Indira Gandhi Delhi Technical University for Women
(Established by Govt. of Delhi vide Act 09 of 2012)
Kashmere Gate, Delhi-110006

B.Tech. - Teaching Scheme

CSE, CSE -AI, ECE, ECE-AI, IT, AI&ML, MAE/DMAM

(First Year)

Academic Session: 2025-26

B.Tech (Computer Science and Engineering) First Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1	Basic Sciences	Applied Mathematics	3-1-0	BAS 101	4
2.	Basic Sciences	Applied Physics	2-1-2	BAS 102	4
3.	DCC	Programming with C	3-0-2	BCS 101	4
4.	Interdisciplinary	Cyber Security Awareness	2-0-2	BIT 101	3
		IT Workshop	2-0-2	BAI 102	
		Introduction to Data Science	2-0-2	BAI 103	
		Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5.	SEC	Web Application Development	2-0-2	BCS 102	3
6.	AEC	Communication Skills	2-0-2	HMC 101	3
		Total			**21**
Second Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1	Basic Sciences	Probability and Statistics	3-0-2	BAS 103	4
2.	Basic Sciences	Environmental Sciences	2-1-2	BAS 104	4
3.	DCC	Data Structures	3-0-2	BCS 103	4
4.	Interdisciplinary	Cyber Security Awareness	2-0-2	BIT 101	3
		IT Workshop	2-0-2	BAI 102	
		Introduction to Data Science	2-0-2	BAI 103	
		Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5.	SEC	Mobile Application Development	2-0-2	BCS 104	3
6.	AEC	Soft Skills and Personality Development	2-0-2	HMC 102	3
		Total			**21**

B.Tech. – CSE (Artificial Intelligence) First Semester					
S No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1.	Basic Sciences	Probability and Statistics	3-0-2	BAS 103	4
2.	Basic Sciences	Environmental Sciences	2-1-2	BAS 104	4
3.	DCC	Programming with Python	3-0-2	BAI 101	4
4.	Interdisciplinary	Cyber Security Awareness	2-0-2	BIT 101	3
		Web Application Development	2-0-2	BCS 102	
		Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5.	SEC	IT Workshop	2-0-2	BAI 102	3
6.	AEC	Communication Skills	2-0-2	HMC 101	3
		Total			21
Second Semester					
S No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1.	Basic Sciences	Applied Mathematics	3-1-0	BAS 101	4
2.	Basic Sciences	Applied Physics	2-1-2	BAS 102	4
3.	DCC	Data Structures	3-0-2	BCS 103	4
4.	Interdisciplinary	Cyber Security Awareness	2-0-2	BIT 101	3
		Web Application Development	2-0-2	BCS 102	
		Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5.	SEC	Introduction to Data Science	2-0-2	BAI 103	3
6.	AEC	Soft Skills and Personality Development	2-0-2	HMC 102	3
		Total			**21**

B.Tech (Electronics and Communication Engineering) First Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1	Basic Sciences	Applied Mathematics	3-1-0	BAS 101	4
2	Basic Sciences	Fundamentals of Electrical Sciences	2-1-2	BEC 105	4
3	DCC	Signals and Systems	3-0-2	BEC 102	4
4	Interdisciplinary	Programming Fundamentals	2-0-2	BAI 104	3
		Cyber Security Awareness	2-0-2	BIT 101	
		Web Application Development	2-0-2	BCS 102	
		Introduction to Data Science	2-0-2	BAI 103	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5	SEC	Electronics Workshop	2-0-2	BEC 103	3
6	AEC	Communication Skills	2-0-2	HMC 101	3
		Total			**21**
Second Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1	Basic Sciences	Environmental Sciences	2-1-2	BAS 104	4
2	Basic Sciences	Applied Physics	2-1-2	BAS 102	4
3	DCC	Network Analysis and Synthesis	3-0-2	BEC 104	4
4	Interdisciplinary	Programming Fundamentals	2-0-2	BAI 104	3
		Cyber Security Awareness	2-0-2	BIT 101	
		Web Application Development	2-0-2	BCS 102	
		Introduction to Data Science	2-0-2	BAI 103	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5	SEC	IT Workshop	2-0-2	BAI 102	3
6	AEC	Soft Skills and Personality Development	2-0-2	HMC 102	3
		Total			**21**

B.Tech (ECE- Artificial Intelligence) First Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1	Basic Sciences	Applied Mathematics	3-1-0	BAS 101	4
2	Basic Sciences	Fundamentals of Electrical Sciences	2-1-2	BEC 105	4
3	DCC	Signals and Systems	3-0-2	BEC 102	4
4	Interdisciplinary	Programming Fundamentals	2-0-2	BAI 104	3
		Cyber Security Awareness	2-0-2	BIT 101	
		Web Application Development	2-0-2	BCS 102	
		Introduction to Data Science	2-0-2	BAI 103	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5	SEC	Electronics Workshop	2-0-2	BEC 103	3
6	AEC	Communication Skills	2-0-2	HMC 101	3
		Total			**21**
Second Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1	Basic Sciences	Environmental Sciences	2-1-2	BAS 104	4
2	Basic Sciences	Applied Physics	2-1-2	BAS 102	4
3	DCC	Network Analysis and Synthesis	3-0-2	BEC 104	4
4	Interdisciplinary	Programming Fundamentals	2-0-2	BAI 104	3
		Cyber Security Awareness	2-0-2	BIT 101	
		Web Application Development	2-0-2	BCS 102	
		Introduction to Data Science	2-0-2	BAI 103	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5	SEC	IT Workshop	2-0-2	BAI 102	3
6	AEC	Soft Skills and Personality Development	2-0-2	HMC 102	3
		Total			**21**

B.Tech (Information Technology) First Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1.	Basic Sciences	Applied Mathematics	3-1-0	BAS 101	4
2.	Basic Sciences	Applied Physics	2-1-2	BAS 102	4
3.	DCC	Programming with Python	3-0-2	BAI 101	4
4.	Interdisciplinary	IT Workshop	2-0-2	BAI 102	3
		Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5.	SEC	Web Application Development	2-0-2	BCS 102	3
6.	AEC	Communication Skills	2-0-2	HMC 101	3
		Total			**21**
Second Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1.	Basic Sciences	Probability and Statistics	3-0-2	BAS 103	4
2.	Basic Sciences	Environmental Sciences	2-1-2	BAS 104	4
3.	DCC	Object Oriented Programming	3-0-2	BIT 102	4
4.	Interdisciplinary	IT Workshop	2-0-2	BAI 102	3
		Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5.	SEC	Introduction to Data Science	2-0-2	BAI 103	3
6.	AEC	Soft Skills and Personality Development	2-0-2	HMC 102	3
		Total			**21**

B.Tech (Artificial Intelligence and Machine Learning) First Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1.	Basic Sciences	Probability and Statistics	3-0-2	BAS 103	4
2.	Basic Sciences	Environmental Sciences	2-1-2	BAS 104	4
3.	DCC	Programming with Python	3-0-2	BAI 101	4
4.	Interdisciplinary	IT Workshop	2-0-2	BAI 102	3
		Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5.	SEC	Web Application Development	2-0-2	BCS 102	3
6.	AEC	Communication Skills	2-0-2	HMC 101	3
		Total			**21**
Second Semester					
SN	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1.	Basic Sciences	Applied Mathematics	3-1-0	BAS 101	4
2.	Basic Sciences	Applied Physics	2-1-2	BAS 102	4
3.	DCC	Object Oriented Programming	3-0-2	BIT 102	4
4.	Interdisciplinary	IT Workshop	2-0-2	BAI 102	3
		Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	
		Electrical and Hybrid Vehicle Technology	2-0-2	BMA 108	
		Energy Conversion Systems	2-0-2	BMA 109	
		Introduction to Robotics	2-0-2	BMA 110	
5.	SEC	Introduction to Data Science	2-0-2	BAI 103	3
6.	AEC	Soft Skills and Personality Development	2-0-2	HMC 102	3
		Total			**21**

B.Tech (Mechanical and Automation Engineering)/DMAM First Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1.	Basic Sciences	Applied Mathematics	3-1-0	BAS 101	4
2.	Basic Sciences	Applied Physics	2-1-2	BAS 102	4
3.	DCC	Elements of Mechanical Engineering	3-0-2	BMA 106	4
4.	Interdisciplinary	Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	3
		Programming Fundamentals	2-0-2	BAI 104	
		Introduction to Data Science	2-0-2	BAI 103	
		Web Application Development	2-0-2	BCS 102	
		Cyber Security Awareness	2-0-2	BIT 101	
5.	SEC	Workshop Practice	2-0-2	BMA 107	3
6.	AEC	Communication Skills	2-0-2	HMC 101	3
		Total			**21**
Second Semester					
S.No	**Type of Course**	**Subject**	**L-T-P**	**Code**	**Credits**
1.	Basic Sciences	Probability and Statistics	3-0-2	BAS 103	4
2.	Basic Sciences	Environmental Sciences	2-1-2	BAS 104	4
3.	DCC	Engineering Mechanics	3-0-2	BMA 103	4
4.	Interdisciplinary	Basics of Electrical and Electronics Engineering	2-0-2	BEC 101	3
		Programming Fundamentals	2-0-2	BAI 104	
		Introduction to Data Science	2-0-2	BAI 103	
		Web Application Development	2-0-2	BCS 102	
		Cyber Security Awareness	2-0-2	BIT 101	
5.	SEC	Engineering Graphics & CAD Modelling	2-0-2	BMA 111	3
6.	AEC	Soft Skills and Personality Development	2-0-2	HMC 102	3
		Total			**21**

APPLIED MATHEMATICS	
Course Code: BAS 101 Contact Hours: L-3 T-1 P-0 Course Category: BAS	Credits: 4 Semesters: I/II

Introduction: Mathematics is used in almost every field of engineering be it computer science and information technology wherein it may be used in artificial intelligence, machine learning, image processing etc., or by electronics engineers for signal processing, control engineering or by mechanical engineers for design, modelling, manufacturing etc. But the problem faced by engineers is to how to apply the basic mathematical concepts in engineering problem which they would be dealing in coming years. The course covers the various topics of applied mathematics such as linear algebra, calculus of functions of more than one variable and vector calculus.

Course Objectives:

- The students will be made familiar with the concepts of linear algebra.
- To provide students with skills and knowledge of calculus of functions of several variables, integral and vector calculus which would enable them to devise solutions for given situations they may encounter in day to day engineering problems.

Prerequisite: Fundamentals of Matrices, Calculus of Functions of Single Variable, Vectors.

Course Outcomes: Having successfully completed this course, the student will be able to

CO1. Recall the concepts of matrices. Evaluate rank, inverse, Eigen values and Eigen vectors of a matrix and apply them in engineering problems.

CO2. Find the partial derivatives and evaluate maxima/minima for functions of two or more variables and apply them in real world problems.

CO3. Apply the knowledge of calculus to trace simple Cartesian and polar curves for evaluating multiple integrals.

CO4. Compute gradient, divergence and curl of scalar and vector point functions. Evaluate line, surface and volume integrals using Green's, Gauss's divergence and Stoke's theorem.

Pedagogy: Apart from class room teaching, main focus is to enhance problem solving ability supported by weekly assignments and discussing individual's doubts.

Contents

UNIT-I	08 Hours
Linear Algebra-Elementary transformations, linear dependence and independence of vectors, rank of a matrix (echelon & normal form), inverse of a matrix by elementary operations; solution of non-homogeneous and homogeneous systems of linear equations, linear transformations; eigenvalues and eigenvectors, diagonalization of a matrix; Cayley-Hamilton's theorem (without proof) and its applications.	
UNIT-II	12 Hours
Differential Calculus- Successive differentiation, Leibnitz theorem; functions of several variables: limits, continuity and differentiability, partial differentiation; Euler's Theorem for homogeneous functions; composite functions, total derivatives, change of variables; Taylor's and Maclaurin's Series; maxima and minima of functions of two variables.	
UNIT-III	12 Hours
Tracing of standard curves in the cartesian, parametric and polar form. **Integral Calculus**- Multiple Integrals: double integration in cartesian and polar coordinates; evaluation of double integrals by substitution and changing the order of integration; triple	

integral; applications of multiple integrals to find area as double integral, volume as triple integral and surface area.	
UNIT-IV	12 Hours
Vector Calculus- Vector point functions; gradient, directional derivative, equation of tangent plane; divergence, curl and their physical interpretation; solenoidal, irrotational and conservative vector fields; vector identities; line, surface and volume integrals; Green's, Stokes's and Gauss divergence theorems (without proofs).	
Text Books	
1.	D. G. Zill and W. S. Wright, "Advanced Engineering Mathematics", 6th Edition, The Jones and Bartlett Learning Publishers, 2018.
2.	Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 5th Edition, Narosa Publishing House Pvt. Ltd. 2016.
3.	Grewal, B. S. , "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017
Reference Books	
1.	George B. Thomas Jr., Ross L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson Education India, 2010
2.	Greenberg M., "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, 1998.
3.	Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2010.

APPLIED PHYSICS	
Course Code: BAS 102 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: I/II

Introduction: Physics is a subject that is continuously evolving with latest research. The scientific principles of physics are basis of various devices, applications and technological breakthrough. This Applied Physics course has been designed to cover the wide ranging topics of the physics that have direct impact on technological advancements. In this course the students will learn various concepts of modern and device-oriented physics that will enhance their ability to apply fundamentals to various applications.

Course Objectives:

- To introduce the students with the wide-ranging topics of the modern physics such as electromagnetic theory, quantum mechanics, optics, and its applications in the form of lasers and optical fiber communication. These topics form the underlying principles of various technologies.
- To impart an in-depth knowledge of everyday systems and phenomena surrounding them and explain the underlying physics.
- To enhance the ability of students to apply physics fundamentals to various modern applications for societal benefits.
- To develop a quantitative aptitude for solving engineering problems.
- To perform and interpret experiments using modern tools, techniques and write effective lab reports to various engineering problems, with an understanding of the limitations.

Course Outcomes: Having successfully completed this course, the student will be able to

CO1: Gain knowledge of different concepts in Optics and optical devices.

CO2: Understand the laws of Electromagnetic (EM) theory and solve engineering problems, based on propagation of EM waves in different media.

CO3: Explain the basic principles and laws of Quantum Mechanics and examine the quantum mechanical behavior of a particle in a 1-D box.

CO4: Describe the principles of LASER and optical fibers and study their modern- day applications.

Pedagogy: Classroom teaching which focuses on relating the textbook concepts with real world phenomena, supplemented with periodic tutorial classes to enhance the problem-solving ability. The students would perform experiments to develop a deeper insight into the underlying principles of Physics.

Contents

UNIT-I	08 Hours
Optics - Coherent Sources, Temporal and Spatial Coherence, Interference due to Division of wave-front and Division of Amplitude, Interference in Parallel Thin Films, Fresnel Diffraction at Straight Edge, Fraunhofer Diffraction due to Single Slit, N Slits, Diffraction Grating (absent spectra, resolving and dispersive power of grating (Formula only without derivation) Polarization, Malus Law, Brewster Law, Double Refraction, Nicol Prism, Production of Plane, Elliptically and Circularly Polarized Light.	
UNIT-II	08 Hours
Electro Magnetic Theory - Introduction to gradient, divergence, curl, Gauss divergence theorem and Stoke's theorem (without proof). Electromagnetic Waves, Electromagnetic spectrum, Equation of Continuity, Maxwell's Equations, Poynting Theorem (No Derivation),	

Propagation of Electromagnetic Waves in Free Space, Dielectric and Conducting Medium (Qualitative), Skin Depth.	
UNIT-III	07 Hours
Quantum Mechanics - Origin of Quantum Mechanics, De Broglie Hypothesis, Heisenberg Uncertainty Principle,Postulates of Quantum Mechanics, Wave Function and Properties, Group and Phase velocity, Time Independent Schrodinger Wave Equation, Particle in 1-D Box.	
UNIT-IV	05 Hours
Laser and Optical Fiber Communication Stimulated and Spontaneous Emission, Principle of LASER, Einstein's A and BCoefficients, Components of LASER, He-Ne LASER. Optical Fibers, Step Index and Graded Index Fibers, Numerical Aperture, Acceptance angle, Pulse Dispersion in Optical Fibers, Schematic of optical fiber communication.	
Text Books	
1.	H. K. Malik and A. K. Singh, "Engineering Physics", 2nd Edition, Mc Graw Hill Ed, 2017.
2.	M. C. Jain, "Textbook of Engineering Physics", 1st Edition, Vol. I and II, Phi Learning Pvt Limited, 2009.
3.	G. Aruldhas, "Engineering Physics", PhI Learning Pvt Limited 2010.
4.	Abhijit Nayak, "Engineering Physics", S K Kataria and Sons, 2011
5.	M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, "A Textbook of Engineering Physics", S Chand Publishing, 11th Edition, 2018.
Reference Books	
1.	Wilson and J.F.B Hawkes, "Optoelectronics", 3rd Edition, Prentice Hall Europe,1998.
2.	Ajoy K. Ghatak, "Optics", 7th Edition, McGraw Hill Education India Private Limited, 2020.
3.	Shobhit Mahajan, S Rai Chaudhary, "Electricity, Magnetism and Electromagnetic Theory", McGraw Hill Education (India) Private Limited, 2012.
4.	F. K. Richtmyer, E. H. Kennard, and J. N. Cooper, "Introduction to Modern Physics" 6th Edition, Tata Mc Graw Hill, 1997.
5.	Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, "Concepts of Modern Physics", 7th Edition, Mc Graw Hill,2015
6.	Eugene Hecht and A.R. Ganesan, "Optics",5th Edition, Pearson Education, 2019.
7.	William H. Hayt and J. A Buck, 6th Edition, "Engineering Electromagnetism",2001.

PRACTICAL CONTENT

Preliminary study

1. To determine the least count of a) Vernier callipers, b) Screw gauge, and c) Spectrometer, and to learn how to take measurements with them and to study the errors in measurement, least count, significant digits in calculation, log error and percentage error.
2. To study the construction and working of mercury vapor and sodium vapor lamps.
3. To study the working of a spectrometer, its different parts and uses.
4. To study the working of a digital multimeter and measurement of resistance, dc voltages, capacitance.
5. To study the working of a DSO and measurement of voltage and frequency of signals coming from a function generator.
6. AC bridges for measurement of capacitance, inductance etc.

List of Experiments (Any 10-15 Experiments to be done)

Optics:

1. Spectrometer based experiments
   a. To determine the refractive index of a prism.
   b. To determine the wavelength of sodium vapour lamp.
   c. To determine the wavelength of sodium light using diffraction grating.

2. To determine the specific rotation of cane sugar solution with the help of polarimeter.
3. To find the wavelength of He-Ne Laser using transmission diffraction grating.
4. To determine the wavelength of Na Lamp using Newton's ring.
5. To determine the numerical aperture of an optical fiber.
6. Measurement of transmission wavelength of various optical filters using Handheld spectrometer.
7. Measurements of emission spectra of various light sources.
8. Measure the refractive indices of the ordinary and extraordinary rays in a double-refracting crystal.
9. Characterize the efficiency of optical fiber coupling by measuring the power transmitted through different fiber couplers and connectors.

Mechanics

1. To determine the acceleration due to gravity using bar pendulum and Kater's pendulum.
2. To determine the moment of inertia of a flywheel about its axis of rotation.
3. To determine the Young's modulus of the material of a given bar by bending.
4. To determine the frequency of A.C. mains using sonometer and an electromagnet.
5. To measure the frequency of a sine-wave voltage obtained from signal generator and to obtain Lissajous pattern on the DSO screen by feeding two sine wave voltages from two signal generators.
6. Setup an interferometer to study the coherence length of a laser beam by observing the fringe visibility as a function of path length difference.
7. Investigate spatial coherence by measuring the visibility of interference fringes produced by two point sources with varying separation.
8. Explore the dependence of diffraction pattern characteristics on the wavelength of light and the size of the aperture.
9. Set up a simple harmonic oscillator (e.g., a mass-spring system) with a damping mechanism (e.g., air resistance or a damping medium like oil) and measurement of its logarithmic decrement.
10. Stirling Engine: Construct a simple Stirling engine using a piston, a cylinder, and a heat source. Measure the temperature at different points in the engine, monitor the pressure changes, and calculate the work output.

Quantum Physics

1. To determine the value of e/m by J J Thompson method.
2. To determine the Planck's constant using LEDs of at least 4 different colors.
3. Young's Double Slit experiment

Electricity, Magnetism, and Electronics

1. To study the IV characteristics of a PN junction diode, Zener Diode and LED.
2. To study the charging and discharging of a capacitor to find the time constant.
3. To study Hall effect and to measure carrier concentration and Hall coefficient for unknown semiconductor.

4. Measurement of high resistance by ballistic galvanometer.
5. To determine the resistivity of Semiconductors by Four Probe Method at different temperatures and to calculate the Bandgap.
6. To study response and IV characteristics of infrared (IR) Sensor.

Thermal Physics

1. To find the thermal conductivity of a poor conductor by Lee's disk method.
2. To trace the B-H curve for a ferromagnetic material using DSO and to find the magnetic parameters from the B-H hysteresis loop.
3. Quinke's method for measurement of Magnetic susceptibility.
4. One-Dimensional Heat Conduction: Construct a simple setup with a metal rod of known thermal conductivity. Apply heat to one end of the rod and measure the temperature at various points along its length over time. Use this data to verify the one-dimensional heat conduction equation.
5. Two-Dimensional Heat Conduction: Create a setup with a metal plate of known thermal conductivity. Apply heat to one side of the plate and measure the temperature distribution across its surface over time using thermocouples or infrared cameras. Compare the experimental results with numerical simulations of the heat diffusion equation in two dimensions.

Reference Books	
1.	Geeta Sanon, "B. Sc. Practical Physics", 1st Edition, R Chand, and Co. New Delhi, 2019.
2.	Indu Prakash, Ramkrishna and A.K. Jha, "A textbook of Practical Physics", Kitab Mahal, 2019.
3.	Harnam Singh and P.S. Hemne, "B.Sc. Practical Physics", S Chand and Company, 2022.
4.	C L Arora, "Practical Physics", S. Chand & Company Ltd., 2020
5.	Manjeet Singh, Surender Duhan and Anita Devi, "Applied Physics Theory and Experiments", 1st Edition, Vayu Education of India Publications, 2011.

BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	
Course Code: BEC 101 Contact Hours: L-2 T-0 P-2 Course Category: Interdisciplinary	Credits: 3 Semester: I/II

Introduction: This course gives a sound understanding of basics of Electrical and Electronics engineering. It covers basic dc and ac circuits, theorems, types of sources and concepts of electronic devices such as p-n junction diode, BJT, and FET.

Course Objectives:

- To give an insight into fundamental concepts of electrical and electronic engineering.
- To give the broad spectrum of electrical circuits and electronic devices.

Pre-requisite: Understanding of Ohms law, electromagnetic induction, basic laws and semiconductor physics.

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

CO1: Understand the basic electrical components and sources such as resistor capacitor and inductor etc.
CO2: Understand the basic electronic devices such as p-n junction diode, BJT, and FET etc.
CO3: Design electrical and electronic circuits.
CO4: Analysis of electrical and electronic circuits.

Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, case studies/presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	08 Hours
Dc Circuits: Circuit Components: Resistor, Inductor, Capacitor, Ohm's Law, Kirchhoff's Laws, Independent and Dependent Sources, Nodal Analysis, Mesh Analysis, Star-Delta Transformation, Superposition Theorem, Reciprocity Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Theorem, Millman's Theorem.	
UNIT-II	07 Hours
Introduction to AC Circuits and Parameters: Waveforms, Average Value, RMS Value, Purely Resistive, Capacitive And Inductive Circuits, Steady State Analysis of Series And Parallel RLC Circuits, Phasor Diagrams Representation, Series and Parallel Resonance, Impedance Triangle, Power Triangle, Power Factor, Bandwidth and Quality Factor.	
UNIT-III	08 Hours
P-N Junction diode, Characteristics and its operation, P-N Junction capacitances (depletion and diffusion), Breakdown in p-n diodes. Diode Applications: Clipping and clamping circuits, Rectifier circuits, Zener diode, Zener diode as regulators, voltage multipliers, switching behavior of P-N diode.	
UNIT-IV	07 Hours
Bipolar junction transistor (BJT): Introduction and types, construction, and characteristics in CB, CE & CC mode. **Introduction to Special Semiconductor Devices**: Thyristors, Silicon Controlled Rectifier (SCR), TRIAC, DIAC, Unijunction Transistor (UJT), Junction Field Effect Transistor (JFET), Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) etc.	
Text Books	

1.	B. L. Theraja, 'A Textbook of Electrical Technology - Volume I (Basic Electrical Engineering)", S. Chand and Company, 2020.
2.	M. S. Sukhija and T. K. Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
3.	Boylestad & Nashelsky, "Electronic Devices & Circuit Theory" PHI – 5th Edition, 2014.
Reference Books	
1.	Vincent DEL TORO, "Electrical Engineering Fundamental's", Pearson Education India, 2015.
2.	R. K. Rajput, "Basic Electrical and Electronics engineering", Laxmi Publications, 2012.
3.	Bhargava, N. N., Kulshreshtha, D. C., Gupta, S. C., "Basic Electronics and Linear Circuits," McGraw Hill education (India) Private Limited. 2013.

List of Experiments

1. To study the various instruments and equipment used in Basic Electrical Engineering Lab.
2. To implement the given circuit on the breadboard and verify Ohm's law.
3. To implement the given circuit on the breadboard and verify Kirchoff's current law & Kirchoff's voltage law.
4. To implement the given circuit on the breadboard and verify the Reciprocity theorem.
5. To implement the given circuit on the breadboard and verify Thevenin's theorem.
6. To implement the given circuit on the breadboard and verify the Maximum power transfer theorem.
7. To implement the given circuit on the breadboard and verify the Superposition theorem.
8. To implement the given circuit on the breadboard and measure power and power factor in a single phase AC circuit using the three ammeters method.
9. To measure power and power factor in a single phase AC circuit using the three voltmeter method.
10. To determine the power factor, true power, apparent power, and reactive power using resistance, choke coil, and capacitor.
11. Study the identification of emitter, base and collector terminal and its working using digital multimeter.
12. Plot the forward and reverse characteristics for Silicon diode and determine its dynamic and static resistance.
13. Plot the forward and reverse characteristics for Zener diode and determine its dynamic and static resistance.
14. Plot the forward and reverse characteristics for Light Emitting Diode and determine its dynamic and static resistance.
15. Plot the input & output characteristics for Common Base Configuration and determine its dynamic and static resistance.

COMMUNICATION SKILLS	
Course Code: HMC 101 Contact Hours: L-2 T-0 P-2 Course Category: AEC	Credits: 3 Semester: I

Introduction: This course facilitates communication skills development by exposing the students to various nuances of effective communication. The course provides an in-depth understanding of several key concepts of Communication like importance and functions of communication, barriers to communication, active listening, group discussions, presentation skills etc. The course also provides valid inputs on the *ethical* dimension of communication to enable the students to be ethical communicators.
The highlight of the course is special emphasis on Professional Communication enhancement that would facilitate the betterment of students with respect to formal speaking and writing. The students will also be acquainted with various forms of business correspondence used in organizations on a regular basis like agenda and minutes of meetings, business letters, reports etc.

Course Objectives:

- To enable students to evaluate their personal communications styles and improve upon it.
- To help the students understand the contemporary trends in communication.
- To facilitate the students in becoming aware of different communication theories and their application.
- To encourage students to develop/create their own unique style of communication.

Course Outcomes: After completion of the course, the students should be able to:

CO1: Evaluate and analyze their personal communication style while adapting their communication to better expression of their ideas at workplace.
CO2: Enhance their knowledge of contemporary trends for effective Communication.
CO3: Effective comprehension and application of different Communication theories.
CO4: Synthesis their own unique communication style.

Pedagogy: Apart from interactive class teaching, various individual and group assignments will be given.

Contents

UNIT-I	08 Hours
Introducing Communication: Importance and function of Communication, Communication Cycle, Characteristics and Types of Communication, Channels and Medium of Communication, 7 C's of Communication, Barriers to Communication. Ethics of Communication (plagiarism, language sensitivity towards gender, caste, race, disability etc.)	
UNIT-II	08 Hours
Everyday Communication: Non-Verbal Language (Symbols, Appearance, Paralanguage and Body Language, Proxemics, Chronemics), Listening Skills (Importance, Barriers, Essentials of Good Listening), Communication Skills (greetings, introducing, making requests, asking and giving permission, offering help and giving instructions and directions etc.), Understanding Telephone Skills (handling calls, leaving a message, asking and giving information and instructions etc.), Net Etiquettes.	

UNIT-III	07 Hours
Presentations & Employment Communication: Classroom Presentations (purpose, types, preparing and presenting – use of visual aids/ power point presentations), Group Discussion (purpose, strategies, guidelines etc.), Job Application (Resume and Cover Letter)	
UNIT-IV	07 Hours
Writing on the Job: Formal and Informal Writing, Basics of Paragraph Writing**,** Email Writing, Letters at the workplace, Meeting documentations (Agenda and Minutes of meeting etc.), Report Writing (characteristics, types, structure of formal report).	
Text Books	
1.	M. Raman and S. Sharma. Technical Communication: Principles and Practice, 3rd Edition, Oxford University Press, 2022.
2.	M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill Publications, 2018.
3.	Mastering Communication (5th Edition) Nicky Stanton, Palgrave Macmillan, 2016.
4.	Communication Skills (2nd Edition) Sanjay Kumar and Pushp Lata, Oxford University Press, 2015.
5.	Effective Technical Communication: A Guide for Scientists and Engineers. Barun K. Mitra, Oxford University Press, 2006.
Reference Books	
1.	Lewis and Hedwig, Body Language: A Guide for Professionals, New Delhi, Response Books, 2000
2.	Sides and H. Charles, How to Write & Present Technical Information, Cambridge, CUP, 1999.
3.	S. Kumar and P. Lata. Language and Communication Skills for Engineers, Oxford University Press, 2018.
4.	Hasson, Gill. Brilliant Communication Skills. Pearson Education, 2012.

List of Experiments

S.No.	Experiment Name
1.	The Art of Self Introduction
2.	Case Study Analysis and Discussion : Understanding Barriers
3.	Introduction to Phonetics - Vowel Sounds
4.	Phonetics – Consonant Sounds
5.	Nuances of Publics Speaking
6.	Listening and comprehension
7.	Mock Group Discussions
8.	Mock Presentation
9.	Writing Effective Paragraphs: Using AI for Impact
10.	Professional Email Writing

CYBER SECURITY AWARENESS	
Course Code: BIT 101 Contact Hours: L-2 T-0 P-2 Course Category: Interdisciplinary	Credits: 3 Semester: I/II

Introduction: Cyber Security Awareness encompasses understanding digital risks and best practices for protection. It involves recognizing threats like phishing, malware, and social engineering, and adopting proactive measures to mitigate them. Through education and vigilance, individuals and organizations can defend against cyber threats, safeguarding sensitive information and ensuring digital safety.

Course Objectives:

- To develop an understanding of common cyber threats and vulnerabilities.
- To develop an understanding Types of Cyber Crimes and Cyber Attacks
- To develop an understanding of various types of security standards compliances.

Pre-requisite: Basics of Information Technology

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Understand the cyber security fundamentals and the cyber security needs

CO2: Diagnose and investigate cyber security events or crimes related to computer systems and digital evidence.

CO3: Protect data and respond to threats that occur over the Internet and locally.

CO4: Understand and evaluate the cyber security preparedness of the organization.

Pedagogy: Classroom teaching which focuses on developing understanding of students to digest the concepts of subject with large number of examples. The teaching-learning of the course would be organized through lectures, tutorials, assignments, and quizzes.

Contents

UNIT-I	12 Hours
Introduction: Cyber Security Concepts, Security Goals, Security Services and Mechanism, Vulnerabilities, Sources of Security Threats, Target assets, Vulnerabilities, Insider threats, Intruders and Hackers, Network threats: Active/Passive, Malicious Software, Virus, Trojan, Worms, Spywares, Rootkit, Ransomware, Adware, Backdoor, Bots, Social Engineering, Phishing, Key logging, Mail Bombs, Pornography, Intellectual Property Theft, Session Hijacking, Ransome ware Attacks	
UNIT-II	10 Hours
Cyber Crime: Types of Cybercrime, Cyber Attacks methodology, Credit card fraud, Software Piracy and legal issues, Security issues in M-commerce e.g. mobile wallet, mobile payment m-banking, Identity Theft, Password Cracking, Spamming, Stalking and Obscenity in Internet, Social Network Account attack, Security and Privacy Issues on Social Networking Websites, Security issues in Cloud based Services, Security issues of Smart Phones, digital tablets and smart Devices, Cyber Warfare, Cyber Terrorism and Hacktivism	
UNIT-III	10 Hours
Device Security: Securing PC, Securing Smart Phone, Securing Laptops/Tabs, Securing Pen drives, WiFi security, Browser security, Cloud Security, OS Security, Data Security, Database Security; Trends in Cyber Crime, Recent Case study of various Cyber Crime and Cyber attacks	
UNIT-IV	10 Hours
Defenses and Security Countermeasures: Access Control, Secure Design Principles, Defense Models: The Lollipop Model, The Onion Model, Security Policies and Procedures, Firewalls, IDS, IPS, Next Generation Firewall, Indian IT ACT and Standards	

Text Books	
1.	W. Stallings and L. Brown, "Computer Security: Principles and Practice", Pearson Education, 4th Edition, 2018/ Latest Edition.
2.	M. Ousley, "Information Security: The Complete Reference", McGraw Hill Education, 2nd Edition, 2013/ Latest Edition.
Reference Books	
1.	W. Stallings, "Network security essentials: Applications and Standards", Pearson Education, 6th Edition, 2018/ Latest Edition.

DATA STRUCTURES	
Course Code: BCS 103 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 2

Introduction: This course introduces about data structures and their useful applications in Information Technology. It deals with all aspects of Data structures like static and dynamic data structure and how to choose a particular data structure for any specific problem.

Course Objectives:

- To impart the basic concepts of data structures and algorithms
- To understand concepts about searching and sorting techniques
- To Understand basic concepts about stacks, queues, lists, trees and graphs
- To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.

Pre-requisite: The student should have knowledge of fundamentals of Programming and working experience of programming language.

Course Outcomes: After completing this course, the students will be able to:

CO1: Explain the concept of time and space complexity of the algorithm.

CO2: Understand the use of fundamental data structures and algorithm appropriately to solve a number of computational problems.

CO3: Apply various algorithms to solve the problems of searching and of data.

CO4: Design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.

Pedagogy: The teaching-learning of the course would be organized through lectures, tutorials, assignments, projects/ presentations, and quizzes. Students would be encouraged to develop an understanding of the subject. The use of ICT and web-based sources will be adopted.

Contents

UNIT-I	10 Hours
Introduction: Introduction to Data Structure, Introduction to Algorithm Complexity- Time-Space Trade off. Introduction to abstract data types, design, implementation and applications. **Arrays and Strings:** Representation of Arrays in Memory: one dimensional, two dimensional and Multidimensional, Accessing of elements of array, performing operations like Insertion, Deletion and Searching. Sorting elements of arrays. Strings and String Operations. Introduction to recursion	
UNIT-II	10 Hours
Stacks and Queues: Introduction to data structures like Stacks and Queues. Operations on Stacks and Queues, Array representation of Stacks, Applications of Stacks: recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues. **Linked Lists:** Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion and Deletion, Searching, Applications of Linked List. Concepts of Circular linked list and Doubly linked list and their Applications. Stacks and Queues using linked list.	
UNIT-III	12 Hours
Trees: Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching, Insertion and Deletion, Applications of Binary search Trees, Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded binary tree, B- tree.	

Searching and Sorting: Linear Search, Binary search, Interpolation Search, Insertion Sort, Quick sort, Merge sort, Heap sort, sorting on different keys, External sorting.	
UNIT-IV	10 Hours
Graphs: Terminology and Representations, Directed Graphs, Representation of graphs and their Transversal, Spanning trees, Single source shortest paths: Dijkstra's algorithms, Hashing: Introduction, Hash Functions, Collision Resolution Techniques.	
Text Books	
1.	Horowitz, Sahni, and Anreson, "Fundamentals of Data structures in C", Universities Press, 2008 / Latest Edition..
2.	Tannenbaum, "Data Structures", Pearson Education India, Latest Edition, 2007
3.	Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2004/ Latest Edition.
Reference Books	
1.	R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI, 2009/Latest Edition.
2.	Seymour Lipschutz Saucham's series, "Data Structures", Mc-Graw Hill Publication, 2018/Latest Edition.

LIST OF PRACTICALS

Name of the Experiment

1. Write a program to find the sum, average, maximum and minimum element in an array.
2. Write a program to reverse a string using recursion
3. Write a program to implement following string operations without using built-in function: (a) To Concatenate Two Strings, (b) To Compare Two Strings (c) To Check if the Substring is Present in the Given String (d) To Find the Length of a String (e) To Insert Character/Word in Any Desired Location in a String (f) To Delete All Repeated Words in String
4. Write a program that uses functions to perform the following operations on singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.
5. Write a program that uses functions to perform the following operations on doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.
6. Write a program that implement stack (its operations) using i) Arrays ii) Linked list (Pointers).
7. Write a program that implement Queue (its operations) using i) Arrays ii) Linked list (Pointers).
8. Write a program that uses functions to perform the following operations on circular linked List i) Creation ii) Insertion iii) Deletion iv) Traversal.
9. Write a program that implement Circular Queue (its operations) using Arrays.
10. Write a program to implement the tree traversal methods.
11. Write a program to perform the following operations: a) Insert an element into a binary search tree. b) Delete an element from a binary search tree. c) Search for a key element in a binary search tree.
12. Write a program to perform the following operations: a) Insert an element into a AVL tree. b) Search for a key element in a AVL tree.
13. Write a program that implements the following sorting i) Selection sort ii)Quick sort, iii) Insertion sort iv) Merge sort v)Heap sort.
14. Write a program that uses both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers: a) Linear search b) Binary search.

15. Write a program to implement the adjacency list representation of a graph with m vertices and n edges. Also check whether a path of a given length exist between any two pair of vertices or not.
16. Write a program to implement the following graph traversal: (a) Breadth First Search and (b) Depth First Search.
17. Write a program to implement Hashing Technique and perform linear probing, double hashing, and quadratic hashing to resolve the collision.

ENVIRONMENTAL SCIENCES	
Course Code: BAS 104 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: I/II

Introduction: A scientific study of the natural world and how it is influenced by people. It Surveys environmental studies, examining ecological, socioeconomic, and technological factors that influence the quality of life on Earth.

Course Objectives:

- Environmental science prepares students for career success in environmental monitoring and remediation, natural resources and conservation, public health, industrial environmental management.
- The curriculum is so designed that the students get an in-depth knowledge of the environment and various issues arising due to mismanagement of resources.

Course Outcomes: Having successfully completed this course, students will be able to:

CO1: Understand the critical issue of water pollution and understand the processes of treatment of waste water with its conservation

CO2: Understand and evaluate the transnational character of environmental problems, their sources, sinks and control strategies along with their short-term and long term impacts to humans. Students will also learn to apply green methodologies to find solutions to address various environmental issues.

CO3: Understand the interconnected and interdisciplinary branches like Toxicology, synthesis and applications of Eco friendly polymers and demonstrate an integrative approach to environmental issues with a focus on sustainability.

CO4: Understand about the availability and sustainable use of natural resources and implement their interpretative skills to evaluate the usage and application of alternate energy sources for sustainability.

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with periodic tutorial classes to enhance the problem-solving ability.

Contents

UNIT-I	07 Hours
Environment Pollution and Control-I Water Pollution: Brief overview of water quality parameters, Classification of water pollutants and their sources Total Hardness and its determination (EDTA method)-(Numericals), Alkalinity and its determination-(Numericals), DO, BOD and COD their determination Treatment of Water for Domestic use: Disinfection by Breakpoint chlorination. Waste-water treatment: Primary, secondary and tertiary treatment Water Conservation and Management, Rain-water harvesting	
UNIT-II	07 Hours
Environment Pollution and Control-II **Air Pollution**: Types of air pollutants, source, effects, sink & control of common air pollutants (CO, oxides of nitrogen & sulfur, hydrocarbons and particulates), Photochemical smog, acid rain, greenhouse effect, global warming, Carbon dioxide sequestration and the concept of Carbon Credits. **Solid and Hazardous Waste Pollution**: Classification, waste treatment and disposal methods: Sanitary landfill, thermal processes, chemical and biological processes, disposal methods for nuclear waste, nuclear disaster (case study), disposal methods for e-waste.	

Green Technology and Green Chemistry: Introduction to concept of Green Technology and Zero Waste Technology, Green Chemistry & its basic principles, Atom Economy (Numerical), evaluation of feedstock, reaction types, methods, reagents and solvents.

UNIT-III	07 Hours

Chemical Toxicology and Eco-Friendly Polymers

Toxicology: terminology & toxic effects, chemical interactions, impact of toxic chemicals on enzymes, Biochemical effects of arsenic, mercury, lead, chromium, & cadmium. Polymers Introduction: Functionality of monomer, polymerization, degree of polymerization, Number average and weight average molecular weight of polymers (Numerical). Environmental degradation of polymers: Biodegradable, Photo-biodegradable polymers, Hydrolysis & Hydro-biodegradable polymers Biopolymers & Bio plastics.

UNIT-IV	07 Hours

Energy Resources and Management:

Energy resources: Growing energy needs, renewable and non-renewable energy sources.

Use of alternate energy sources including solar energy harnessing (photovoltaic), wind energy, hydro-energy, geothermal energy, ocean energy, biodiesel, power alcohol, biomass energy, Hydrogen energy

Resource Management-Concept of Sustainable development, Environmental Management Systems, Environmental Impact Assessment, Pollution Management Initiatives taken by Government.

Important Environment Laws

Text Books

1.	Ranu Gadi, Sunita Rattan, Sushmita Mohapatra. A Text book of Environmental Studies (with experiments), 5th Ed., S.K. Kataria & Sons, 2024.
2.	S. Rattan, "Applied Chemistry", S.K.Kataria & Sons, 2023.
3.	S.S.Dara, D.D.Mishra. A Textbook of Environmental Chemistry and Pollution Control (With Energy, Ecology, Ethics and Society) S. Chand and Company Pvt. Ltd. (India), 2018.

Reference Books

1.	Richard T. Wright, Dorothy F Boorse, Environmental Science Towards A Sustainable Future, 13thEdition, Pearson Education, 2017.
2.	E. Barucha, Textbook of Environmental Studies for Undergraduate Courses, Universities Press (India) Pvt. Ltd., 2019.
3.	C.N. Sawyer, P.L. McCarty, and G.F. Parkin, "Chemistry for Environmental Engg. and Science", 5th Ed., The McGraw-Hill Companies, 2017.
4.	R. Rajagopalan, Environmental studies from crisis to cure, 3rd edition, Oxford University Press., 2016.

PRACTICAL COMPONENT

Introduction: Environmental Studies Lab acquaints the students with fundamental laboratory equipment and their usage. The students gain hands on experience in performing various experiments.

List of Experiments (Minimum 10-12 experiments to be performed)

1. Determination of Alkalinity in the water sample.
2. Determination of Hardness in the water sample.
3. Determination of Dissolved Oxygen (DO) in the water sample.
4. Determination of Biological oxygen demand (BOD) in the water sample.
5. Determination of Chemical oxygen demand (COD) in the water sample.
6. Determination of pH, conductivity and TDS in different drinking water samples and preparation of report.
7. Determination of Residual Chlorine in the water sample.
8. Determination of Ammonia in the water sample.
9. Determination of Free Carbon Dioxide in the water sample.
10. To determine the concentration of fine particulate matter ($PM_{2.5}$) in ambient air by gravimetric method
11. Acetylation of primary amines using green methodology
12. Preparation of urea formaldehyde resin and functional group analysis using IR spectroscopy.
13. Preparation of aloevera/avocado soap by green method of saponification.
14. Preparation of biodiesel from waste cooking oil using KOH as the catalyst.
15. Synthesis of benzoin catalysed by Thiamine hydrochloride
16. Microwave assisted synthesis of ammonium formate-mediated Knoevenagel reaction
17. Synthesis of bioplastic using banana peel.
18. Preparation of hydrogen gas using electrolysis/solar energy.
19. Synthesis of bioplastic from tapioca starch and citric acid
20. Analysis of the degradation of the bioplastics.
21. Detection of Cd^{2+}, K^{+}, Ca^{2+} in water samples (Spot Tests).
22. Detection of Mg^{2+} in water samples (Titan Yellow test).
23. Detection of Sulphate (SO^{4-}) in water samples (Spot Test).
24. Synthesis of Biodegradable polymer via Green Polymerization of Aspartic Acid.
25. Separation and purification of polymer: A Quantitative analysis.
26. Synthesis of poly(ethylene terephthalate) polymer.
27. Measurement of viscosity-average molecular weight of polymer using viscometer.
28. To determine the concentration of metal ions in a given water sample by spectrophotometric method.
29. To determine concentrations of SO_2 and NO_X in ambient air using UV-VIS Spectrophotometer.
30. To synthesize bioethanol from rice straw using acid/alkali/ultrasound/ enzyme/subcritical water pretreatment.
31. To remove redox active metals (Fe, Cu, Zn) from ambient air (PM10/PM2.5/PM1) using nanomaterials/nanocomposites.
32. To study the levels of particulate matter at solid waste landfill sites using portable Fine Particulate Sampler.

S.No	Reference Books
1.	Standard Methods for the Examination of Water and Wastewater, American Public Health Association (APHA), American Water Works Association (AWWA) & Water Environment Federation (WEF), 24th edition, 2023.
2.	Sunita Rattan, Experiments in Applied Chemistry, Publ.: S.K. Kataria & Sons, Delhi, 8th Edition 2023.
3.	S.K. Bhasin and Sudha Rani, Laboratory Manual on Engg. Chemistry, Dhanpat Rai Publ. Comp., New Delhi, 3rd Edition 2012.
4	Ranu Gadi, Sunita Rattan, Sushmita Mohapatra, Environmental Studies (with experiments), 5th Edition, S.K. Kataria & Sons, 2024.

INTRODUCTION TO DATA SCIENCE	
Course Code: BAI 103 Contact Hours: L-2 T-0 P-2 Course Category: SEC/Interdisciplinary	Credits: 3 Semester: I/II

Introduction: This course serves as an introduction to the basics of Data Science including programming for Data Analytics, File Management and Data Visualization. The course aims to understand the underlying core concepts and emerging technologies in data science. The foundation is laid for big data applications ranging from social networks to medical and business informatics.

Course Objectives:

- To learn the Data Science concepts and its various Applications
- To understand the Data Science processes including Data Wrangling, Data Exploration and Data Visualization
- To explore various Packages and Libraries in Python for Mathematical Computing

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

CO1: Understand the basic principles and ethics of data science to process the data.
CO2: Explore different data preprocessing and manipulating techniques.
CO3: Use the visualization techniques to translate analytical data into visual results.
CO4: Analyze data using Tableau for designing various visual features like Carts, Graphs, Plots and others.

Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, projects/presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	07 Hours
Data Science Overview, Evolution of Data Science, Data Science Roles, Tools for Data Science, Applications of Data Science Data Science Process Overview, Defining Goals, Retrieving Data, Data Preparation, Data Exploration, Data Modeling, Presentation Data Science Ethics, Doing good Data Science, Owners of the Data, Valuing different aspects of Privacy, Getting Informed Consent, The Five Cs of Data Science, Diversity, Inclusion, Future Trends in Data Science.	
UNIT-II	07 Hours
Mathematical Computing with Python (NumPy):Working with NumPy Arrays, Data Types, Array Creation, Indexing and Slicing, Numerical Operations on Arrays, Array Functions, Data Processing using Arrays**,** Loading and Saving Data, Saving an Array, Loading an Array, Numpy Random Numbers Data Manipulation with Pandas: Data Wrangling, Data Exploration, Cleaning Data, Filtering, Merging Data, Reshaping Data, Data Aggregation**,** Reading and Writing Files, Loading and Saving Data with Pandas	
UNIT-III	07 Hours
Data Visualization in Python, Understanding Data Visualization, Creating different Visualization like Bar Charts, Line Plot, Area Plots, Histograms, Pie Charts, Box Plots, Scatter Plots, Time Series plots, Figures and Subplots, Plotting Functions with Pandas .	

UNIT-IV		07 Hours
Data Visualization using non programming tools like Tableau. Work with Filter, Parameters, Sets. Arithmetic and logical table. Data visualization techniques such as heat map, tree map, Pareto. Interactive dashboards, story interfaces, and how to share your work.		
Text Books		
1.	Joshua N. Milligan, Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics and transform your organization, Packt Publishing Limited, 4th/Latest Edition (2020)/ Latest Edition	
2.	Joel Grus, Data Science from Scratch, O'Reilly, 2019 2nd/Latest Edition	
3.	Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media, 2017/ Latest Edition	
Reference Books		
1.	Prateek Gupta, Data Science with Jupyter, BPB Publication, 2019 1st/Latest Edition	
2.	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning Publications Company, 2016 1st/Latest Edition	
3.	Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from the Frontline, O' Reilly, 2013 1st/Latest Edition	

List of Practical's

a. Write a Python function that takes a list of integers and converts it into a NumPy array.
b. Create a NumPy array containing the numbers from 1 to 10 (inclusive).
c. Given a NumPy array, write a function to find the maximum value in the array.
d. Create a 3x3 identity matrix using NumPy.
e. Write a function to compute the mean of a NumPy array.
f. Generate a random NumPy array of size 5x5 containing integers between 1 and 100.
g. Given two NumPy arrays, write a function to concatenate them horizontally.
h. Write a function to reshape a 1D NumPy array into a 2D array with 3 rows.

2. a. Calculate the dot product of two NumPy arrays.
b. Write a function to find the indices of non-zero elements in a NumPy array.
c. Create a NumPy array containing the first 10 even numbers.
d. Given a NumPy array, write a function to sort it in descending order.
e. Write a function to calculate the standard deviation of a NumPy array.
f. Create a 5x5 NumPy array with random floats between 0 and 1.
g. Given a NumPy array, write a function to normalize the values to be between 0 and 1.

3. a. Write a function to find the unique elements in a NumPy array.
b. Given a NumPy array, write a function to calculate the cumulative sum along the rows.
c. Create a NumPy array containing 10 equally spaced values between 0 and 1.
d. Write a function to compute the element-wise square root of a NumPy array.
e. Generate a 3x3 NumPy array with random integers between -10 and 10.

4. a. Given a NumPy array, write a function to calculate the median of its values.
b. Create a 4x4 NumPy array with consecutive integers starting from 1 and reshape it into a 2x8 array.
c. Write a function to calculate the absolute difference between two NumPy arrays.
d. Generate a random NumPy array of size 3x3 and replace all negative values with 0.
e. Given a NumPy array, write a function to calculate the cumulative product along the columns.
f. Create a NumPy array containing the first 10 Fibonacci numbers.

5. a. Write a function to calculate the exponential of each element in a NumPy array.
   b. Given two NumPy arrays, write a function to find the common elements between them.
   c. Generate a 5x5 NumPy array with random integers and find the indices of the maximum value.
   d. Write a function to calculate the Pearson correlation coefficient between two NumPy arrays.
   e. You are given a 2D array representing a matrix. Write a Python function using NumPy that takes this matrix as input and returns the sum of the diagonal elements.

6. a. Write a Python function that reads a CSV file into a Pandas DataFrame.
   b. Given a Pandas DataFrame, write a function to display the first 5 rows.
   c. Create a Pandas DataFrame from a dictionary containing student names and their corresponding ages.
   d. Write a function to calculate the average of a specific column in a Pandas DataFrame.
   e. Given a Pandas DataFrame, write a function to find the maximum value in a specific column.
   f. Generate a Pandas DataFrame containing random numbers with 5 rows and 3 columns.

7. a. Write a function to rename a specific column in a Pandas DataFrame.
   b. Given two Pandas DataFrames, write a function to concatenate them vertically.
   c. Create a Pandas DataFrame from a list of dictionaries, where each dictionary represents a row.
   d. Write a function to filter rows in a Pandas DataFrame based on a specified condition.
   e. Given a Pandas DataFrame, write a function to drop rows with missing values.
   f. Generate a Pandas DataFrame containing dates from January 1, 2022, to December 31, 2022.
   g. Write a function to sort a Pandas DataFrame by values in a specific column.
   h. Given a Pandas DataFrame, write a function to calculate the correlation between two columns.

8. a. Create a new column in a Pandas DataFrame by applying a function to existing columns.
   b. Write a function to group data in a Pandas DataFrame by a specific column.
   c. Given a Pandas DataFrame, write a function to calculate summary statistics for numerical columns.
   d. Merge two Pandas DataFrames based on a common column.
   e. Write a function to pivot a Pandas DataFrame.

9. a. Given a Pandas DataFrame, write a function to export it to an Excel file.
   b. Given a Pandas DataFrame containing sales data with columns for date, product ID, and quantity sold, write a function to calculate the moving average of the quantity sold for each product over a 30-day period.
   c. Create a function that reads a JSON file containing nested data into a Pandas DataFrame and flattens it into a tabular structure, handling any missing values appropriately.
   d. Write a function to identify and remove outliers from a Pandas DataFrame based on the interquartile range (IQR) method for a specific numerical column.

e. Given a Pandas DataFrame with columns for user IDs, timestamps, and actions performed by users, write a function to calculate the time spent by each user between consecutive actions and identify users who spent the most time between actions.

10. a. Create a function that reads multiple CSV files containing similar data structures into separate Pandas DataFrames, concatenates them, and performs data cleansing operations such as removing duplicates and handling missing values, ensuring consistency across all files.
    b. You have a dataset containing information about students' grades in different subjects. Write a Python function using Pandas to calculate the average grade for each subject.
    c. Given a dataset with customer information, including age, gender, and purchase history, use Pandas to find the median age of male and female customers separately.
    d. Create a Python function that reads a CSV file containing sales data into a Pandas DataFrame and calculates the total revenue generated from each product category.
    e. You're provided with a dataset containing employee information, including department, salary, and tenure. Write a function using Pandas to identify the department with the highest average salary.
    f. Given a dataset with stock market data, including price and volume, write a Python function using Pandas to calculate the average trading volume for a specific stock over a given time period.

11. a. Given a dataset containing monthly sales data for different products, create a line plot to visualize the trend of sales for each product over the past year.
    b. Use Matplotlib to create a bar chart showing the distribution of product categories in sales dataset.
    c. Generate a histogram to visualize the distribution of ages in a population dataset.
    d. Given a dataset with two numerical variables (e.g., height and weight), create a scatter plot to explore the relationship between them.
    e. Use Matplotlib to create a pie chart showing the market share of different companies in a specific industry based on sales data.

12. a. Given a dataset containing exam scores of students in different subjects, create a box plot to identify outliers and visualize the spread of scores.
    b. Generate a heatmap to visualize the correlation matrix of numerical variables in a dataset, highlighting strong correlations.
    c. Create a stacked bar chart to compare the sales performance of different regions over multiple quarters.
    d. Given experimental data with mean values and standard deviations, create a line plot with error bars to visualize the variability of measurements over time.
    e. Use Matplotlib to create a time series plot of stock prices over the past year, adding annotations to highlight significant events such as earnings announcements or market fluctuations.
    f. You're given a dataset containing the monthly sales data of a company for the past year. The dataset includes two columns: "Month" (containing the month names) and "Sales" (containing the corresponding sales values). Using Matplotlib, create a line plot to visualize the trend of monthly sales over the past year.

13. a. You're given a dataset containing sales data for a retail store. Using Tableau, create a bar chart showing the total sales for each product category.

b. Given a dataset with customer information including age, gender, and purchase history, use Tableau to visualize the distribution of ages among male and female customers.
c. Create a dashboard in Tableau that displays key performance indicators (KPIs) such as revenue, profit margin, and sales growth over time for a retail business.
d. You have a dataset with sales data from multiple regions. Use Tableau to create a map visualization showing sales revenue by region.

14. a. Given a dataset containing employee information including department, salary, and performance ratings, use Tableau to create a scatter plot showing the relationship between salary and performance ratings.
b. Create a dashboard in Tableau that tracks website traffic metrics such as page views, bounce rate, and conversion rate over a specific time period.
c. You're provided with a dataset containing customer feedback data. Use Tableau to create a word cloud visualization highlighting the most commonly used words in customer feedback comments.

15. a. Given a dataset with stock market data including price, volume, and market cap, use Tableau to create a line chart showing the trend of a specific stock's price over time.
b. Create a dashboard in Tableau that visualizes the customer churn rate over time, including churn reasons and retention strategies.
c. You have a dataset with survey responses from employees about their job satisfaction. Use Tableau to create a bar chart showing the distribution of job satisfaction levels among different departments.

IT WORKSHOP	
Course Code: BAI 102 Contact Hours: L-2 T-0 P-2 Course Category: SEC/Interdisciplinary	Credits: 3 Semester: I/II

Introduction: IT Workshop is a practical course where students will learn programming with R. R is capable of handling mathematical and statistical manipulations. It has its own programming language as well as built-in functions to perform any specialized task.

Course Objectives:

- To introduce students to the statistical package R for data analysis.
- To use R to perform descriptive statistics including graphics, perform basic inferential statistical analyses including regression analysis, read and write data files,
- To perform basic data manipulations (eg, creating new variables, merging data sets), write and use R script files, use R packages, write and use R functions, and perform basic programming in R.

Course Outcomes: Upon successful completion of the course, students will be able to:
CO1: Learn the fundamentals and usage of R software.
CO2: Understand the basic syntax and structure of R language.
CO3: Explore different data preprocessing and analytical techniques.
CO4: Analyze the visual results from analytical data using visualization techniques.

Pedagogy: The teaching-learning of the course would be organized through lectures and practical sessions in lab. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	07 Hours
An overview of R language: Basic fundamentals, installation and use of software, data editing, use of R as a calculator, functions and assignments. Getting R and Running R, R Packages Expressions, Objects, Symbols, Functions Special Values	
UNIT-II	07 Hours
Constants, Numeric vectors, Character Vectors, Operators. R Syntax, Data Structure in R (Matrices, Arrays, Factors, Data frames), Attributes, Symbols and Environment, Functions, Loading, Saving, and Editing Data in R, Combining Datasets, Transformations, Binning Data	
UNIT-III	07 Hours
Subsets, Summarizing Functions, Data Cleaning. Analyzing Data, Probability Distribution, Continuous Data , Discrete Data, T-test Design, Anova Test Design, Introduction to Regression, Linear model, Smoothening	
UNIT-IV	07 Hours
Graphics and Plots: Scatter Plots, Bar Charts, Pie Charts, Three-dimensional Data, Plotting Distribution, Customizing Charts, Basic Graphic Functions, Common Arguments for Chart Functions.	
Text Books	
1.	Liu Peng "The Statistics and Machine Learning with R Workshop: Unlock the power of efficient data science modeling with this hands-on guide", Packt Publishing; 1st edition, 2023/Latest Edition
2.	Long, James D., and Paul Teetor. R Cookbook: Proven Recipes for Data Analysis, Statistics, and Graphics. O' Reilly Media, 2019/ Latest Edition

3.	Christian Heumann, Michael Schomaker and Shalabh, Introduction to Statistics and Data Analysis - With Exercises, Solutions and Applications in R, Springer, 2016/ Latest Edition
4.	Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Liquet, The R Software- Fundamentals of Programming and Statistical Analysis, Springer 2013/ Latest Edition
Reference Books	
1.	Hadley Wickham, ggplot2 Elegant Graphics for Data Analysis, Springer 2016
2.	Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, A Beginner's Guide to R (Use R), Springer 2009/ Latest Edition

List of Practicals

1. Introduction to R Language.

   CONSOLE

   a) Perform the following operations on R console:
      1. Sample Program
      2. Addition
      3. Subtraction
      4. Multiplication
      5. Division

   EDITOR

   b) Perform the following operations on R editor:
      1. Sample Program
      2. Addition
      3. Subtraction
      4. Multiplication
      5. Division

2. Implement basic functionality of R.
   a) Create two vectors of equal length and perform:
      1. Addition
      2. Subtraction
      3. Multiplication
      4. Division

   b) Create two vectors of equal length and perform:
      1. Addition
      2. Subtraction
      3. Multiplication
      4. Division

   c) Create two vectors of unequal length and perform:
      1. Addition
      2. Subtraction
      3. Multiplication
      4. Division

3. Implement the concept of data frame.
   Create a data frame for the employee consisting of attributes: employee code, employee name and the salary of the employee.
   Perform all the operations, i.e., class, structure, summary of dataframe, extract specific rows and columns from dataframe, add a row and column.

4. Perform computation of matrices in R.
   (i) Create two 2x3 matrices column wise and perform the addition, subtraction, multiplication and division.

(ii) Create two 2x3 matrices row wise and perform the addition, subtraction, multiplication and division.
(iii) Create two 2x3 matrices row wise and perform scalar multiplication.
(iv) Perform multiplication of matrices using operators.

5. Implement Control Statements in R Programming:
    1. if condition
    2. if-else condition
    3. for loop
    4. while loop
    5. repeat and break statement
    6. return statement
    7. next statement
    8. break statement

    Write the following programs in R language:
    1. Compare two numbers
    2. Find out whether a number is positive, negative or zero
    3. Print fibonnaci series upto 10 elements.

6. Implement data import and export functionality in R
    1. Importing Comma Separated Value (CSV) file
    2. Importing Text (tab separated) file
    3. Exporting to Comma Separated Value (CSV) file
    4. Exporting to text (tab separated) file

7. Apply the basic visualization techniques in R to understand data
    1. Bar Chart - Data Set used: BOD (inbuilt)
    2. Histogram - Data Set used: mtcars (inbuilt)
    3. Pie Charts

8. Apply some advanced visualization techniques in R to analyze the data
    1. Line Chart- Data Set used: pressure (inbuilt)
    2. Scatter Plot - Data Set used: airquality (inbuilt)
    3. Box Plot - Data Set used: mtcars (inbuilt)

9. Apply Functions and Packages:
    1. Writing custom functions.
    2. Using built-in functions.
    3. Introduction to packages and installing packages from CRAN.

10. Apply Data Cleaning and Preprocessing:
    1. Handling missing values (removing, imputing).
    2. Data normalization and standardization.
    3. Removing duplicates.

11. Project Work:
    Assign a small project where students can apply their learning of R to analyze a dataset, perform statistical analysis, visualize data, and draw conclusions.

PROBABILITY AND STATISTICS	
Course Code: BAS 103 Contact Hours: L-3 T-0 P-2 Course Category: BAS	Credits: 4 Semester: I/II

Introduction: Students will learn fundamental rules of Probability, discrete and continuous probability distributions, and statistical methods most commonly used in various domains of engineering and management.

Course Objectives:

- To introduce the basic concepts of probability and random variables
- To introduce the basic concepts of two dimensional random variables.
- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.

Course Outcomes: On completion of the course, the students will be able to:

CO1: Recall the basics of probability theory and apply it to determine total and conditional Probabilities.

CO2: Understand the concepts of Random variable, various discrete and continuous probability distributions and use it to solve the statistical situations.

CO3: Evaluate the correlation between two variables and analyze statistical data.

CO4: Determine probabilities of making errors in hypothesis testing and draw conclusions using critical values.

Prerequisite: Basics of permutations & combinations and probability theory.

Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. The students would implement programs using MS-Excel/R/SPSS/MATLAB to develop a deeper insight into the underlying principles of the concepts taught in theory classes.

Contents

UNIT-I	10 Hours
Concept of probability, additive and multiplicative law of probability, total and conditional probabilities, Baye's theorem. Measures of central tendency, dispersion, kurtosis, moments. Definition and properties of random variables, discrete and continuous random variables, probability mass and density functions, distribution functions.	
UNIT-II	12 Hours
Concepts of bi-variate random variables-Joint, marginal and conditional distributions. Transformations of one and two-dimensional random variables. Mathematical expectation-Definition and its properties. Variance, standard deviation, Covariance. Moment generating function- Definition and their properties.	
UNIT-III	10 Hours
Discrete distributions-Binomial, Poisson and geometric distributions with their properties. Continuous distributions- Uniform, Exponential and Normal distributions with their properties. Linear Correlation, Correlation Coefficient, Rank Correlation Coefficient, Regression. Central limit theorem.	

UNIT-IV		10 Hours
Formation of Hypothesis, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and standard deviations. Test of significance for small samples: t- Test for single mean and difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.		
Text Books		
1.	Montgomery, Douglas C., and George C. Runger. "Applied Statistics and Probability for Engineers", Seventh Edition. John Wiley & Sons, 2018.	
2.	Sheldon Ross M., Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, 6thEdtion, 2020.	
3.	Rukmangadachari E., and Keshava, Reddy E. Probability and Statistics, Pearson Education India, 2015.	
4.	Ravichandran J., Probability and Statistics for Engineers. Wiley India, 2010.	
Reference Books		
1.	Devore, Jay L. "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage, 2010.	
2.	Scheaffer, Richard, Madhuri Mulekar, and James McClave. Probability and Statistics for Engineers. Nelson Education, 2010.	
3.	Meyer, Paul L. Introductory Probability and Statistical Applications. 2nd Edition, Oxford and IBH publishing, 1965.	
4.	Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics, S Chand Publications, 11th Edition, 2002	

PRACTICAL CONTENT

1. Load real-world datasets from sources like CSV files or online repositories.
2. Calculate descriptive statistics like mean, median, and standard deviation.
3. Create histograms, boxplots, scatter plots, and bar charts to visualize data distributions, relationships between variables, and identify potential outliers.
4. Simulate random outcomes and calculate probabilities for the case of coin flips and card draws.
5. Simulate experimental probabilities and compare it with theoretical probabilities.
6. Calculate expected value and variance in the context of single random variable.
7. Generate and plot probabilities for events in discrete and continuous distributions (Binomial, Poisson, Geometric, and Normal).
8. Fit simple linear regression models using built-in functions.
9. Applying the t-test for independent and dependent samples.
10. Use chi-square tests to assess independence or association between categorical variables in real-world dataset.
11. Testing of hypothesis for sample means and proportion from real time problems.

PROGRAMMING WITH PYTHON	
Course Code: BAI 101 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 1

Introduction: Python is a programming language that supports various paradigms used in programming. It features a dynamic programming system, and the memory type is automated. The basic design structure is such that it emphasizes code readability, and its usage has become much more prevalent. The goal of this course is to introduce Python programming with a basic problem solving approach.

Course Objectives:

- To know the basics of algorithmic problem solving for reading and writing Python programs.
- To develop Python programs with conditions and loops.
- To use Python data structures –- lists, tuples dictionaries.
- To define Python functions and call them.
- To do input/output with files in Python

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

CO1: Understand and apply basic programming concepts, including variables, expressions, loops, conditionals, and functions, to solve problems in Python.

CO2: Learn to create, manipulate, and leverage Python-specific data structures.

CO3: Implement modular programming concepts to design and develop reusable code structures.

CO4: Apply acquired programming skills and knowledge to build small-scale applications using Python.

Pedagogy: Lectures will be imparted along with hands-on lab sessions and the latest real-world case studies where python can be used.

Contents

UNIT-I	10 Hours
Introduction: Introduction to Python, Program Development Cycle, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Nested Loops, break and continue.	
UNIT-II	12 Hours
Strings: Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Indexing, Searching, and Manipulating Strings. **Lists:** Introduction to Lists, List slicing, Basic List Operations, Built-in Functions of Lists, Copying Lists, Two-Dimensional Lists. **Tuples:** Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-in Functions used in Tuples, Tuple Methods. **Dictionaries:** Creating a Dictionary, Accessing and Modifying key:value pairs in Dictionary, Built-in Functions of Dictionary, Dictionary Methods. **Sets:** Set methods, Traversing of Sets, Frozenset	

UNIT-III	10 Hours
Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments, Functions-Generating Random Numbers. **Recursion:** Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms. **Files:** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Exceptions, Python math, random, os and os.path, date, time, scipy modules.	
UNIT-IV	10 Hours
Regular Expression Operations: Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions and Regular Expression with glob Module. **Python Packages:** Simple programs using the built-in functions of packages matplotlib, numpy, pandas, keras etc. **Object-Oriented Programming:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism.	
Text Books	
1.	Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning, 2019/ Latest Edition.
2.	Allen B. Downey, "Think Python: How to think like a Computer Scientist", John Wiley, 2016/ Latest Edition.
Reference Books	
1.	Mark Lutz, "Learning Python", O'Reilly Publication, 2013/ Latest Edition.
2.	Charles R. Severance, "Python for Everybody: Exploring Data in Python 3", Shroff Publishers. 2016/ Latest Edition
3.	Martin C. Brown, "Python: The Complete Reference", McGraw-Hill, 2018/ Latest Edition.

List of Practical's

1. Implement a program to calculate the remainder of two numbers using the modulo operator.
2. Write a program that takes two lists and returns True if they have at least one common member.
3. Write a Python script to sort (ascending and descending) a dictionary by value.
4. Write Python programs to demonstrate the following: i) input( ) ii) print( ) iii) 'sep' attribute iv) 'end' attribute v) replacement Operator ({ })
5. Python program that accepts a string and calculates the number of digits and Letters.
6. Write a Python program to get a substring from a given string starting from the 3rd character to the 5th character.
7. Write a Python program to remove a key-value pair from a dictionary.
8. Write a Python program to read and write to a binary file using random access methods.
9. Write a Python program to handle the exception that occurs when trying to open a non-existing file.
10. Write a Python program to handle the exception that occurs when accessing an index out of range in a list.
11. Create a Python class Student with attributes name and grade. Use the__str__ and __len__ in-built functions to customize the string representation and length of the object.
12. Create a base class Animal with a method sound. Create a derived class Dog that overrides the sound method to print " Woof ". Create an object of the Dog class and call its sound method.

13. Create a Python class named Car with attributes brand and model. Create an object of this class and print its attributes.
14. Write a Python function that takes a list as an argument and returns the sum of all the elements in the list. Test this function with a sample list.
15. Write a Python function named operate that takes two numbers and an operation as arguments. The operation can be add, subtract, multiply, or divide. Use lambda functions to perform the respective operations.
16. Use Matplotlib to plot a sine wave from 0 to 2π.
17. Create a NumPy array containing numbers from 1 to 10. Calculate its mean, median, and standard deviation.
18. Create a basic Flask application with a route that returns "Hello, Flask!". Create a Tkinter window with an entry field. When a button is clicked, display the entered text in a message box.
19. Create a Tkinter window with an entry field. When a button is clicked, display the entered text in a message box.
20. Install PyTorch. Create a tensor with random values and perform basic operations like addition and multiplication.

SOFT SKILLS AND PERSONALITY DEVELOPMENT	
Course Code: HMC 102 Contact Hours: L-2 T-0 P-2 Course Category: AEC	Credits: 3 Semester: II

Introduction: The course aims to equip the students with the versatile abilities required for effective performance in diverse professional environments. The course emphasizes on communication, collaboration, persuasion, evaluation, and overall personality development of the students. By offering interactive lectures tailored to address common professional challenges related to soft skills and behavioral dynamics, the course fosters competencies essential for success in interviews, group discussions, critical thinking, problem solving and decision making.

Course Objectives:

- To enable students to understand the concept of soft skills along with providing training in personality development.
- To help students understand the nuances of interpersonal skills, with special emphasis on team behavior and leadership skills.
- To facilitate betterment of critical thinking, problem solving and decision-making skills.
- To encourage practical orientation that helps in career visioning and anticipated placements.

Course Outcomes: After completion of the course, the students should be able to:

CO1: Evaluate their personalities with reference to soft skills while enabling them to navigate professional challenges with confidence and efficiency.

CO2: Utilize their understanding of interpersonal skills to display better team behavior and leadership at workplace.

CO3: Display effective utilization of critical thinking, problem solving and decision-making skills

CO4: Demonstrate the ability for productive career visioning and placements.

Pedagogy: To provide knowledge of various communication processes through innovative and interactive classroom teaching sessions. To evaluate student's progress through practical sessions including group participation, case studies and various class room activities.

Contents

UNIT-I	08 Hours
Soft Skills and Personality Development: What Are Soft Skills, Need for Soft Skills, Johari Window, SWOT, Grooming, Personality Development, Self-Advertising, Time Management (Building Up the Routine), Stress Management (Recognition, Acknowledging, Signs, Tackling)	
UNIT-II	08 Hours
Interpersonal Skills: Building Relationships, Social Etiquettes, Group Conflicts and Their Resolution, Establishing Identity, What to Listen and Why, When to Speak and How, Empathy, Power Dressing.	
UNIT-III	07 Hours
Critical Thinking, Problem Solving Skills and Decision Making: Techniques and Importance of Problem Solving, Keys to Decision Making (Elements, Emotional Intelligence), Critical Versus Creative Thinking, Blooms Taxonomy, Barriers to Critical Thinking	

UNIT-IV		07 Hours
Career Visioning and Placement: Leadership (Importance, Function, Responsibility and Styles), Motivating Others, Art of Persuasion, Negotiation Skills, Balancing Career and Life, Team Behavior (Characteristics, Understanding Behavior)**,** Types of Interviews, Preparing for The Interviews, Attending the Interview, Interview Process, Employers Expectations, General Etiquette.		
Text Books		
1.	Personality Development, Harold R. Wallace &L.Ann Masters, Cengage Learning, 2010	
2.	Dorch, Patricia. What Are Soft Skills? New York:Execu Dress Publisher, 2013.	
3.	Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012 New Delhi.	
4.	Klaus, Peggy, Jane Rohman & Molly Hamaker.The Hard Truth about Soft Skills. London:Harper Collins E-books, 2007.	
Reference Books		
1.	Dorch, Patricia. What Are Soft Skills? New York:Execu Dress Publisher, 2013.	
2.	Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer &Company, 2013.	
3.	Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.	
4.	Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success.Canada: Wiley & Sons, 2006.	

List of Experiments

S.No	Experiment Name
1.	SWOC Analysis
2.	Ad Mad Activity : Self Advertising
3.	Time Management
4.	Practicing Stress Management
5.	Case Study Discussions : Resolving Conflicts
6.	Developing Empathy : Community Service Video Presentation
7.	Documentary / Movie Review
8.	Negotiation Skills: Role Plays
9.	Skit Presentation : Team Building and Leadership
10.	Mock Interviews

WEB APPLICATION DEVELOPMENT	
Course Code: BCS 102 Contact Hours: L-2 T-0 P-2 Course Category: Interdisciplinary/SEC	Credits: 3 Semester: I/II

Introduction: This undergraduate program course provides a foundational understanding and practical skills essential for the creation of effective web pages. Covering key terminologies, tools, such as HTML5, Cascading Style Sheets (CSS), and introductory JavaScript, students will learn the fundamentals of web development. The course also includes instruction on website hosting, offering a comprehensive overview of essential concepts for aspiring web developers.

Course Outcomes: After completing this course, the students will be able to:

CO1: Understand core principles and technologies in web development, including HTML5, CSS, JavaScript, and server-side scripting.

CO2: Design and develop responsive and secure web applications with a focus on user experience and data management.

CO3: Apply software-engineering best practices to plan, collaborate, and manage web development effectively.

CO4: Deploy and maintain web applications

Pedagogy: The teaching-learning of the course would be organized through lectures, tutorials, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based resources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	08 Hours
HTML: HTML-Introduction, tag basics, page structure, adding comments working with texts, paragraphs and line break. Emphasizing test, heading and horizontal rules, list, font size, face and color, alignment links, tables, frames, Introduction to Python for Web Development **Forms & Images Using Html:** Graphics: Introduction, How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page.	
UNIT-II	07 Hours
XML & DHTML: Cascading style sheet (CSS), what is CSS, Why we use CSS, adding CSS to your web pages, Grouping styles-extensible, Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT. Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding.	
UNIT-III	08 Hours
JavaScript: Client side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition, Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations. **Ajax:** Introduction, advantages & disadvantages, Purpose of ajax, ajax based web application, alternatives of ajax Java Script & AJAX: Introduction to array-operators, making statement, date & time, mathematics strings, Event handling, form properties. AJAX - Introduction to jQuery and AngularJS.	

UNIT-IV		07 Hours
PHP and MYSQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs. **CMS:** Introduction to CMS: Overview, benefits, and types, WordPress Development: Theme customization, plugin development, and best practices, Drupal CMS: Configuration, module development, and site building techniques		
Text Books		
1.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1stEdition, Pearson Education India. (ISBN:978-9332575271)	
2.	Ralph Moseley and M. T. Savaliya, Developing Web Applications, Wiley-India Private Limited, 2011.	
3.	Robert W.Sebesta, Programming the World Wide Web, 7th edition, Pearson Education, 2013.	
Reference Books		
1.	Internet and World Wide Web How to program, Paul J. Deitel, Harvey M. Deitel, and Abbey Deitel, 5th Edition, Pearson Education, 2011.	
2.	Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)	
3.	B. M. Harwani, Developing Web Applications in PHP and AJAX, Tata McGraw-Hill, 2010.	
4.	Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/ Wiley India, 2012. (ISBN:978-8126535088)	

LIST OF PRACTICALS

1. Create a basic webpage using HTML and apply CSS styles for layout and design.
2. Develop interactive features using JavaScript, such as form validation and DOM manipulation.
3. Implement server-side scripting with languages like PHP, Python, or Node.js to handle user inputs and database interactions.
4. Set up and configure a database system (e.g., MySQL, MongoDB) for storing and retrieving data in web applications.
5. Design and implement user authentication and authorization systems to secure access to web application resources.
6. Integrate external APIs (e.g., Google Maps API, Twitter API) to enhance functionality and access external data sources.
7. Deploy the web application on a web server or cloud platform (e.g., AWS, Heroku) and configure domain settings for public access.
8. Perform testing and debugging to ensure the functionality, security, and performance of the web application across different devices and browsers.

This is only the suggested list of Practicals. Instructor may frame additional Practicals relevant to the course contents

MOBILE APPLICATION DEVELOPMENT	
Course Code: BCS 104 Contact Hours: L-2 T-0 P-2 Course Category: SEC	Credits: 3 Semester: II

Introduction: Mobile Application Development is process of creating software applications that runs on mobile devices. This course is highly essential and relevant as it has applicability to diverse domains like education, healthcare, e-commerce, entertainment by developing mobile apps for these fields. The mobile development process involves creating installable software bundles (code, binaries, assets, etc.), implementing backend services such as data access with an API, and testing the application on target devices.

Course Outcomes: After completing this course, the students will be able to:

CO1: Understand the workflow of mobile application development along with the case study of android and Swift programming.

CO2: Develop Android/iOS based mobile applications

CO3: Design and implement the user interfaces for mobile applications.

CO4: Deploy sophisticated mobile applications for various applications.

Pedagogy: The teaching-learning of the course would be organized through lectures, tutorials, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based resources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	08 Hours
Introduction: Overview of Mobile Application Development, Integrated Development Environment(IDE), Source Code Repository, Workflow, Native Apps vs Hybrid Apps, Mobile Applications, Characteristics and Benefits. **Introduction to Mobile Operating Systems:** Android, Windows and iOS Platforms, Application development fundamentals, SDKs Model-View Controller for user interface	
UNIT-II	07 Hours
Tools: Google Android Platform, Eclipse Simulator, Android Application Architecture, Event based programming, Apple iPhone Platform, UI tool kit interfaces, Event handling and Graphics services, Layer Animation.	
UNIT-III	08 Hours
Android Programming: Android Basics, Android Architecture, Android Application Design Essentials: terminologies, application context, activities, services, intents. Android User Interface Design Essentials. Testing and Deploying Android Applications. Common Android APIs	
UNIT-IV	07 Hours
Application Development: Data Storage, Cloud Storage for app development, Publishing Android application, Using Android preferences, Other OS case studies, IOS/Windows, course project mobile application development and deployment	

Text Books

1.	Griffiths, Dawn, and David Griffiths. Head First Android Development: a brain-friendly guide. " O'Reilly Media, Inc.", 2017
2.	Keur, Christian, and Aaron Hillegass. iOS programming: the Big Nerd Ranch guide. Pearson Technology Group, 2016
3.	McWherter J, Gowell S. Professional mobile application development. John Wiley & Sons; 2012 Aug 16.

Reference Books	
1.	Hellman, Erik. Android programming: pushing the limits. John Wiley & Sons, 2013.
2.	Pradhan, Anubhav, and Anil V. Deshpande. "Composing Mobile Apps Learn Explore Apply using Android." Wiley 2014
3.	Jemerov and S. Isakova, Kotlin in Action, 1st Ed. Manning Publications, 2016
4.	Cornez, Trish, and Richard Cornez. Android Programming Concepts. Jones & Bartlett Publishers, 2015.

LIST OF PRACTICALS

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Implement an application that implements Multi-threading.
7. Develop a native application that uses GPS location information.
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message.
10. Develop a mobile application that creates alarm clock.
11. Integration of sensors for solving real-world problems.
12. Publication of sensored data on the cloud and subsequent analysis.

This is only the suggested list of Practicals. Instructor may frame additional Practicals relevant to the course contents.

PROGRAMMING WITH C	
Course Code: BCS 101 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: I

Introduction: This course briefs about basic introduction to computers and its corresponding concepts in benefit of students coming from non-computer background. Apart from this, programming concepts are also discussed in this course using C programming language.

Course Objectives: This course covers essential programming concepts in C through practical exercises. Students will learn to create programs, manipulate data structures, use memory efficiently, and handle files effectively, preparing them for real-world software development. Below are the course objectives, presented in a concise and detailed manner:

- Ensure understanding of fundamental principles and practical significance of algorithms and programming.
- Acquire skills in C programming using essential constructs, with a focus on arrays and strings for problem-solving and data manipulation.
- Proficiency in designing and implementing C software applications using functions and structures for enhanced code organization and reusability.
- Competent in advanced programming concepts including pointers for optimized memory usage and program efficiency.
- Equip students with file handling and memory management techniques in C programming for real-world software development challenges.

Pre-requisite: Basic computer literacy and problem-solving skills are recommended.

Course Outcomes: After completing this course, the students will be able to:

CO1: Understand the significance and fundamental concepts of algorithms and programming.
CO2: Explain basic programming constructs in C and their application in problem-solving.
CO3: Analyze and solve problems using arrays, strings, functions, and structures in C programming.
CO4: Apply advanced programming techniques including pointers, file handling, and memory management in C to develop robust applications.

Pedagogy: The teaching-learning of the course would be organized through lectures, tutorials, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based resources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	10 Hours
Programming Fundamentals: Introduction, Programming through Algorithms and Flowcharts. Basics of Computer Organization. **Overview of C**: History and Importance of C, Basic Structure of C Program, Executing a C Program. **Constants, Variable and Data Types:** Introduction, C Tokens, Character Set, Keywords and Identifiers, Basic Data Types, Constants, Variables, Input/Output Statements **Operators and Expressions:** Introduction, Operators: Arithmetic, Relational, Logical, Assignment, Unary, Conditional, and Bitwise, Arithmetic Expressions, Evaluation of Expressions, Type Conversions and Type Casting	

UNIT-II	10 Hours
Control Structures: Introduction to Decision Control Statements, Conditional Statements (if, if-else, if-else-if, switch), Iterative Statements (for, do-while, while), Nested Loops, The Break and Continue Statements, goto Statement **Arrays:** Declaration, Accessing and Storage of Arrays, Operations on Array, Passing Arrays to Functions, Two-Dimensional Arrays, Operations on 2D Arrays, Multidimensional Arrays, Applications of Array **Character and Strings:** Declaring and Initializing Character and String Variables, Reading & Writing Strings, String Taxonomy, String Operations, Array of Strings.	
UNIT-III	12 Hours
Functions: Introduction to Functions, Function Declaration, Function Definition User-defined Functions, Function Call, Return Statement, Passing Parameters to Functions, Scope of Variables, Storage Classes, Recursive Functions and its Types, Recursion vs Iteration **Pointers**: Declaration, Initialization and Accessing Pointer Variables, Null and Generic Pointers, Pointer Expressions and Arithmetic, Passing Arguments to Function using Pointers, Pointers and Arrays, Passing Arrays to Functions, Array of Pointers, Function Pointers, Pointers to Pointers, Call by Reference, Call by Value **Dynamic Memory Allocation:** Memory Allocation Process, malloc(), calloc(), realloc(), free().	
UNIT-IV	10 Hours
Structure and Unions: Structure Definition, Declaration, and Initialization, Nested Structures, Arrays of Structures, Structure and Functions, Self-referential Structures, Unions, Arrays of Union Variables, Unions Inside Structures, Structures Inside Unions, Enumerated Data Type **File Handling:** Introduction to Files, Reading and Writing from Files, Error Handling, Remove(), Renaming the File, Introduction To C Preprocessors - #define, #include, and conditional compilation directives - #ifdef, #ifndef, #endif, #else, Predefined Macro Names	
Text Books	
1.	Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016
2.	E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.
Reference Books	
1.	Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication
2.	Juneja, B. L and Anita Seth, “Programming in C”, CENGAGE Learning India pvt. Ltd., 2011
3.	Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009

List of Practical

- Write a program to perform formatted output using printf() and input using scanf(). Also, demonstrate unformatted input/output operations using getchar() and putchar() functions.
- Demonstrate the declaration of variables of different data types and perform arithmetic operations such as addition, subtraction, multiplication, division, and modulus.
- Write a program to showcase the use of relational (>, <, >=, <=, ==, !=), logical (&&, ||, !), assignment (=), ternary (? :), and other operators (*, /, etc.).
- Write a program to evaluate expressions to demonstrate operator precedence and associativity.
- Write a program to implement decision-making programs using if, if-else, if-else ladder, nested if, and switch cases. Provide examples illustrating various scenarios where these control statements are used for decision making.
- Write programs using different types of loops including for, while, and do-while loops. Compare and contrast the functionalities of these loops and discuss the differences between entry-controlled and exit-controlled loops.

- Write a program to declare, initialize, and manipulate single-dimensional and multi-dimensional arrays. Also, manipulate strings (character arrays) using various string handling functions such as strcat(), strcpy(), strlen(), etc.
- Write a program to use user-defined functions with and without parameters or return type. Implement recursive functions for problem-solving and compare them with iterative approaches. Discuss the concepts of call by value and call by address.
- Write a program demonstrating the scope and lifetime of automatic, global, and static variables. Discuss the differences between these types of variables and their use cases.
- Write a program to demonstrate pointer arithmetic and its applications. Explore the relationships between pointers and arrays, character strings, functions, and structures.
- Write programs using dynamic memory allocation techniques such as malloc(), calloc(), realloc(), and free(). Discuss the advantages and limitations of dynamic memory allocation.
- Write a program utilizing structures to define complex data types and create programs that manipulate structures and arrays of structures. Pass structures and arrays of structures to functions and discuss the concept of a pointer to a structure.
- Write a program to perform file operations such as opening, reading from, writing to, and closing files. Implement programs to maintain records and manipulate them in files.
- Write a program utilizing preprocessor directives such as #define, #include, and conditional compilation directives (#ifdef, #ifndef, #endif, #else) for defining constants, including files, and conditional compilation.

MINI - PROJECTS:

- Write a C program to build a simple calculator.

Instructions:

- The calculator should be capable of performing basic arithmetic operations such as addition, subtraction, multiplication, and division.
- Prompt the user to enter two numbers and the desired operation.
- Display the result of the operation.
- Implement error handling for invalid inputs, such as division by zero or unrecognized operations.
- Provide comments in your code to explain the logic and functionality of each section.
- Test your program with different sets of inputs to ensure its correctness.
- Write a C program to build a basic Library Management System.

Instructions:

- The Library Management System should provide functionalities for adding, deleting, searching, and displaying books.
- Each book record should include information such as title, author, ISBN, genre, and availability status.
- Implement appropriate data structures (e.g., arrays, linked lists) to manage the collection of books efficiently.
- Include options for users to perform operations like borrowing and returning books.
- Ensure error handling for scenarios such as attempting to borrow a book that is not available or deleting a book that is not in the library.
- Provide a user-friendly interface with clear prompts and instructions.
- Add comments in your code to explain the purpose of each function and major sections.
- Test your program thoroughly with various scenarios to validate its functionality and robustness.
- Write a C program to build a basic version of the Tic-tac-toe game.

Instructions:

- The Tic-tac-toe game should allow two players to take turns marking spaces on a 3x3 grid.

- Players should be represented by symbols, typically "X" and "O".
- The game should detect when a player has won by achieving three marks in a row (horizontally, vertically, or diagonally) or when the grid is full with no winner, resulting in a draw.
- Implement a user-friendly interface to display the game board and accept player input for placing marks.
- Ensure proper validation of user input to prevent placing marks on already occupied spaces or out-of-bounds positions.
- Provide options to start a new game or exit the program after each game concludes.
- Include comments in your code to explain the logic and functionality of each function.
- Test the game thoroughly to verify correct behavior in various scenarios, including winning, drawing, and invalid moves.
- Write a C program to build a typing tutor to help users improve their typing speed and accuracy.

Instructions:

- The typing tutor should provide a selection of text passages for users to practice typing.
- Display one passage at a time, and prompt the user to type it.
- Calculate and display statistics such as typing speed (in words per minute) and accuracy (percentage of correct keystrokes).
- Implement features to allow users to adjust settings such as passage difficulty, duration of practice sessions, and typing mode (e.g., timed or untimed).
- Include error detection and correction functionality to highlight mistakes made by the user and provide feedback.
- Design a user-friendly interface with clear instructions and visual cues to guide the user through the typing exercises.
- Ensure proper error handling for scenarios such as invalid input or unexpected program behavior.
- Document your code with comments to explain the purpose of each function and major sections.
- Test the program rigorously to verify its correctness, usability, and effectiveness in improving typing skills.

NOTE: This is only the suggested list of Practical and Projects. Instructor may frame other Practical and Projects relevant to the course content.

ELECTRONICS WORKSHOP	
Course Code: BEC 103 Contact Hours: L-2 T-0 P-2 Course Category: SEC	Credits: 3 Semester: 1

Introduction: This course introduces the practical concepts about electronic components, circuits and electronic instruments. This course will familiarize the students with the basic analog and digital circuits and implementing those using EDA Tools. The course will enable students to get a good opportunity for beginning their professional career even at the end of first year.

Course Objectives:

- To give an insight into fundamental concepts of semiconductor devices and identifying various electronic components.
- To design analog circuits and implement them using EDA tools
- To give the broad spectrum of analog principles and design equations.
- To Familiarize with Electronic and Measuring Instruments
- To analyze digital logic processes and implement logical operations using combinational logic circuits.

Pre-requisite: Theory of Semiconductor Physics

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

CO1: Understand the basic electronics components and instruments.

CO2: Differentiate between various ICs in terms of their identification numbers and functionalities.

CO3: Disassemble a computer and identify various peripherals and internal circuit component.

CO4: Design and analysis of Electronic circuits using EDA Tools.

Pedagogy: The teaching-learning of the course would be organized through lectures, tutorials, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT,web-based resources as well as flipped classroom teaching will be adopted.

Contents

UNIT-I	05 Hours
Review of semiconductor physics, p-n Junction diode, p-n diode characteristics and its operation, p-n junction capacitances (depletion and diffusion), Breakdown in p-n diodes. Diode Applications: Clipping and clamping circuits, Rectifier circuits, Zener diode, Zener diode as regulators. **Bipolar junction transistor:** Introduction and types of Transistors, construction, BJT characteristics in CB, CE & CC mode, operating point, AC/DC Load Line, leakage currents, saturation and cut off mode of operations, Ebers-moll model.	
UNIT-II	06 Hours
Bias stabilization: Need for stabilization, various biasing schemes, bias stability with respect to variations in Ico, V_{BE} & β, Stabilization factors, thermal stability. Measuring Instruments: Classification, Absolute and secondary instruments, indicating instruments, control, balancing and damping, constructional details, characteristics, errors in measurement. Ammeters, voltmeters: (DC/AC) PMMC, MI. Electrodynamometer type Wattmeter.	

UNIT-III	05 Hours
Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter. Digital Multi-meter: Block diagram, principle of operation, Electronic Voltmeter: Block diagram, principle of operation, Digital Frequency meter: Block diagram, principle of operation.	
UNIT-IV	04 Hours
Analog & Digital signals, AND, OR, NOT, NAND, NOR & XOR gates, Boolean algebra. Standard representation of Logical functions, K-map representation and simplification of logical functions, Don't care conditions, X-OR & X-NOR simplification of K-maps. Combinational circuits: Multiplexers, demultiplexers, Decoders & Encoders, Adders & Subtractor, Code Converters, comparators, decoder/ drivers for display devices.	
Text Books	
1.	B. L. Theraja, 'A Textbook of Electrical Technology - Volume I (Basic Electrical Engineering)", S. Chand and Company, 2020.
2.	Millman and Halkias, "Electronic devices and circuits" TMH, 4th Edition, 2015 (latest edition)
3.	R.P. Jain, Kishor Sarawadekar, "Modern Digital Electronics", TMH, 5th Edition, 2022.
Reference Books	
1.	Vincent Del Toro, "Electrical Engineering Fundamentals", Pearson Education India, 2015.
2.	Sedra & Smith, "Micro Electronic Circuits" Oxford University Press, 6th Edition, 2012 (latest edition).
3.	S. Salivahanan, S. Arivazhagan, "Digital circuits and design", Oxford Univ. Press, 5th Edition, 2018.

List of Topics for Electronics Workshop

Topic 1. To identify various components being used in any electronic circuit such as resistor, capacitor, various diodes (p-n junction, Zener, LED), transistors (BJT, MOSFET, FET), breadboard, potentiometer.

- Learn graphical symbols used to represent the various components.
- Find the value of resistance, capacitance by its color code and value mentioned on the component.

Topic 2. To **s**tudy the various control on the panel of a typical DSO, Multimeter.

Topic 3. To **s**tudy the various control on the panel of a function generator and DC power supply.

Topic 4. To Study the pin configuration of a given IC number.

Topic 5. To Measure the current, voltage & Power using electrical/electronic instruments

Topic 6. To study and verify the truth table of various logic gates on the breadboard.

Topic 8. To design an electronic circuit with discrete components on Breadboard/general purpose PCB.

Topic 9. To realize schematic of an electronic circuit using any design software (OrCAD/TINA/ KiCAD/ DesignSpark PCB/ any other available software).

Topic 10. To identify various peripheral devices including a keyboard, mouse, printer, and flash drive of a computer

Topic 11. To study motherboard and various ports in a computer for interaction with computer and identify various hardware peripherals like RAM, ROM and Processor

NETWORK ANALYSIS AND SYNTHESIS	
Course Code: BEC 104 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: II

Introduction: This course provides basics of electrical circuit concepts, circuit modelling and methods of circuit analysis in time domain and frequency domain. The individual will be able to solve simple and complex multi-dimensional circuits including direct current (DC) and alternating current (AC) circuits with the help of circuit theory and network theorems. The laboratory exercises will help to design, build, and implement basic AC and DC circuits. The aim of this course is to provide a thorough comprehension of the fundamental behavior of electrical and electronic circuits, two port networks, and network synthesis.

Course Objectives:

- To make the students capable of analyzing any given electrical network.
- To make the students learn how to synthesize an electrical network from a given impedance/admittance function.
- To analyze the behavior of the circuit's response in the time and frequency domain.
- To understand the significance of network functions.
- To learn techniques of solving circuits involving different active and passive elements.
- To learn several powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation, and several methods of simplifying networks.
- To analyze various types of a two-port network using network parameters, with different types of connections.

Pre-requisite: Basic course in Electrical Engineering.

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

CO1: Apply the fundamental concepts in solving and analyzing different electrical networks

CO2: Analyze the electrical network in different conditions by selecting relevant technique and apply mathematics in synthesizing the networks in time and frequency domain.

CO3: Evaluate the performance of a particular network from its analysis.

CO4: Understand the various laws and theorems related to electric networks

Pedagogy: The teaching-learning of the course would be organized through lectures, tutorials, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based resources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	10 Hours
Basic Concepts: Charge and Energy, Relationship of Field and Circuit Concepts, Capacitance, Inductance and Resistance Parameters, Directions for Current and Voltage, Active Element conventions, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems, Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Sawtooth signal, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits,Dot Convention for Coupled Circuits, Topological Description of Networks. **Network Equations:** Number of Network Equations, Source Transformations, Loop and Node Variable Analysis, Analysis with dependent current and voltage sources, Duality, Star/Delta connection, Superposition theorem, Thevenin's theorem, Norton's theorem, Source	

transformations,
Maximum power transfer theorem Compensation theorem, Reciprocity theorem, Millman's theorem,Telegen's theorem.

UNIT-II	10 Hours

Differential Equations and Initial Conditions in Networks: General and Particular Solutions, Time Constants, The Integrating Factor, Initial Conditions in Elements, second order Equations, Networks Excited by External Energy Sources, Time domain response of First order RL, RC andRLC circuits with and without initial conditions.

Laplace Transformation: Unit step & Sinusoidal response of RL, RC, and series, parallel and mixed RLC circuits. Transient analysis of different electrical circuits with and without initial conditions. Concept of Convolution theorem and its application, Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots) for series and parallel resonances, tuned circuits.

UNIT-III	10 Hours

Network Functions; Poles and Zeros: One-port and Two-port Network Functions, Pole and ZeroLocations for Driving-Point Functions, Time-domain Behavior.

Two-Port Parameters: Relationship of Two-Port Variables, Short-Circuit Admittance, Open-Circuit Impedance, Transmission and Hybrid Parameters, Equivalent circuits of two port parameters, Topological descriptions of different commonly used networks, π to T and T to π conversions, Reduction of complicated network, Symmetrical network; Matrix forms of input-output relations;

Cascade, Parallel and series connection of two ports; Iterative and image impedances, Characteristic impedance.

UNIT-IV	10 Hours

Passive Network Synthesis: Synthesis vs. analysis, Elements of circuit synthesis, LL FPB networks, Purpose and scope of network synthesis, Positive Real Function: Definition, Necessary and sufficientconditions for a function to be positive real, Testing of driving point functions for positive realness. Hurwitz polynomial, FOSTER and CAUER Forms: L-C Immittance Functions, Foster Form I, Foster Form II, First Cauer Form, II Cauer Form, RC impedance Functions, Cauer Forms of RC Networks,Cauer Forms of RL Impedance and RC Admittance.

Text Books

1.	W. Hayt, J.E. Kemmerley and S. M. Durbin, "Engineering circuit Analysis", Tata McGraw-Hill, 8th Edition, 2013 (latest edition).
2.	M.E.VanValkenburg, "Network Analysis", Prentice-Hall, 3rd Edition, 2006 (latest edition).
3.	V. K, Aatre, "Network Theory and Filter Design", New Age International Publishers, 3rd Edition, 2014 (latest edition).

Reference Books

1.	J. A, Edminister, "Theory and Problems of Electric Circuits", Schaum's Outline Series, Tata McGraw Hill, 5th Edition, 2017 (latest edition).
2.	R. C, Dorf & J. A, Svoboda, "Introduction to Electric Circuits", John Wiley & Sons, 8th Edition, 2010 (latest edition).
3.	Sudhakar. A and Shyammohan S.Palli, "Circuits and Networks Analysis and Synthesis", Tata McGraw- Hill Publishing Company Limited, 5th Edition, 2017 (latest edition).

List of Experiments

1. To implement the given circuit on the breadboard and verify Thevenin's theorem.
2. To implement the given circuit on the breadboard and verify the Maximum power transfer theorem.
3. To implement the given circuit on the breadboard and verify the Reciprocity theorem.
4. To implement the given circuit on the breadboard and verify the Superposition theorem.
5. To implement the given circuit on the breadboard and find the Z parameter (open circuit parameter) of a two-port resistive network.
6. To implement the given circuit on the breadboard and find the Y parameter (short circuit parameter) of a two-port resistive network.
7. To implement the given circuit on the breadboard and find the ABCD parameter (transmission parameter) of a two-port resistive network.
8. To implement the given circuit on the breadboard and find the H parameter (hybrid parameter) of a two-port resistive network.
9. To implement the given circuit on the breadboard and find the G parameter (hybrid parameter) of a two-port resistive network.
10. To implement the given circuit on the breadboard and find the Z parameter of a series-series connected two port resistive network.
11. To implement the given circuit on the breadboard and find the ABCD parameter of a cascade-connected two-port resistive network.
12. To implement the given circuit on the breadboard and find the Y parameter of a parallel-parallel connected two port resistive network.

PROGRAMMING FUNDAMENTALS	
Course Code: BAI 104 Contact Hours: L-2 T-0 P-2 Course Category: SEC/Interdisciplinary	Credits: 3 Semester: I/II

Introduction: Python is a high-level, general-purpose programming language with support for Object Oriented Programming, known for its readability and straightforward syntax. The goal is to gain knowledge of Python syntax and semantics, learn and apply core programming concepts, design and write fully-functional Python programs for real-world applications.

Course Objectives:

- To know the basics of algorithmic problem solving for reading and writing Python programs.
- To develop Python programs with conditions and loops.
- To use Python data structures –- lists, tuples dictionaries.
- To define Python functions and call them.
- To do input/output with files in Python

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

CO1: Illustrate the syntax and semantics, control statements and looping structures in Python programming language.

CO2: Learn and apply essential Python data structures for effective data operations.

CO3: Implement modular programming concepts to design and develop reusable code structures.

CO4: Explore and apply Python libraries to address real-world challenges.

Pedagogy: Lectures will be imparted along with hands-on lab sessions and the latest real-world case studies where python can be used.

Contents

UNIT-I	07 Hours
Introduction to programming: Introduction to Computers, Types of Programming Languages, Algorithms, Flowcharts. Data types, Variables, Assignments, Immutable variables, Numerical types, Arithmetic operators and Expressions, Comments, Understanding error messages. Conditions, Boolean logic, Logical Operators, Ranges, Control statements, Loops. **Introduction to OOP:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, Polymorphism	
UNIT-II	07 Hours
Strings: Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Indexing, Searching, and Manipulating Strings. **Lists:** Introduction to Lists, List slicing, Basic List Operations, Built-in Functions of Lists, Copying Lists, Two-Dimensional Lists. **Tuples:** Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-in Functions used in Tuples, Tuple Methods. **Dictionary:** dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.	
UNIT-III	07 Hours
Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default	

Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments, Functions-Generating Random Numbers. **Recursion:** Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.	
UNIT-IV	07 Hours
Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Exceptions, Python math, random, os and os.path, date, time, scipy modules. **Python Packages:** Simple programs using the built-in functions of packages matplotlib, numpy, pandas, keras etc.	
Text Books	
1.	Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning, 2019/ Latest Edition.
2.	Allen B. Downey, "Think Python: How to think like a Computer Scientist", John Wiley, 2016/ Latest Edition.
Reference Books	
1.	Mark Lutz, "Learning Python", O'Reilly Publication, 2013/ Latest Edition.
2.	Charles R. Severance, "Python for Everybody: Exploring Data in Python 3", Shroff Publishers. 2016/ Latest Edition
3.	Martin C. Brown, "Python: The Complete Reference", McGraw-Hill, 2018/ Latest Edition.
4.	John V Guttag, "Introduction to Computation and Programming Using Python", MIT Press, Revised and expanded Edition, 2013 / Latest Edition

List of Practical's

1) Implement a program to calculate the remainder of two numbers using the modulo operator.
2) Write a program that takes two lists and returns True if they have at least one common member.
3) Write a Python script to sort (ascending and descending) a dictionary by value.
4) Write Python programs to demonstrate the following: i) input( ) ii) print( ) iii) 'sep' attribute iv) 'end' attribute v) replacement Operator ({ })
5) Python program that accepts a string and calculates the number of digits and Letters.
6) Write a Python program to get a substring from a given string starting from the 3rd character to the 5th character.
7) Write a Python program to remove a key-value pair from a dictionary.
8) Write a Python program to read and write to a binary file using random access methods.
9) Write a Python program to handle the exception that occurs when trying to open a non-existing file.
10) Write a Python program to handle the exception that occurs when accessing an index out of range in a list.
11) Create a Python class Student with attributes name and grade. Use the__str__ and __len__ in-built functions to customize the string representation and length of the object.
12) Create a Python class named Car with attributes brand and model. Create an object of this class and print its attributes.
13) Write a Python function that takes a list as an argument and returns the sum of all the elements in the list. Test this function with a sample list.
14) Write a Python function named operate that takes two numbers and an operation as arguments. The operation can be add, subtract, multiply, or divide. Use lambda functions to perform the respective operations.
15) Use Matplotlib to plot a sine wave from 0 to 2π.
16) Create a NumPy array containing numbers from 1 to 10. Calculate its mean, median, and standard deviation.

SIGNALS AND SYSTEMS	
Course Code: BEC 102 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: I

Introduction: This course introduces the concept of analog and digital signal processing, which formsan integral part of engineering systems in many diverse areas, including seismic data processing, communications, speech processing, image processing, defense electronics, consumer electronics, and consumer products. The course presents and integrates the basic concepts for both continuous-time and discrete-time signals and systems. It addresses classifications of signals and systems, basic signal operations, linear time-invariant (LTI) systems, time-domain analysis of LTI systems, signal representation using Fourier series, continuous-time Fourier transform, discrete-time Fourier transform,and Laplace transform.

Course Objective:

- To provide a strong foundation on signals and systems, which is the foundation of communication and signal processing.
- To make the students learn about basic continuous time and discrete time signals and systems.
- To provide an understanding of the application of various transforms for analysis of signals andsystems in both continuous time and discrete time domains.
- To create an understanding of the power and energy signals and spectrum.
- To create strong foundation of communication and signal processing to be covered in thesubsequent semesters.

Pre-requisite: Inclination to learn mathematics, basic knowledge of differential equations, electricalcircuits and networks.

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

CO1: Understand various types of signals, classify them, and perform various operation on them.

CO2: Understand about various types of systems, classify them, analyze them, and understand theirresponse behavior.

CO3: Apply transforms in the analysis of signals and systems.

CO4: Analyze the effects of applying various properties and operations on signals and systems bycarrying out simulation.

Pedagogy: The teaching-learning of the course would be organized through lectures, tutorials, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT,web-based resources as well as flipped classroom teaching will be adopted.

Contents

UNIT-I	10 Hours
Introduction: Signals: Classification of signals, Continuous – Discrete time; Even/Odd signals, Periodic/ Nonperiodic signals, Deterministic/Random signals, Energy/Power signals; Basic operations on signals: Basic (Continuous/Discrete) signals – unit step, unit impulse, sinusoidal and complex exponential signals etc. **Operations on signals:** Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, time shifting and folding, precedence rule. Systems (Continuous/Discrete): Representation, Classification – Linear/Nonlinear,	

Causal/Non- causal, Time invariant/Time variant, with/ without memory; BIBO stability, Feedback system, system properties from impulse response.
Concept of convolution in time domain, graphical convolution, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between convolution and correlation.

UNIT-II	10 Hours

Signal Transmission through Linear Systems: Linear Time Invariant (LTI) systems, Differential/Difference equation representation of LTI system and its solution. Impulse response and Transfer function of a LTI system, interconnection of LTI systems, evaluating impulse response from the step response. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics.
Fourier series: Fourier series – half range expansions –Parseval's identity – Transform integrals –Fourier Integrals – theorem – Sine and cosine integrals. Fourier series for periodic signals;Properties of continuous time Fourier Series (CTFS), Convergence of Fourier series, Discrete time Fourier Series (DTFS), Properties of DTFS, Fourier series and LTI system;.

UNIT-III	10 Hours

Fourier analysis of continuous time signals and systems: Deriving Fourier transform (FT) from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals– Properties of continuous time FT, problem solving using properties, amplitude spectrum, phase spectrum of the signal and system. Interplay between time and frequency domain using sinc and rectangular signals, energy spectral density, parsevals theorem, power spectral density, inter relation between correlation and spectral density. Limitations of FT and need of Laplace transform and Z-transform
Laplace transform analysis of systems – Inverse transforms, linearity, shifting, Transforms of derivatives and integrals – ROC and pole zero concept – Frequency response of continuous time LTI systems-Transfer function of LTI system, Initial value theorem and final value theorem, frequency response from pole zero locations, Bode plots, solution of ODEs using Laplace transform, zero-state and zero-input response, frequency response from pole zero locations, Laplace Transform of certain signals using waveform synthesis, Relation between Laplace transform and Fourier transform of a signal.

UNIT-IV	10 Hours

Sampling: Sampling theorem, Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Aliasing, Sampling of discrete time signals,
Z transforms – definition – ROC – inverse transforms – properties, Initial value theorem and final value theorem, Distinction between Laplace transform, Fourier transform and Z transform, frequency response of discrete time LTI systems, Pole-Zero plot, Causality and stability, unilateral Z-transform and solution of difference equations, Realization of Discrete Systems: Structural realization of discrete systems – Direct form– I, Direct form-II, Cascade and parallel forms

Text Books

1.	Alan V. Oppenheim, Alan S. Wilsky and Nawab, "Signals and Systems", Prentice Hall, 2ndEdition, 2017 (latest edition)
2.	J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles, Algorithms andApplications", Pearson Education, 4th Edition, 2009 (latest edition).
3.	Simon Haykin and Bary Van Veen, "Signals and Systems", Wiley India Publications, 2ndEdition, 2007 (latest edition)

Reference Books

1.	Michal J. Roberts and Govind Sharma, "Signals and Systems", Tata Mc-Graw Hill Publications, 2nd Edition, 2017 (latest edition).

2.	B.P. Lathi, "Linear Systems and Signals", Oxford University Press, 3rd Edition, 2017(latest edition).
3.	Ramesh Babu, "Signal & Systems", Scitech, 4th Edition, 2011 (latest edition).

LIST OF EXPERIMENTS

Exp-1 Signals and their properties: Demonstration of different signals and their properties.

1. To demonstrate some simple signal viz. sinusoidal signal, delta function, unit step function and periodic signal.
2. To create user defined functions for signal operation: signal addition, amplitude-scaling, time shifting, time scaling and time inversion.
3. To explore the commutation of even and odd symmetries in a signal with algebraic operations.
4. To explore the various properties of the impulse signals.
5. To visualize the complex exponential signal and real sinusoids.

Exp-2 System and their property: Demonstration of Salient properties systems.

1. To identify a given system as linear or non-linear.
2. To explore the time variance and time invariance property of a given system.
3. To explore causality and non-causality property of a system.

Exp-3 Fourier analysis of signals: Analysis of Fourier properties of Signals.

1. To visualize the relationship between the continuous-time Fourier series and Fourier transform of a signal.
2. To visualize the relationship between the discrete-time Fourier series and Fourier transform of a signal.
3. To visualize the relationship between continuous-time and discrete-time Fourier transform of a signals.
4. To visualize the relationship among Fourier analysis methods.
5. Take rectangular and sinc signal as examples and demonstrate the applications of CTFT properties. And also demonstrate the interplay between the time and frequency domain.

Exp-4 Sampling and signal reconstruction: Demonstration of sampling/ reconstruction of signals and spectral analysis using DFT.

1. To demonstrate the time domain sampling of bandlimited signals (Nyquist theorem).
2. To demonstrate the time domain sampling of non-bandlimited signals and antialiasing filter.
3. To demonstrate the signal reconstruction using zero-order hold and first-order hold filters.
4. To demonstrate the sampling in frequency domain (Discrete Fourier Transform).
5. To demonstrate the spectral analysis using Discrete Fourier Transform.

Exp-5 Analysis of LTI system response: Convolution and correlation of signals.

1. To demonstrate the convolution of two continuous-time signals.
2. To demonstrate the convolution of two discrete-time signals.
3. To compute auto-correlation and cross-correlation of two signals and verify its properties
4. Determine the following
    a) Energy from definition
    b) Energy Spectral Density directly
    c) ESD from Autocorrelation

Exp-6 Laplace and Z-transform: Determination of Laplace and Z-transform and its inverse

1. To compute and plot the impulse response and pole-zero diagram of transfer function using Laplace transform.
2. To compute and plot the impulse response and pole-zero diagram of transfer function using Z-transform.
3. State and prove the properties of Lapalce Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis
4. State and prove the properties of Z-Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis

OBJECT ORIENTED PROGRAMMING	
Course Code: BIT 102 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: II

Introduction: This course is designed to enable students to understand object oriented concepts, principles and techniques using C++ .As well as students will understand how to use C++ classes, class libraries and related concepts like inheritance , polymorphism and File Input output.

Course Objectives:

- To learn Object Oriented principles
- Students will able to practice object oriented programming concepts using C++ programming

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

CO1: To learn the process of representing problems and writing, compiling and debugging programs.

CO2: To introduce the principles of inheritance and polymorphism**.**

CO3: Implement programs to express proficiency and improve effective programming skills using classes, objects.

CO4: Understand commonly used operations for file system, exception handling and create namespace solutions.

Pedagogy: Lectures will be imparted along with hands-on lab sessions and development of Object Oriented programs with use of arrays, pointers, classes and objects.

Contents

UNIT-I	10 Hours
Introduction to Object Oriented Programming: Need for Object Oriented Programming, Comparison of Programming paradigms, Characteristics of Object-Oriented Programming Languages, Structure of a C++ program, Use of cin and cout, Compilation process. C++ Programming Language (Procedural): Tokens, Data Types (Basic, Advanced and Derived), Variables, Reference vs Pointers, Operators (scope resolution, dynamic memory related, typecast), Expressions, Functions (inline function, const arguments, default arguments).	
UNIT-II	11 Hours
Classes and Objects: Objects, Classes, Encapsulation, Data Abstraction, Role of private and public access specifier, Memory organization of class, Member functions – inline and non inline, static member variables, Friend functions, Class vs Structure, Constructors – default, parameterized, copy and dynamic, Destructors, Assignment operator Polymorphism: Function overloading, Constructor overloading, Compile time polymorphism, Overloading Rules, Operator Overloading (Unary and Binary) as member function/friend function, Example operators to be overloaded: Arithmetic, Output/Input, Prefix/ Postfix Increment and Decrement, Comparison, Assignment, subscript and function call Operator.	
UNIT-III	10 Hours
Inheritance: Inheritance, Types of Inheritance, Use of protected access specifier, Virtual base class, Ambiguity resolution using scope resolution operator and Virtual base class, Overriding inheritance methods, Constructors and Destructor in derived classes. Runtime polymorphism, Pointer to objects, Virtual Functions (concept of virtual table), pure virtual functions, Abstract Class. Managing Input / Output: Concept of streams, console I/O, File I/O – Predefined classes, file opening & closing, file manipulation, read & write operations, sequential and random file access.	

UNIT-IV	11 Hours
Exception Handling: Basic mechanism, Throwing, Catching and Re-throwing. Namespace: Basic concept, role of scope resolution operator and using keyword. Generic Programming: User defined Templates - Class templates with and without multiple parameters and Function templates with and without parameters, Template overloading.	
Text Books	
1.	Bjarne Stroustrup , "The C++ Programming Language", Addison Wesley, 4th Edition,2022/latest edition
2.	Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill, 2017/latest edition.
Reference Books	
1.	Balagurusamy, E. "Object oriented programming with C++.",8th Edition, McGraw Hill, 2021 /latest edition

Practical List

1. Using conditional operator shown as follows, determine:

   a. If the ages of Ram and Shyam are input through the keyboard, write a program to determine the younger of the two.
   b. Write a program to check whether a number is even or odd.
   c. Write a program to check largest of three numbers.
   d. Write a program to check whether a number is positive or negative.
   e. Write a program to enter two numbers. Make a comparison between them with the conditional operator. If the first number is greater than the second, perform division operation otherwise multiplication operation.
2. Write a program to input angles of a triangle and check whether triangle is valid or not.
3. Write a program to input marks of five subjects Physics, Chemistry, Biology, Mathematics and Computer. Calculate percentage and grade according to following:
   Percentage >= 90% : Grade A
   Percentage >= 80% : Grade B
   Percentage >= 70% : Grade C
   Percentage >= 60% : Grade D
   Percentage >= 40% : Grade E
   Percentage < 40% : Grade F

Using classes, objects and functions, write the following codes

4. Create a class called Musicians to contain three methods string ( ), wind ( ) and percussion ( ). Each of these methods should initialize a string array to contain the following instruments
   – veena, guitar, sitar, sarod and mandolin under string ( )
   – flute, clarinet saxophone, nadhaswaram and piccolo under wind ( )
   – tabla, mridangam, bangos, drums and tambour under percussion ( )
   The base class should also display the contents of the arrays that are initialized using show() method.

Create a derived class called InsType to contain a method called get ( ) and show ( ). The get ( ) method must display Type of instruments to be displayed

a. String instruments
b. ind instruments
c. Percussion instruments

The show ( ) method should display the relevant detail according to our choice. The base class variables must be accessible only to its derived classes.

5. Create a base class that asks the user to enter a complex number having two components – real and img. Also create a method in the base class to display the user input. Create a derived class that accepts another complex number from user and adds the complex number of its own with the base. Display the added result. Finally make a third class that is friend of derived and calculates the difference of base complex number and its own complex number. Display the result.

6. Create a base class student. Create a function get() to get the student details including roll number and marks of 3 subjects. Create a derived class sports. Declare and define the function getsm() to input the sports marks of the student. Create a class reportcard derived from student and sports. Create the function display() to find out the total and average of all marks of the student including sports marks. Display the report card results.

7. Write a C++ program to demonstrate multiple inheritance by creating a class cuboid which extends class rectangle, class shape. It calculates area and volume. Use appropriate constructors and member variables.

ELEMENTS OF MECHANICAL ENGINEERING	
Course Code: BMA 106 Contact Hours: L -3 T-0 P-2 Course Category: DCC	Credits:4 Semesters: 1

Introduction: Understanding of basic principles of Mechanical Engineering is required in various fields of engineering.

Course Objective:

1. To understand the various types of engineering materials
2. To understand the various kinds of stresses developing in the parts due to the applied load
3. To get well-versed and understand the different mechanical transmission drives

Prerequisite: NIL

Course Outcomes:

CO1: Acquire a basic understanding role of Mechanical Engineering in the industry and society

CO 2: Acquire a basic understanding of the formation of steam and its industrial Application

CO3: Acquire knowledge of various engineering materials and various joining processes.

CO4: Acquire knowledge of different types of engineering stress strain, SFD, and BMD

CO5: Acquire essential experience on basic Power transmission systems,

Pedagogy: Classroom teaching is supported by White board, black board, chalks, markers, projector and screen. The handwritten notes, PowerPoint slides and assignments will be provided to the students and also mailed to them. The students can also raise their issues related to the course in the class and mail.

Contents

UNIT-I	10 Hours
Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors and contribute to the GDP. **Thermodynamics, Steam Formation and Application:** Concept of work and energy, laws of thermodynamics, Carnot cycle, petrol and diesel cycle, Formation of steam and thermodynamic properties of steam (Simple Problems using Steam Tables), Applications of steam in industries namely, Sugar industry, Dairy industry, Paper industry, Food processing industry for Heating/Sterilization, Propulsion/Drive, Motive, Atomization, Cleaning, Miniaturization, Humidification.	
UNIT-II	10 Hours
Engineering Materials: Properties, Composition, and Industrial Application of Engineering Materials. **Metals**-Ferrous: Tool steels and stainless steels. Non-ferrous /metals: aluminum alloys.	

Ceramics- Glass, optical fiber glass, cermets. Composites- Fiber reinforced composites, Metal
matrix Composites. Smart materials- Piezoelectric materials, shape memory alloys, semiconductors, and super-insulators.

Metal Joining Processes:

Soldering, Brazing and Welding: Definitions. Classification and methods of soldering, brazing, and welding. Brief description of arc welding, Oxy-acetylene welding, Introduction to
TIG welding and MIG welding.

UNIT-III	10 Hours

Mechanics of Solids

Simple Stresses & strains: Tensile, Compressive, shear and volumetric stresses and Strains, stress strain diagram, complementary shear stress, lateral strain and Poisson's ratio.

Simple bending: Shear force and bending moment diagrams of cantilevers, simply supported
beams under concentrated with and without overhangs.

UNIT-IV	10 Hours

Mechanical Power Transmission:

Gear Drives: Types - spur, helical, bevel, worm and rack and pinion, velocity ratio, Gear Trains and their application: simple and compound Gear Trains, Simple numerical problems on Gear trains involving velocity ratios

Belt Drives: Components of belt drive and concept of velocity ratio; Types of belt drives, Flat-
Belt Drive, V-Belt Drive and Application of Belt Drives.
Simple numerical problems on Belt drives involving velocity ratios,

Text Books

1.	Elements of Mechanical Engineering, K R Gopala Krishna, Subhash Publications, 2008
2.	Elements of Workshop Technology (Vol. 1 and 2), Hazra Choudhry and Nirzar Roy, Media Promoters and Publishers Pvt. Ltd., 2010.
3.	An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, ThirdEdition, 2012
4.	Basic and Applied Thermodynamics, P.K.Nag, Tata McGraw Hill 2nd Ed., 2002

Reference Books

1.	Ryder G.H., "Strength of Materials", Macmillan, Delhi, 2003.
2.	V. B. Bhandari, "Design of Machine Elements", 5th Edition, McGraw Hill, 2017.
3.	William D. Callister, "Material Science & Engineering" Wiley India Ltd., 2010

ENGINEERING GRAPHICS & CAD MODELLING	
Course Code: BMA 111 Contact Hours: L-2 T-0 P-2 Course Category: SEC	Credits: 3 Semesters: 2

Introduction: Technical Graphics is used to communicate the necessary technical information required for the manufacture and assembly of machine components. These drawings follow rules laid down by national and International Organizations for Standards (ISO). Hence the knowledge of the different standards is very essential.

Course Objectives:

1. To learn basic engineering graphic communication concepts.

2. To learn the principles of orthographic projections

3. To know the projections of planes and solids

4. To learn principles of isometric projections of simple solids

5. To learn conversion of orthographic views to isometric views and vice-versa.

Course Outcomes:

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

CO1: Communicate engineering graphics by doing geometric constructions and Dimensioning.

CO2: Produce basic orthographic projections on projections of points and lines.

CO3: Produce orthographic projections on planes and solids.

CO4: Develop isometric drawings of simple objects using CAD software 3D interface.

CO5: Make conversion of isometric views to orthographic views and vice-versa using any CAD software

Prerequisite: NIL

Pedagogy: Classroom teaching is supported by White board, black board, chalks, markers, projector and screen. The hand written notes, PowerPoint slides and assignments will be provided to the students. The students can also raise their issues related to the course in the class

List of Experiments:

General: Importance, Significance and scope of engineering drawing Lettering, Dimensioning, Scales, Sense of Proportioning, Different types of Projections, B.I.S. Specification, line symbols.

Projections of Points and Lines: Introduction of planes of projection, Reference and auxiliary planes, projections of points and lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations, etc., projections of points lines in the planes, conversion of the oblique plane into the auxiliary plane, and solution of related problems.

Projections of Plane Figures: Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining the true shape

of the plane figure by projection.

Projection of Solids: Simple cases when a solid is placed indifferent positions, axes, faces and lines lying in the faces of the solid making given angles.

Isometric and Orthographic Views: First and Third angle of the system of projection, sketching of orthographic views from pictorial views and vice–versa, Sectional views. Principles of dimensioning, Development of lateral surfaces of simple solids.

CAD Modelling: Introduction to available design and drafting softwares, creations of 2D sketches.

3D Modelling Based Features: geometric modelling (3D models), practical work should be done using CAD software (e.g., CREO) with various part modelling features such as extrude and revolve.

Text Books

1.	N.Sideshwer, P. Kannaiaha, V.V.S. Sastry, Engineering Graphics , Tata McGraw Hill Education, 2005
2.	Engineering Graphics, Chandra, A.M. and Chandra Satish, CRC Press 2003
3.	Computer Aided Engineering Graphics by Rajashekar Patil, New Age International Pvt. Ltd.

Reference Books

1.	N.D. Bhatt, Engineering Drawing Charotar Publications 2023
2.	Engineering Graphics, Naveen Kumar and S C Sharma 2013

List of Experiments

EG Lab:

Make Drawing sheets for following:

1. Lettering, dimensioning and lines and learn concept of Projections.
2. Types of Scales.
3. Projection of Points.
4. Projection of Lines.
5. Projection of Lines inclined to both the reference planes.
6. Projection of Planes.
7. Projection of Solids.
8. Section of Solids.
9. Development of Surfaces.
10. Isometric Projections.

CAD Modeling Lab:

Work on CAD software on following:

1. Introduction to software: user interface, menus and toolboxes.
2. Create sketched geometry using commands such as line, polyline, circle, rectangle, etc.
3. Create sketched geometry using constraints and commands such as cut, mirror, trim and symmetry, etc.
4. Create part model using extrude and revolve commands.
5. Create part model using commands such as pattern, hole, fillet, chamfer, etc.
6. Create part model using rib, shaft and multi-section solid.
7. Introduction to assembly
8. Assembly of mechanical component such as piston and piston pin
9. Assembly of universal coupling
10. Assembly of knuckle joint
11. Create engineering drawing and bill of materials

ENGINEERING MECHANICS	
Course Code: BMA 103 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 1

Introduction: Engineering mechanics deals with the various types of forces, their analysis and applications. The students need to design applications and this subject gives basic knowledge for designing and algorithm development for software applications.

Course Objective: The course will make the student comfortable with the concepts of forces and their applications. It provides the basic knowledge required to understand and apply concepts in subjects such as: Machine Design, Theory of Machines, Strength of Materials, Fluid Mechanics and design projects. The students are further provided with hands-on practical exposure on topics covered in the course.

Course Outcomes: Having successfully completed this course the student will be able to:

CO1: Understand and apply concepts related to different types of forces and friction acting on the elements.

CO2: Understand apply concepts of centroid, Moment of Inertia and trusses.

CO3: Analyse and evaluate problems related to kinematics and kinetics of particles.

CO4: Analyse and evaluate problems related to kinematics and kinetics of rigid Bodies

Pedagogy: The classroom sessions will be aimed at creating a strong theoretical basis with strong emphasis on the application part and tutorial sessions will give concentrated attention to individual student.

CONTENTS

UNIT-I	11 Hours
Force Systems: Introduction, Laws of Mechanics, Force Systems - Force, moment & couple, Varignon's theorem, Resultant of concurrent and non-concurrent forces, Free Body Diagram, Equilibrium conditions, Application to various problems. **Friction:** Introduction, Laws of Dry Friction, Coefficients of Friction, Angle of Friction, Cone of friction, Applications of Friction in Wedges, Ladder, Inclined Plane.	
UNIT-II	11 Hours
Centroid and Centre of gravity: Introduction, Centre of gravity, Centroids of lines, Areas & Volumes, Centroid of Composite bodies, Pappus theorems. **Moment of Inertia:** Introduction, Moment of Inertia of Area, Polar Moment of Inertia, Radius of gyration, Parallel axis and Perpendicular axis theorem, Moment of inertia of composite areas, MOI about an arbitrary axis, Radius of gyration, Moment of Inertia of masses, Moment of Inertia of Solids of Revolutions **Trusses:** Introduction, Various types of trusses, Perfect and imperfect truss, Assumption in the truss analysis, Analysis of perfect plane trusses by the method of joints and method of section.	
UNIT-III	10 Hours
Kinematics of Particles: Equation of motion, Rectilinear motion and plane curvilinear motion, Rectangular coordinates, Normal and tangential components. **Kinetics of Particles:** Work energy equation, Conservation of energy, Principle of Impulse and momentum, Linear and angular momentum, D'Alembert's principle, Conservation of momentum, Impact of bodies, Co-efficient of restitution, Loss of energy during impact.	
UNIT-IV	10 Hours
Kinematics of Rigid Bodies: Concept of rigid body, Rotation, translation and general plane motion of rigid bodies, Analysis by relative velocity and instantaneous center of rotation methods. Application to various problems.	

Kinetics of Rigid Bodies: Rotary motion and torque, Moment of momentum, Laws of Rotary motion, Torque and angular momentum, Kinetic energy due to rotation, Work energy principle and principle of conservation of energy applied to rigid bodies, Equation of motion.	
Text Books	
1.	D. S. Kumar, Engineering Mechanics, S.K. Kataria & Sons, Delhi, Latest Edition.
2.	I. B. Prasad: A Text Book of Applied Mechanics, Khanna Pub. Delhi. Latest Edition
3.	A.K. Tayal: Engineering Mechanics (Statics and Dynamics) Umesh Pub. Delhi. Latest Edition
Reference Books	
1.	I. H. Shames, Engineering Mechanics—Statics and Dynamics, Latest Edition, Prentice Hall of India, 1996.
2.	F.P. Beer and E.R. Johnston, Vector Mechanics for Engineers – Statics, McGraw Hill Book Company, Latest Edition.

List of Experiments

1. To verify the law of Force Polygon;
2. To verify the law of Moments using Parallel Force apparatus (Simply supported type);
3. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane;
4. To find the forces in the members of Jib Crane;
5. To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack;
6. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle;
7. To determine the MA, VR, Efficiency of Worm Wheel;
8. Verification of force transmitted by members of given truss;
9. To verify the law of moments using Bell crank lever;
10. 10. To find CG and moment of Inertia of an irregular body

WORKSHOP PRACTICE	
Course Code: BMA103 Contact Hours: L-2 T-0 P-2 Course Category: SEC	Credits: 3 Semesters: 1

Introduction: This course provides hands on experience in preparing simple jobs in various shops like; Fitting Shop, Sheet Metal, Welding Shop, Foundry Shop and Machine Shop.

Prerequisite: NIL

Course Outcomes:

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

CO1: Understand the basic concept of workshop practice and safety useful for our daily living.

CO2: Understand the use of various tool used in different shops of workshop.

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

CO4: Apply hands on practice of various processes of Workshop which give a lot of confidence to manufacture physical prototypes in project works.

Pedagogy: Classroom teaching is supported by White board, black board, chalks, markers, projector and screen. The hand-written notes, Power Point slides and assignments will be provided to the students and also mailed to them. The students can also raise their issues related to the course in the class and mail

Contents

UNIT-I	8 Hours
Introduction and demonstration: Introduction to various shops/ sections and workshop layouts, safety norms to be followed in a workshop should be conveyed to students. **Fitting shop:** Introduction of tools and operations, types of marking tools and their uses, types of fitting cutting tool and their uses, fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping. Typical jobs that may be made in this practice module such as: to make a Gauge from MS plate, joint (plug and socket) etc.	
UNIT-II	8 Hours
Sheet Metal shop: Introduction of tools and operations, types of various tools, Typical jobs that may be made in this practice module such as: Tray, Frustum of cone, Prism (Hexagon & Pentagon), Truncated Square Pyramid, Funnel. **Welding & Soldering shop:** Introduction of Tools, Types of welding Joint, Arc welding, Gas welding. Soldering, Brazing, Typical jobs that may be made in this practice module such as: To join two thick (approx 5mm) MS plates by manual metal arc welding/gas welding.	
UNIT-III	7 Hours
Foundry shop: Introduction to foundry, types of moulds and pattern, tool used in foundry, types of moulding sand, properties of moulding sand, Additives, binders, pattern material, moulding processes and mould making, Typical jobs that may be made in this practice module such as: to	

prepare a sand mold, using the given single piece patter and Split-piece pattern etc.	
UNIT-IV	7 Hours
Machine Shop:- Introduction of machine tools and operations, Demonstrations of basic machine tools like Lathe, Shaper, drilling, Milling machine and CNC with basic operations and uses, exposure to a 3D printing machine, 3D printing of at least one sample model using available materials.	
Text Books	
1.	Raghuvanshi B.S., "Workshop Technology Vol. I & II", Dhanpath Rai & Sons, 2017.
2.	Bawa H S., "Workshop Practices", Tata McGraw-Hill, 2009.
3.	John K.C., "Mechanical Workshop Practice", PHI, 2010, 2nd Ed.
Reference Books	
1.	Choudhury Hajra S.K., Choudhury Hajra A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology Vol. I & II", Media promoters and publishers private limited, Mumbai, 2008 and 2010.
2.	R. K. Jain, Production Engineering, Khanna Publishers, 2001.
3.	Kannaiah P. and Narayana K.L., "Workshop Manual, Scitech publishers", 2009. 2 nd Ed.

ELECTRICAL AND HYBRID VEHICLE TECHNOLOGY	
Course Code: BMA 108 Contact Hours: L-2 T-0 P-2 Course Category: Interdisciplinary	Credits: 3 Semesters: 1 & 2

Introduction: This course is designed for students, professionals, engineers, and enthusiasts who seek to explore the rapidly evolving field of electric and hybrid electric vehicles (EVs and HEVs) and their pivotal role in sustainable transportation.

Prerequisite: NIL

Course Outcomes:

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

CO1: Understand the basic working and characteristic performance of EHV & PHEVs.

CO2: Understand the basic functioning of both Electric and Hybrid vehicles and the drive train technologies.

CO3: Understand detail electric propulsion systems, types of motors in Electric vehicles.

CO4: Understand the different concepts of charging related to both EHV& PHEV operation & energy management.

CO5: Understand different possible energy storage systems for both EHV & PHEV

Pedagogy: Classroom teaching is supported by White board, black board, chalks, markers, projector and screen. The hand-written notes, Power Point slides and assignments will be provided to the students and also mailed to them. The students can also raise their issues related to the course in the class and mail

Contents

UNIT-I	7 Hours
Introduction to EV: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, Classification of EV, Architecture of HEV, Power flow control in hybrid drive train topologies.	
UNIT-II	8 Hours
Electric Propulsion Systems and Chargers: Introduction to electric components used in HEV's, DC Motor drives, permanent magnet BLDC & SRM motor drives, switch Reluctance Motor drives, plug-in hybrid electric vehicles, operating principles of plug- in hybrid vehicle, fundamentals of chargers, charger classification and standards, charger requirements, topology selection for Level 1 and 2 AC Chargers: Front-End AC–DC Converter Topologies, Isolated DC–DC Converter Topologies, Wireless Chargers.	
UNIT-III	8 Hours
Energy Storage: Introduction to energy storage requirements in Electric Vehicles, battery parameters, Battery based energy storage: Lead acid battery, Lithium Ion Battery and Metal Air batteries, Super Capacitor based energy storage, Fuel Cell based energy storage, Hybridization of different energy storage device.	
UNIT-IV	7 Hours
Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy	

management strategies. Introduction to various charging techniques and schematic of charging stations.	
Text Books	
1.	C. Mi, M. A. Masrur and D. W. Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons, 2011.
2.	Ali Emadi, Advanced Electrical Hybrid Vehicles, CRC Press, 2015, Taylor & Francis Group.
3.	M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2004.
Reference Books	
1.	T. Denton, Electric and Hybrid Vehicles, Routledge, 2016.
2.	S. Onori, L. Serrao andG. Rizzoni, Hybrid Electric Vehicles: Energy Management Strategies, Springer, 2015.
3.	Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.

ENERGY CONVERSION SYSTEMS	
Course Code: BMA 109 Contact Hours: L-2 T-0 P-2 Course Category: Interdisciplinary	Credits: 3 Semesters: 1& 2

Introduction:

Energy conversion systems are used to transform naturally available forms of energy from resources such as fossil fuels, hydro, solar, wind, biomass, geothermal etc. into a usable form usually electrical or mechanical energy for human applications. Knowledge of such systems is essential for the present time engineering students across all engineering disciplines to make themselves fit in the interdisciplinary environment of modern industries. Keeping this in view, this course is introduced as an interdisciplinary course.

Course Objective: The course objectives of 'Energy Conversion Systems' typically aim to provide students with a comprehensive understanding of the principles behind converting energy from naturally available form to usable form, including conversion technologies, performance evaluation, and relevant environmental considerations across various energy conversion methods like fossil fuels, solar, wind, biomass, hydropower etc. that would enable them to critically analyse and design efficient energy systems.

Prerequisite: Knowledge of Physics and Chemistry of School 12^{th} class level.

Course Outcomes:

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

CO1: Understand the general principles and technology of conventional energy conversion systems.

CO2: Understand the basic construction and operation of various jet and rocket engines and technological principles of solar energy.

CO3: Understand the conversion of abundantly available biomass chemical energy and wind energy into mechanical power.

CO4: Understand the principles of conversion of hydroelectric, geothermal, biomass, wave, tidal and other resources into mechanical energy.

Pedagogy: Classroom teaching is supported by White board, black board, chalks, markers,

projector and screen. The handwritten notes, PowerPoint slides and assignments will be provided to the students. The students can also raise their issues related to the course in the class.

Contents

UNIT-I	8 Hours
Conventional I.C. Engines: Classification, Spark Ignition Engine, Compression Ignition Engine, Two stroke Engine, Four Stroke Engine, principle and operation, Applications, Relative advantages and disadvantages. **Conventional Thermal Power Plants:** Steam Power Plant - Major Components, Cycle of operation (Rankine cycle); Gas Turbine based plant - Major Components, Cycle of operation (Brayton cycle); Relative advantages and disadvantages.	
UNIT-II	7 Hours

Propulsion Systems: Types of jet engines, Ram Jet, Pulse jet, Turbojet, Turbo propulsion, principle and operation, Types of rocket engines, liquid propellant rockets, principle and operation.

Solar Photovoltaic System: Photovoltaic effect, Principle of operation of solar cell, Types of Solar cells, efficiency of solar cells, semiconductor materials for solar cells.

UNIT-III	_7 Hours

Bio mass: Bio mass gasifiers, principle and operation, Gobar gas plant, Sewage sludge biogas generation.

Wind Energy: Basic principles of wind energy conversion, wind energy estimation, site selection consideration, basic components of wind energy conversion system, classification, advantages & disadvantages of WECS.

UNIT-IV	8 Hours

Other Renewable Energy Resources: Tidal and wave energy and OTEC - principle, Fuel cell technology, Principle of MHD power system, types of MHD system, advantages, and materials for MHD system. Geothermal energy, nature of geothermal fields, geothermal sources, geothermal power generation system.

Text Books

1.	Kothari D.P., Renewable energy resources and emerging technologies, Prentice Hall of India Pvt. Ltd.
2.	S. P. Sukhatme, Solar Energy - Principles of thermal collection and storage, second edition, Tata McGraw-Hill, New Delhi, 1996.
3.	Arora S.C and Domkundwar S., A course in Power Plant Engineering, Dhanpatrai & Sons Publishers, New Delhi, 1988

Reference Books

1.	V. Ganesan, “Internal Combustion Engines”, Tata McGraw-Hill Publishing Company Limited, New Delhi, India, 2004.
2.	G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers.
3.	Garg & Prakash, Solar Energy, TMH Pub.

INTRODUCTION TO ROBOTICS	
Course Code: BMA 110 Contact Hours: L-2 T-0 P-2 Course Category: Interdisciplinary	Credits: 3 Semesters: 1&2

Introduction:

Robotics engineering provides an overview of robot mechanisms, kinematics, dynamics, and intelligent controls. The aim of this course is to familiarize the student with kinematics of robots, differential motions and velocities of robots, dynamic analysis of forces, trajectory planning and online and offline robotic programming etc.

Prerequisite: NIL

Course Outcomes:

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

CO1: Understand the robots, its components and classifications.
CO2: Understand the actuation mechanism of robot and control.

CO3: Analyze the robot transformation and robotic vision.

CO4: Design the robot cell and various applications.

Pedagogy: Classroom teaching is supported by White board, black board, chalks, markers, projector and screen. The hand-written notes, Power Point slides and assignments will be provided to the students and also mailed to them. The students can also raise their issues related to the course in the class and mail

Contents

UNIT-I	7 Hours
Introduction: Robot anatomy-Definition, law of robotics, History and Terminology of Robotics, Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot, Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system.	
UNIT-II	8Hours
End Effectors and Robot Controls: Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.	
UNIT-III	8 Hours
Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors. **Robot Transformations and Sensors:** Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation, Homogeneous coordinates, multiple transformation-Simple problems.	
UNIT-IV	7 Hours

Robot Cell Design and Applications: Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, Robot applications- Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.	
Text Books	
1.	Deb .S.R, "Robotics Technology and flexible automation", Tata McGraw-Hill Education, 2009.
2.	Saha S K, "Introduction to Robotics", TMH Publication, 2008
3.	Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, 2003.
Reference Books	
1.	Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, "Technology Programming and Applications", McGraw Hill, 2012.
2.	Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, "Robotics Engineering an Integrated Approach", Phi Learning., 2009.
3.	Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons Inc.,1985.

FUNDAMENTALS OF ELECTRICAL SCIENCE

Course Code: BEC 105	
Contact Hours: L-3 T-0 P-2 2-1-2	Credits: 4
Course Category:	Semester: 1

Introduction: To impart basic knowledge of electrical engineering with an understanding of fundamental knowledge.

Course Objective: The aim of this course is to:

- Make the students learn basic fundamentals of electrical science and
- Develop basic ability to solve various electrical circuits.

Course Outcome:

Having successfully completed this course, the student will be able to:

CO1: Learn and comprehend various fundamentals of electrical science.

CO2: Build a sound foundation of applications of electrical science in electronics and other allied engineering fields.

CO3: Identify and analyze relationship between various principles of electrical science.

CO4: Evaluate and apply the quantitative and qualitative aspects of electrical science to further innovate new applications.

Pre-requisite:

- Knowledge of basic physics

Pedagogy:

The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	10 Hours
Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star Delta Transformation, Application of theorems for the Analysis of dc circuits.	
UNIT-II	**10 Hours**
A. C. Circuit: Basics of AC, effective, average and maximum values, form factor and k- factor, different types of AC power, R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor- representations, Response of R-L, RC and R-L-C circuit to sinusoidal input, Resonance-series and parallel Circuits, Q-factor, and Bandwidth.	

UNIT-III	10 Hours
Measuring Instruments: Principles, construction and application of moving coil, moving iron, dynamometer type, induction type instruments, extension of range of ammeter, voltmeter (shunt and multiplier), Two-wattmeter method, for the measurement of power	
UNIT-IV	**10 Hours**
Transformer and Electrical Machines: Construction and working principles, phasor diagrams of single-phase Transformer, Emf equation, equivalent circuit, regulation and efficiency, auto transformer. Rotating Machines DC Machines: Construction and working principles of dc motor and generator and its characteristics, applications of DC machines.	

Text Books	
1	Charles K. Alexander, Mathew N.O Sadiku, "Fundamentals of Electrical Circuits", Tata McGraw Hill, 7th Edition.
2	Vincent Del Toro, "Electrical Engineering Fundamental's", Prentice Hall India, Ed 2011 or latest.
3	A. Sudhakar, Shyammohan, S Palli, "Electrical Circuits", McGraw Hill.
4	J. Edminister, M. Nahvi, K. Rao, "Electric Circuits," Schaum's Outline Series, 2017.
Reference Books	
1	Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (1986), "Engineering Circuit Analysis", (p. 74), New York: McGraw-Hill or latest.
2	Fitzgerald, Arthur Eugene, David E. Higginbotham, and Arvin Grabel, "Basic Electrical Engineering," McGraw-Hill Series in Electrical Engineering, Auckland: McGraw-Hill, 1981, 5th ed. (1981) or latest.

List of Experiments

1. To study the various instruments and equipment used in Basic Electrical Engineering Lab.
2. To implement the given circuit on the breadboard and verify Ohm's law.
3. To implement the given circuit on the breadboard and verify Kirchoff's current law & Kirchoff's voltage law.
4. To implement the given circuit on the breadboard and verify the Reciprocity theorem.
5. To implement the given circuit on the breadboard and verify Thevenin's theorem.
6. To implement the given circuit on the breadboard and verify the Maximum power transfer theorem.
7. To implement the given circuit on the breadboard and verify the Superposition theorem.
8. To implement the given circuit on the breadboard and measure power and power factor in a single-phase AC circuit using the three ammeters method.
9. To measure power and power factor in a single-phase AC circuit using the three-voltmeter method.
10. To determine the power factor, true power, apparent power, and reactive power using resistance, choke coil, and capacitor.
11. To perform an open circuit test on a single-phase transformer and calculate its equivalent circuit parameters.