://www.youtube.com/watch?v=_uQrJ0TkZlc

6. https://www.udemy.com/topic/python/

7. https://freevideolectures.com/course/2512/python-programming

WEB RESOURCES:

1. https://www.w3schools.com/python/
2. https://www.programiz.com/python-programming
3. https://www.geeksforgeeks.org/python-programming-language/
4. https://www.javatpoint.com/python-lists
5. https://www.learnpython.org/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI104002	**OBJECT ORIENTED PROGRAMMING THROUGH JAVA**	3	-	2	4	5

Pre-Requisite   Programming for Problem Solving

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course is emphasize on the fundamentals structure design with classes including development, testing, implementation and documentation. This course also focuses on understanding and practical mastery of object oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism. By end of the course, students will acquire the basic knowledge and skills necessary to implement object-oriented programming techniques in software development using Java.

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

CO1.   Apply object oriented programming constructs to solve computational problems.

CO2.   Use Exception handling and multithreading mechanisms to create efficient software applications.

CO3.   Create Web based applications using collections frameworks to solve real world problems.

CO4.   Design and develop GUI using applets and swings for internet and system based applications.

CO5.   Work independently or in team to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	3	-	-	-	2	-	-	-	-	2	3	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	1	3	2	3	1	-	1	2	3	3	2	1	3	-	-	

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

COURSE CONTENT

Module 1:   OOPS Fundamentals   *(09 Periods)*

Introduction: History of Java, Byte code, JVM, Java buzzwords, OOP principles, Data types, Variables, Scope and life time of variables, Operators, Control statements, Type conversion and casting, Arrays.
Concepts Of Classes And Objects: Introducing methods, Method overloading, Constructors, Constructor overloading, Usage of static with data and method, Access control, this key word, Garbage collection, String class, StringTokenizer.

Module 2:   Inheritance, Interface and Packages   *(09 Periods)*

 Inheritance basics, Types of inheritance, Member access rules, Usage of super key word, Method overriding, Usage of final, Abstract classes, Interfaces - differences between abstract classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces; Packages - defining, creating and accessing a package, importing packages, access control in packages.

Module 3   Exception Handling and Multithreading   *(10 Periods)*

Exception Handling: Concepts of exception handling, Types of exceptions, Usage of try, catch, throw, throws and finally keywords, Built-in exceptions, Creating user defined exception;
Multithreading: Concepts of multithreading, Differences between process and thread, Thread life cycle, Creating multiple threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter thread communication.

Module 4   Collection Framework   *(08 Periods)*

Collection Framework: Collections Overview, Collection Interfaces - List, Set, Map, List - ArrayList, Linked List, Vector, Set - HashSet, TreeSet, Map - HashTable, HashMap, Accessing a collection via an Iterator, comparator, comparable.

Module 5   GUI Programming   *(09 Periods)*

GUI Programming With Applets: Applets - Applet Class, Applet skeleton, Simple Applet; Delegation event model - Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events.
Exploring Swing Controls: JLabel and Image Icon, JText Field, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JCombo Box.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

OOPS Fundamentals

1.   a)   Develop a Java application for generating Electricity bill.
            Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
            ➢ First 100 units - Rs. 1 per unit
            ➢ 101-200 units - Rs. 2.50 per unit
            ➢ 201 -500 units - Rs. 4 per unit
            ➢ >501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

- ➢ First 100 units - Rs. 2 per unit
- ➢ 101-200 units - Rs. 4.50 per unit
- ➢ 201 -500 units - Rs. 6 per unit
- ➢ > 501 units - Rs. 7 per unit

b) Design a class to represent a Student details include the Student ID, Name of the Student, Branch, year, location and college. Assign initial values using Constructor. Calculate average of marks of 6 subjects and calculate attendance percentage.

2. a) Create a class Student which has data members as name, branch, roll no, age, sex, marks in five subjects. Display the name of the student and his percentage who has more than 70%.Use array of objects.

b) Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imaginary parts to equal values and third which takes two argument is used to initialized real and imaginary to two different values.

Inheritance

3 a) Create a base class basic_info with data members name, roll no, sex and two member functions getdata and display. Derive a class physical_fit from basic_info which has data members height and weight and member functions getdata and display. Display all the information using object of derived class.

b) Create class first with data members book no, book name and member function getdata and putdata. Create a class second with data members author name, publisher and members getdata and showdata. Derive a class third from first and second with data member no of pages and year of publication. Display all these information using array of objects of third class.

4 A High School application has two classes: The Person superclass (Name, age, Gender) and the Student subclass (RegNo, Dept, CGPA).Using inheritance, create two new classes, Teacher and College Student. Teacher will be like Person but will have additional properties such as salary (the amount the teacher earns) and subject (e.g., "Computer Science", "Chemistry", "English", "Other"). The College Student class will extend the Student class by adding a year (current level in college) and major (e.g., "Electrical Engineering", "Communications", "Undeclared"). Create objects and test the functionality of all the methods.

5 Develop a java application for generating pay slip on different category of employees using the concept of inheritance.

Exception Handling and Multithreading

6 Consider two integers x and y as input and compute the value of x/y. Implement a class which raise an exception if x and y are not signed integers or if y is zero.

7 a) Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number

b) Write a program that creates three threads. First thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.

Collection Framework

8   Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

GUI Programming

9   a) Write a java program that simulates a traffic light. The program lets the user select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with "STOP" or "READY" or "GO" should appear above the buttons in selected color. Initially, there is no message shown.

b) Write an Applet that computes the payment of a loan on the amount of the loan, the interest rate and the number of months. It takes one parameter from the browser. Monthly; if true, the interest rate is per month, otherwise the interest rate is annual.

c) Write a java programs to find factorial of a number. User is allowed to enter a number into the text field whose factorial is to be determined. On pressing the button the value of the text field is firstly converted into integer and then processed to find its factorial. The result will get displayed in another text field. (Hint: use swings).

PROJECT BASED LEARNING:

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

Sample Projects:

1. CALENDER APPLICATION
   Develop a calendar application that uses many windows properties to make it colorful, for example, to indicate the vacation, it uses the red foreground color. The calendar can be used for two purposes. First to see the date and month as usual calendars and second to find out the day corresponding to given date. Some of the salient features of the project are
     1. It uses various windows properties to make the program colorful although it has lack of graphics.
     2. It entirely uses java code which is written in simple manner with lots of comments and important notes can be added.
     3. The date with such notes appears different than others with red background color
     4. The months can be navigated using arrow keys.

2. TICKET RESERVATION SYSTEM
   Develop Ticket reservation system to manage details of seats, passenger, trains, Bookings and stations. The features required to be implemented are as follows
1. Provides searching facility based on factors such as seats, trains, booking and stations
2. Manage the information of passengers
3. Shows the information of the seats and trains
4. Provide filter on train, booking, time and station
5. Information Management of booking
6. Export excel report for trains, passengers and station
7. Export pdf for booking details

RESOURCES

TEXT BOOKS:

1. Herbert Schildt, "Java the complete reference", 11th edition, McGraw Hill, Education, 2018.

2. C. Thomas Wu, "An Introduction to Object-Oriented Programming with Java 5th edition", McGraw-Hill Higher Education 2010.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch, "An Introduction to programming and OOPS design using Java", 3rd edition, John Wiley & sons, 2008.

2. P. Radha Krishna, "Object Oriented Programming through Java", 1st edition, Universities Press, 2007.

SOFTWARE/TOOLS:

1. Software: Eclipse / Net beans / JDK 1.7

2. Java compatible web browser

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106105191

2. https://www.udemy.com/course/java-tutorial/

WEB RESOURCES:

1. https://www.tutorialspoint.com/java/java_tutorial.pdf

2. https://www.guru99.com/java-tutorial.html