Course Code	Course Name				Credits
J1BST111	**MULTIVARIABLE CALCULUS**				**3**
Regulation	2026	L:T:P:H:S	3:0:0:0:4.5	Notional Learning Hours/Semester	90
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course Delivery Mode			Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Basic knowledge in single variable calculus				

COURSE OBJECTIVE	
1	To develop students' ability to analyse functions of several variables and understand their behaviour.
2	To enable students to identify and determine extrema using appropriate mathematical techniques.
3	To equip students with optimization skills applicable to solving diverse engineering problems and real-world challenges.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply various concepts in calculus to linearize functions and to analyze concavity.	K3
2	Calculate the limits for functions of two variables and partial derivatives of multivariable functions.	K3
3	Interpret directional derivative and solve maxima and minima of multivariable functions.	K3
4	Solve constrained maxima and minima, LPP and understand the method of Steepest Descent.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	2	3	3	2	1					3	3		2							2			
2	2	3	3	2	1					3	3		2							2			
3	1	3	3	3	2					3	3		2							2			
4	1	3	3	2	1					3	3		2							2			

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Differentiation and ODE**	Second and Higher-Order Derivatives, Instantaneous Rates of Change, Chain Rule, Implicit Differentiation, Tangents and Normal Lines, Linearization, The Second Derivative Test for Concavity. Ordinary differential equations- Homogeneous linear ODEs with constant coefficients (second and higher order), Wronskian [Relevant topics from: Text 1- sections 2.2, 2.5, 3.1, 3.2, 3.3, 3.4, 3.6, 3.7, 3.9, 4.4, Text 2 -sections 2.2,2.6,3.2]	12
2	**Partial derivatives**	Functions of Several Variables: Domains and Ranges, Level curves of two variables, Limits for functions of two variables, Continuity for functions of two variables, Partial derivatives of a function of more than two variables, Partial derivatives and continuity, Second- Order partial derivatives, The mixed derivative theorem, The Chain Rule [Relevant topics from: Text 1- sections 14.1, 14.2, 14.3, 14.4]	12
3	**Directional Derivative**	Directional Derivatives in the Plane, Interpretation of the Directional Derivative, Gradient, Properties of the Directional Derivative, Local Extreme Values for Functions of Two Variables: Relative extrema, First derivative theorem for local extreme values, Critical point, saddle point, Second Derivative Test for Local Extreme Values, Absolute Maxima and Minima on Closed Bounded Regions. [Relevant topics from: Text 1- sections 14.5, 14.7]	10
4	**Optimization**	Constrained Maxima and Minima, The Method of Lagrange Multipliers with one constraint, The Method of Lagrange Multipliers with two constraints, Method of Steepest Descent (only two variables), LPP- Formation, Solution of LPP using graphical method. [Relevant topics from: Text-1 section 14.8, Text-2 sections 22.1, 22.2]	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL.	Name of Book	Name of Author/s	Publisher	Year
1.	Thomas' Calculus	Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki	Pearson	15th edition, 2023
2	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10th edition, 2016

REFERENCE				
SL.	Name of Book	Name of Author/s	Publisher	Year
1	Calculus	Howard Anton, Irl Bivens, Stephens Davis	Wiley	10th edition, 2012
2	Optimization: Algorithms and Applications	Rajesh Kumar Arora	CRC Press	1st edition, 2015
3	Multivariable Calculus	Ron Larson, Bruce Edwards	Brooks/Cole, Cengage Learning	10th edition, 2014
4	Calculus & Its Applications	Goldstein, Schneider, Lay, Asmar	Pearson	14th edition, 2018
5	Bird's Higher Engineering Mathematics	John Bird	Taylor & Francis	9th edition, 2021
6	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39th edition, 2023
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/noc19_ma18/preview			
2	https://onlinecourses.nptel.ac.in/noc24_ma33/preview			
3	https://onlinecourses.nptel.ac.in/noc25_ma98/preview			
4	https://onlinecourses.nptel.ac.in/noc25_ma93/preview			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1. Differentiation and ODE (12Hrs)	Part 1	Rates of Change	Derivative at a Point, Derivative as a Function, Second- and Higher-Order Derivatives, Instantaneous Rates of Change	3
	Part 2	Chain Rule	Chain Rule, Implicit Differentiation, Tangents and Normal Lines, Linearization,Concavity	4
	Part 3	Homogeneous linear ODE -second order	ODE Second order and Wronskian	3
	Part 4	Homogeneous linear ODE-higher orders	ODE higher orders	2

2.Partial derivatives (12 Hrs)	Part 1	Functions of Several Variables	Domains and Ranges, Level curves of two variables, Limits for functions of two variables, Continuity for functions of two variables	5
	Part 2	Partial derivatives of a functions of more than two variables	Partial derivatives of a functions of more than two variables, Partial derivatives and continuity	3
	Part 3	Second-Order partial derivatives	Second- Order partial derivatives, The mixed derivative theorem.	2
	Part 4	The Chain Rule	The Chain Rule: Functions of two variables and three variables	2
3.Directional derivatives (10Hrs)	Part 1	Gradient	Gradient	1
	Part 2	Directional Derivatives	Directional Derivatives in the Plane, Interpretation of the Directional Derivative, Properties of the Directional Derivative	3
	Part 3	Local Extreme Values for Functions of Two Variables	Relative extrema, First derivative theorem for local extreme values, Critical point, saddle point	3
	Part 4	Second Derivative Test for Local Extreme Values	Second Derivative Test for Local Extreme Values, Absolute Maxima and Minima on Closed Bounded Regions	3
4. Optimization (11 Hrs)	Part 1	Constrained Maxima and Minima,	Constrained Maxima and Minima, The Method of Lagrange Multipliers with one constraint	2
	Part 2	The Method of Lagrange Multipliers with two constraints,	The Method of Lagrange Multipliers with two constraints	3
	Part 3	Method of Steepest Descent	Method of Steepest Descent	2
	Part 4	LPP	LPP- Formation, Solution of LPP using graphical method.	4

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl No.	Activity	Description	Time	Module	CO	WK	PO
1	Exploration of Linearization and ODE using Excel	Tabulate and graph functions approaching limits, verify continuity, and perform linearization at given points.	6	1	CO1	WK2, WK3	PO1, PO2,
2	Derivative and Concavity Study with Excel Charts	Calculate first and second derivatives; identify concavity, inflexion points, and tangent/normal lines graphically.	6	2	CO1	WK3, WK4,	PO1, PO2, PO4, PO5
3	Partial Derivatives and Gradient Analysis (3D Visualization)	Compute partial derivatives of two-variable functions, visualize level curves and gradient directions using Excel or GeoGebra.	6	2&3	CO2, CO3	WK3, WK4	PO1, PO2, PO5
4	Directional Derivative and Local Extrema Evaluation	Calculate directional derivatives, interpret gradient direction, and find relative maxima/minima for multivariable functions.	6	3	CO3	WK3, WK4	PO1, PO2, PO5.
5	Optimization using Lagrange Multipliers, LPP & Steepest Descent in Excel	Apply Excel Solver to find constrained maxima/minima using Lagrange multipliers and simulate Steepest Descent steps.	6	4	CO4	WK4, WK5, WK8	PO, PO3, PO11

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Problem-Solving seminar on ODE	Analytical and numerical problem-solving to understand ODE	5 Hrs	1	CO1	WK2, WK3, WK4	PO1, PO2, PO4
2	Analytical Assignment on Partial Derivatives, Chain Rule & Gradient	Compute and interpret partial derivatives, apply chain rule for multivariable functions, and visualize gradient and level curves to identify local extrema.	5 Hrs	2&3	CO2,CO3	WK3, WK4	PO1, PO2, PO5
3	Optimization Project using Lagrange Multipliers, LPP (Excel Solver)	Apply Excel Solver to solve constrained optimization and linear programming problems	5 Hrs	3,4	CO4	WK4, WK5, WK8	PO1, PO3, PO5, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl. No.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Conceptual Understanding (Calculus, Derivatives & Optimization)	Demonstrates complete conceptual clarity and accurate application of all formulas; links theory to real examples.	Clear understanding with minor conceptual gaps.	Basic understanding; uses formulas correctly but lacks explanation	Partial understanding; frequent conceptual errors.	Very limited understanding or irrelevant responses.
2	Problem Solving & Implementation (Manual / Excel-based)	Correct, optimized solutions using Excel tools or manual methods; logical step-by-step approach shown clearly.	Mostly correct with small computational errors or minor lack of optimization.	Partially correct; some errors in calculations or method.	Incomplete or major computational errors.	No valid attempt or copied content.
3	Analysis & Interpretation of Results	Excellent interpretation of results; able to relate derivative behaviour, gradients, and optimization outcomes.	Clear analysis with minor gaps in interpretation	Adequate interpretation but lacks mathematical insight.	Minimal interpretation, weak linkage to results.	No analysis or misinterpreted outcomes.
4	Documentation & Presentation (Report / File Submission)	Professionally formatted, neat, includes objectives, methods, results, and proper references.	Well-organized report with minor formatting issues.	Acceptable structure; lacks detail or references.	Poorly formatted; missing some sections.	Not submitted.
5	Participation & Teamwork (During Term Work Sessions)	Highly collaborative, actively contributes ideas, assists peers.	Participates regularly with good coordination.	Moderate participation; contributes occasionally	Limited participation or passive.	Absent or no contribution.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**40%**
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**60%**
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	**U**	**A**	**An**	**E**	**C**	
1	Differentiation and ODE	12		3	12				15
2	Partial derivatives	12		3	12				15
3	Directional derivatives	10		3	12				15
4	Optimization	11		3	12				15
This shall be treated as a general guideline for students and teachers for the distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	**No. of Questions/Module**	**Total No. of Questions**	**Max. marks/ Question**	**Part Summary**	**Total Marks**
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					**60**

Course Code	Course Name				Credits
J1BSP212	**CHEMISTRY FOR ENGINEERS**				**4**
Regulation	2026	L: T:P:H:S	3:0:2: 0:5.5	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	TP	Course delivery Mode		Theory + Practical	
Scheme of Evaluation		CIE: 60 Marks	ESE:40 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Basic Electrochemistry, Introduction to Organic Chemistry, Redox Reactions, Polymers				

COURSE OBJECTIVE	
1	To impart the fundamental principles of electrochemistry, corrosion and energy-conversion systems used in modern electrical and electronic devices.
2	To familiarise students with engineering materials - nanomaterials, conducting polymers and organic electronic materials - and their role in contemporary electronics
3	To develop the ability to apply spectroscopic and analytical techniques to characterise materials and to address environmental chemistry challenges (water, waste, climate).

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply electrochemical principles to analyse electrochemical cells, energy storage and conversion devices, and corrosion protection techniques for engineering applications.	K3
2	Apply the principles of nanomaterials, advanced polymers, and functional electronic materials to select appropriate materials for emerging engineering applications.	K3
3	Apply spectroscopic and analytical techniques (UV-Vis, IR, XRD, SEM) to characterise materials.	K3
4	Apply water quality assessment, treatment, and sewage management principles to address engineering problems for societal well-being.	K3
5	Apply environmental-chemistry principles to evaluate waste-treatment processes and to discuss climate-change indicators and Sustainable Development Goals.	K3

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	3	2	2	2	-	-	-	3	2	2	2	2	2	-	-	2	-	1			
2	3	2	3	2	-	2	-	-	-	3	2	2	2	2	-	-	-	2	-	1			
3	3	2	3	2	-	3	-	2	-	3	2	2	3	3	-	-	-	2	-	1			
4	3	2	3	2	3	2	2	-	2	3	2	2	2	2	3	-	2	2	-	2			
5	2	2	2	-	3	-	3	3	2	2	-	-	-	-	-	3	1	-	-	-			
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																							

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Electrochemistry and Corrosion Science**	**Electrochemical Cell** - Electrode potential - Electrochemical series – Applications - Nernst equation for single electrode and cell (Numerical problems). **Reference Electrodes** - SHE, Calomel electrode - Glass electrode (construction only). **Energy conversion devices** - Li-ion battery - Fuel cell - Phosphoric acid fuel cell and Polymer electrolyte membrane fuel cell (PEMFC) - Solar cells - Photovoltaic cell (silicon based) - Photoelectrochemical cell - DSSC (Dye sensitised solar cell). **Corrosion** - Electrochemical corrosion mechanism - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and Impressed current cathodic protection - Electroplating of copper - Electroless plating of copper.	10
2	**Materials for Electronic Applications**	**Nano Materials** - Classification based on Dimension & Materials - Synthesis - Sol gel and Chemical Reduction - Applications of nanomaterials - Carbon Nanotubes - Fullerenes - Graphene - Carbon Quantum Dots - Structure, properties & application. **Polymers** - Fire Retardant Polymers - Halogenated & Non-halogenated polymers - Conducting polymers - Classification - Polyaniline & Polypyrrole - synthesis, properties and applications. **Organic electronic materials and devices** - Construction, working and applications of Organic Light Emitting Diode (OLED) & Quantum Dot LED (QLED) - Materials used in Quantum computing Technology - Super capacitors - Spintronics.	8

3	**Molecular Spectroscopy and Analytical Techniques**	**Spectroscopy** - Types of spectra- Molecular energy levels - Beer Lambert's law - Numerical problems **Electronic Spectroscopy** - Principle, Types of electronic transitions - Role of conjugation in absorption maxima - Instrumentation - Applications **Vibrational Spectroscopy** - Principle - Number of vibrational modes - Vibrational modes of CO_2 and H_2O - Applications **X-ray Diffraction (XRD)** - Principle and applications in determining crystal structure and phase identification. **Scanning Electron Microscope (SEM)** - Principle, instrumentation and Applications.	9
4	**Environmental Chemistry**	**Water characteristics** - Hardness - Types of hardness - Temporary and Permanent - Disadvantages of hard water - Degree of hardness (Numerical) **Water softening methods** - Ion exchange process - Principle, procedure and advantages - Reverse osmosis - Principle, process and advantages. **Water disinfection methods** - Chlorination - Break point chlorination - Ozone and UV irradiation. Dissolved oxygen (DO) - BOD and COD - Definition & Significance. **Waste Management** - Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process. E Waste - Methods of disposal - Recycle, recovery and reuse. **Chemistry of climate change** - Greenhouse Gases- Ozone Depletion - Sustainable Development - An introduction to Sustainable Development Goals.	9

LIST OF EXPERIMENTS (24 hours)

Instructions

- Minimum 10 Experiments

Sl. No.	Experiment	CO
1	Estimation of iron in iron ore	1
2	Estimation of copper in brass	1
3	Determination of cell constant and conductance of solutions	1
4	Calibration of pH meter and determination of pH of a solution	1
5	Synthesis of polymer Urea-formaldehyde resin	2
6	Synthesis of polymer Phenol-formaldehyde resin	2
7	Synthesis of polymer Poly aniline.	2
8	Analysis of IR spectra	3
9	Identification of drugs using TLC	3
10	Determination of molar absorptivity of a compound (KMnO4 or any water-soluble food colorant)	3
11	Determination of saponification value of a given vegetable oil	3,5
12	Determination of calorific value using Bomb calorimeter	3,5
13	Estimation of chlorine in water (Mohr's method)	4,5
14	Estimation of total hardness of water-EDTA method	4,5
15	Estimation of dissolved oxygen by Winkler's method	4,5

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl. No	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Chemistry	B. L. Tembe, Kamaluddin, M. S. Krishnan	NPTEL Web-book	2018
2	Physical Chemistry	P. W. Atkins	Oxford University Press	International Edition- 2018
3	Instrumental Methods of Analysis	H. H. Willard, L. L. Merritt	CBS Publishers	7th Edition-2005
4	Engineering Chemistry	Jain & Jain	Dhanpath Rai Publishing Company	17th Edition - 2015
REFERENCE				
Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill	4th Edition, 1995
2	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma, M. S. Pathania	Vishal Publishing Co	47th Edition, 2017
3	Introduction to Spectroscopy	Donald L. Pavia	Cengage Learning India Pvt. Ltd	2015
4	Polymer Chemistry: An Introduction	Raymond B. Seymour, Charles E. Carraher	Marcel Dekker Inc	4th Revised Edition, 1996
5	The Chemistry of Nanomaterials: Synthesis, Properties and Applications	Prof. Dr. C. N. R. Rao, Prof. Dr. h.c. mult. Achim Müller, Prof. Dr. A. K. Cheetham	Wiley-VCH Verlag GmbH & Co. KGaA	2014
6	Organic Electronics Materials and Devices	Organic Electronics Materials and Devices	Shuichiro Ogawa	2024
VIDEO LINKS (NPTEL, SWAYAM…)				
1	https://onlinecourses.nptel.ac.in/noc20_mm04/preview			
2	https://onlinecourses.nptel.ac.in/noc21_mm38/preview			
3	https://onlinecourses.nptel.ac.in/noc20_cy08/preview			
4	https://onlinecourses.nptel.ac.in/noc19_ce32/preview			
VIRTUAL LAB/SIMULATION TOOLS				
1	https://ccnsb06-iiith.vlabs.ac.in/exp/infra-red-spectroscopy/simulation.html?authuser=0			
2	https://mas-iiith.vlabs.ac.in/exp/uv-visible-spectroscopy/simulation.html			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1.Electrochemistry and Corrosion Science	Part 1	**Electrochemical Cells and Electrode Potentials**	Electrochemical Cell - Electrode potential - Electrochemical series – Applications - Nernst equation for single electrode and cell (Numerical problems)	3
	Part 2	**Reference Electrodes**	SHE, Calomel electrode - Glass electrode (construction only)	2
	Part 3	**Energy Conversion Devices**	Li-ion battery - Fuel cell - Phosphoric acid fuel cell and Polymer electrolyte membrane fuel cell (PEMFC) - Solar cells - Photovoltaic cell (silicon based) - Photoelectrochemical cell - DSSC (Dye sensitised solar cell).	3
	Part 4	**Corrosion and Corrosion Control Methods**	Electrochemical corrosion mechanism - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and Impressed current cathodic protection - Electroplating of copper - Electroless plating of copper.	2
2.Materials for Electronic Applications	Part 1	**Classification and Synthesis of Nanomaterials**	Classification of nanomaterials based on Dimension & Materials - Synthesis - Sol gel and Chemical Reduction - Applications of nanomaterials.	2
	Part 2	**Carbon-Based Nanomaterials and Applications**	Carbon Nanotubes - Fullerenes - Graphene - Carbon Quantum Dots - Structure, properties & application.	2
	Part 3	**Functional Polymers**	Polymers - Fire Retardant Polymers - Halogenated & Non-halogenated polymers - Conducting polymers - Classification - Polyaniline & Polypyrrole - synthesis, properties and applications.	2
	Part 4	**Electronic Materials and Devices**	Organic electronic materials and devices - Construction, working and applications of Organic Light Emitting Diode (OLED) & Quantum Dot LED (QLED) - Materials used in Quantum computing Technology - Super capacitors - Spintronics.	2
3.Molecular Spectroscopy and Analytical Techniques	Part 1	**Fundamentals of Spectroscopy and Molecular energy levels**	Spectroscopy - Types of spectra - Molecular energy levels – Beer Lambert's law – Numerical problems	2
	Part 2	**Molecular Electronic Spectroscopy**	Electronic Spectroscopy – Principle, Types of electronic transitions – Role of conjugation in absorption maxima – Instrumentation - Applications.	3
	Part 3	**Vibrational Spectroscopy**	Vibrational Spectroscopy – Principle - Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Applications.	2
	Part 4	**Characterization Techniques**	X-ray Diffraction (XRD) – Principle and applications in determining crystal structure and phase identification. SEM - Principle, instrumentation and Applications.	2

4.Environmental Chemistry	Part 1	**Water Characteristics and Hardness**	Water characteristics - Hardness - Types of hardness- Temporary and Permanent. Disadvantages of hard water -Degree of hardness (Numerical).	2
	Part 2	**Water Softening Methods**	Ion exchange process - principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	2
	Part 3	**Water Disinfection and Waste water Treatment**	Water disinfection methods Chlorination - Break point chlorination Ozone and UV irradiation. Dissolved oxygen (DO), BOD and COD- Definition & Significance. Waste Management -Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.	3
	Part 4	**E - Waste Management and Climate Chemistry**	E Waste - Methods of disposal – Recycle, recovery and reuse - Chemistry of climate change- Greenhouse Gases - Ozone Depletion - Sustainable Development - An introduction to Sustainable Development Goals.	2

SELF LEARNING ACTIVITIES (30 Hrs)

Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	**Battery / Fuel-Cell Case Study**	Pick a real-world battery (e.g., Li-ion in an EV) or Fuel cell application; Write a structured 2-page report on operating principle, performance and sustainability concerns.	6 Hrs	1	CO1	WK1 WK3 WK5 WK7	PO1 PO6 PO PO11
2	**Nanomaterials Survey**	Survey a recent journal/review article on graphene OR conducting polymers; produce a note on synthesis, properties and electronic-engineering applications.	6 Hrs	2	CO2	WK1 WK3 WK8	PO1 PO2 PO9 PO11
3	**Spectra Interpretation Practice**	Take labelled IR and UV-Vis spectra from a public database; identify functional groups / transitions; submit annotated worksheets.	6 Hrs	3	CO3	WK1 WK2 WK3	PO1 PO4 PO5
4	**Water Treatment and Hardness**	Watch NPTEL video on water softening and hardness measurement. Prepare a short write-up on ion-exchange and RO methods	6 Hrs	4	CO4	WK1 WK3 WK5 WK7	PO1 PO6 PO8 PO11

5	**Climate Change Awareness Activity**	Make a 1-page infographic showing greenhouse gases and their impact on climate change	6 Hrs	4	CO5	WK1 WK2 WK3 WK5 WK7 WK8 WK9	PO1 PO7 PO8 PO11

TERM WORK ACTIVITIES (30 Hrs)							
Sl. No.	**Activity**	**Description**	**Time**	**Module**	**CO**	**WK**	**PO**
1	Case Study on corrosion	Study corrosion failures in engineering structures (bridges, pipelines, ships, automobiles, or offshore structures) and recommend suitable corrosion prevention methods.	8 Hrs	1	CO1	WK1 WK2 WK3	PO1 PO2 PO5
2	Concept-Based Quiz on Material Characterization Techniques	Students will prepare and conduct a 20–25 question concept-based quiz covering spectroscopy, XRD,SEM and nano materials	8 Hrs	2, 3	CO, CO3	WK1 WK2 WK3	PO1 PO2 PO4 PO5 PO9
3	Environment / Sustainability Presentation	Prepare a short group presentation or poster on Climate change / Sustainable Development Goals (SDGs). Emphasize chemistry's role in sustainability.	8 Hrs	4	CO5	WK1 WK2 WK3 WK5 WK7 WK8 WK9	PO1 PO7 PO8 PO11
4	Mini Project: Water and Wastewater Analysis	Estimate hardness, chloride, or DO values of given water samples (or simulated data). Create a comparative table of methods (EDTA, Mohr, and Winkler).	6 Hrs	4	CO4	WK, WK, WK7	PO1 PO7

RUBRICS FOR TERM WORK EVALUATION						
Sl. No.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis

4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

LAB EVALUATION RUBRICS							
Sl.No.	**Criteria**	**Weightage**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Preparation & Pre-Lab Work	30%	Comes fully prepared with pre-lab work completed; demonstrates clear understanding of objectives and procedure.	Minor gaps in pre-lab preparation ; understands most objectives and procedures.	Partial pre-lab work done; limited understanding of objectives.	Minimal preparation ; weak understanding of experiment.	No preparation ; unable to explain objectives/ procedure.
2	Experimental Skills & Performance	40%	Performs experiment independently with precision, follows correct procedure	Performs experiment with minor guidance; procedure mostly correct.	Needs frequent guidance; some procedural errors.	Struggles with procedure; requires constant help.	Unable to perform experiment correctly even with help
3	Analysis, Interpretation and Documentation	30%	Analyse, Interpret and Document results correctly	Minor interpretation issues.	Some errors in analysis; interpretation superficial.	Major errors in calculations ; misinterprets results. Errors in Documentation	No meaningful analysis/interpretation.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**60%**
Lab Evaluation	30 %
Learning Activity (Self Learning, Term Work, Assignments,)	20%
Attendance	10 %
Internal Examination	40 %
Course Project	NA
End Semester Examination	**40%**
Total	100

TABLE OF SPECIFICATIONS FOR ESE QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Electrochemistry and Corrosion Science	10	3	5	2				10
2	Materials for Electronic Applications	8	3	5	2				10
3	Molecular Spectroscopy and Analytical Techniques	9		7	3				10
4	Environmental Chemistry	9		7	3				10
Total		36	6	24	10				40
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper				2	
Part	No. of Questions/ Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	1 (No choice)	4	3	4 x 3	12
B	2 (Including Choice)	8	7	4 x 7	28
TOTAL MARKS					**40**

Course Code	Course Name				Credits
J1EST103	**PROGRAMMING IN C**				**4**
Regulation	2026	L: T:P:H:S	3:1:0: 0:5	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	**Introduce** the fundamental concepts of structured programming using the C language, including data types, operators, expressions, and control statements.
2	**Develop** problem-solving and logical thinking skills through the implementation of arrays, strings, functions, and structures for modular program design
3	**Enable** students to apply pointers, dynamic memory allocation, and file handling techniques to design efficient and real-world C programs.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain the basic structure, data types, operators, and control statements of the C programming language.	K2
2	Apply arrays, strings, and functions to develop modular and reusable C programs.	K3
3	Analyze the use of structures, unions, and pointers for efficient data management and memory utilization.	K3
4	Implement file handling and dynamic memory allocation concepts to design functional C applications.	K3

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5 6**		**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	-	3	3	3	-	-	-	2	-	3	3	3	3	-	-	-	-	-	-	3	1	3	-
2	-	3	3	3	-	-	-	2	-	3	3	3	3	-	-	-	-	-	-	3	1	3	-
3	-	3	3	3	-	-	-	2	-	3	3	3	3	-	-	-	-	-	-	3	1	3	-
4	-	3	3	3	-	3	3	2	3	3	3	3	3	-	-	-	-	-	-	3	1	3	-
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																							

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Introduction to C programming**	Algorithm and Flowchart. **C Fundamentals** - Character Set, Constants, Identifiers, Keywords, Basic Data types, Variables, Operators and its precedence and associativity, operators, Expressions; Statements - Input and Output statements; Structure of a C program; **Control Statements** - if, if Else, nested if, if else if ladder, switch, while, do-while, for, break & continue, nested loops.	15
2	**Arrays and Strings**	**Arrays** - Single dimensional arrays, Defining an array, Array initialization, Accessing array elements; Two dimensional arrays – Defining a two-dimensional array; Programs for matrix processing; Programs for sequential search; Bubble sort; **Strings** - Declaring a string variable, Reading and displaying strings, String related library functions – Programs for string matching.	15
3	**Functions and Structures**	**Functions** - Function definition, Function call, Function prototype, Parameter passing; Recursion; Passing array to function; **Structure** - Defining a Structure variable, accessing members, Array of structures, Passing structure to function; Defining and invoking macros, using command line arguments **Union**. **Storage Classes** - Storage Classes associated with variables: automatic, static, and external and register.	15

4	**Pointers and Files**	**Pointers** - Declaration, Operations on pointers, call by reference, passing pointer to a function, accessing array elements using pointers, Processing strings using pointers, Pointer to pointer, Array of pointers, Pointer to function, Pointer to structure, Dynamic Memory Allocation. **Files** - Different types of files in C, Opening & Closing a file, Writing to and Reading from a file, Processing files, Library functions related to files.	15

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL	Name of Book	Name of Author/s	Publisher	Year
1	Programming in ANSI C	E Balagurusamy	Mc Graw Hill 9/e,	2024
2	Programming with C	Byron S Gottfried	Mc Graw Hill 4/e,	2018
REFERENCE				
SL	Name of Book	Name of Author/s	Publisher	Year
1	Problem Solving and Program Design in C	Jeri R Hanly and Elliot B Koffman	Mc Graw Hill	2013
2	The C Programming Language	Brian W. Kernighan and Dennis Ritchie	Pearson 2/e,	2015
3	C The Complete Reference	Herbert Schildt	Mc Graw Hill	4/e,2017
4	Let us C	Yashavant Kanetkar	BPB Publishers	19/e,2022
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/noc24_cs43/preview – NPTEL: Programming in C			
2	https://onlinecourses.nptel.ac.in/noc22_cs37/preview – *NPTEL: Problem Solving Through C*			
3	https://www.youtube.com/playlist?list=PLBlnK6fEyqRgMCpWVuFwshJHfVhE-Sv6a – *Gate Smashers: C Programming Complete Course*			
VIRTUAL LAB/SIMULATION TOOLS				
1	OnlineGDB / Replit (C Compiler and Debugger)			
2	Code::Blocks / Dev C++			
3	Visual Studio Code (with C/C++ extensions)			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1. C Fundamentals and Control Structures (11 Hrs.)	Part 1	Introduction to C	Algorithms. Overview of C language, features, structure of a C program, compiling and executing a C program	4
	Part 2	Data Types and Operators	Character set, identifiers, keywords, constants, variables, data types, operators, expressions, and type conversions	4
	Part 3	Input, Output and Library Functions	Input/output functions (scanf, printf), library functions, writing simple programs	3
	Part 4	Control Statements	Decision making (if, if-else, nested if, switch), loops (while, do-while, for), break, continue, nested loops	3
2. Arrays and Strings (12 Hrs.)	Part 1	Arrays	One-dimensional arrays, declaration, initialization, accessing elements, simple programs	3
	Part 2	Two-Dimensional Arrays	Declaration, initialization, accessing elements, programs for matrix operations	3
	Part 3	Searching and Sorting	Sequential search, bubble sort algorithms and programs	2
	Part 4	Strings	String declaration, reading/displaying strings, string functions, string matching programs	4
3. Functions, Structures, and Storage Classes (11 Hrs.)	Part 1	Functions	Function definition, function prototype, parameter passing, return types, recursion	4
	Part 2	Macros and Command Line Arguments	Defining and invoking macros, using command line arguments	3
	Part 3	Structures and Unions	Structure definition, array of structures, accessing members, union concepts	4
	Part 4	Storage Classes	automatic, static, external, and register variables – scope and lifetime	4
4. Pointers and File Handling (11 Hrs.)	Part 1	Pointers	Pointer declaration, initialization, arithmetic, pointer to pointer, array of pointers	4
	Part 2	Dynamic	malloc, calloc, realloc, and free –	4

		Memory Allocation	concepts and programs	
	Part 3	File Handling	File types, opening, reading, writing, closing files, file operations and examples	3
	Part 4	Applications	Case studies integrating pointers and file operations in simple applications	4

SELF LEARNING ACTIVITIES (12 Hrs.)

Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Video-based Learning	Watch NPTEL lectures on C fundamentals, data types, and control structures. Summarize key takeaways and examples in a short report.	6	1	CO1	WK1	PO1, PO2
2	Code Practice Log	Practice small C programs (loops, conditionals, arrays) using an online compiler. Document challenges and corrections.	6	1,2	CO1, CO2	WK2	PO2, PO3
3	Mini-Tutorial Creation	Prepare a short tutorial on a C programming concept (functions, recursion, or structures) with code examples for peer learning.	6	3	CO2, CO3	WK3, WK4	PO3, PO5
4	Debugging Exercise	Identify and fix logical and syntax errors in given C programs. Document debugging strategies.	6	2,3	CO2, CO3	WK3	PO4, PO6
5	Case Study	Analyze real-world C applications (e.g., embedded systems, system utilities) and explain how modular programming principles are applied.	6	4	CO4	WK5	PO1, PO2

TERM WORK ACTIVITIES (12 Hrs.)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Control Structures Implementation	Develop C programs using if, switch, loops, and nested control structures. Evaluate output correctness and efficiency.	10	1	CO1	WK1	PO1, PO2, PO5
2	Arrays and Strings Application	Implement searching, sorting, and string manipulation programs. Compare time complexity and efficiency.	10	2	CO2	WK2	PO1, PO2, PO3 PO4,
3	Modular Programming Project	Design a mini-project using functions, structures, and file handling (e.g., student record system). Submit code, report, and demonstration.	10	3,4	CO3, CO4	WK3	PO1, PO2, PO4, PO6, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Completeness	All programs and reports are complete with additional features Implemented.	All tasks completed With minor gaps.	Most tasks done with limited depth.	Some tasks incomplete or missing.	Very little completed.
2	Technical Accuracy	Programs are logically correct, efficient, and well Documented.	Mostly correct, minor logical Errors.	Some syntax or logical issues.	Frequent errors or inefficiencies.	Incorrect or no Implementation.
3	Documentation on & Presentation	Code and report are neat, well commented, and Professionally presented.	Structured With minor lapses.	Understandable but lacks clarity.	Poorly formatted or incomplete.	No document at ion Submitted.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**40%**
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**60%**
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	**U**	**A**	**An**	**E**	**C**	
1	C Fundamentals and Control Structures.	11	3	1 2					15
2	Arrays and Strings	12	-	3	12				15
3	Functions, Structures, and Storage Classes.	11		3	12				15
4	Pointers and File Handling.	12		3	12				15
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	**No. of Questions/Module**	**Total No. of Questions**	**Max. marks/ Question**	**Part Summary**	**Total Marks**
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					**60**

CO No.	Course Outcome	Relevant WK Codes	Justification / Mapping Explanation
CO1	Explain the basic structure, data types, operators, and control statements of the C programming language.	**WK2, WK3, WK4,WK8**	Relates to understanding Computational logic, mathematical operations, and core programming fundamentals.
CO2	Apply arrays, strings, and functions to develop modular and reusable C programs.	**WK2, WK3, WK4,WK8**	Integrates mathematical reasoning, structured logic, and practical programming design principles.
CO3	Analyze the use of structures, unions, and pointers for efficient data management and memory utilization.	**WK2, WK3, WK4,WK8**	Involves engineering-specific knowledge and practice in efficient memory handling and modular programming.
CO4	Implement file handling and dynamic memory allocation concepts to design functional C applications.	**WK2,WK3, WK4, WK6, WK7,WK8, WK9**	Connects programming fundamentals with practical application, professional Responsibility, and ethical coding practices.

Course Code	Course Name				Credits
J1ESP104	**ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING**				**3**
Regulation	2026	L: T:P:H:S	2:0:2:0:4	Notional Learning Hours/Semester	90
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	ES	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 60 Marks	ESE: 40 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	To learn the principles and techniques of dimensioning and preparing engineering drawings.
2	To develop the ability to accurately interpret and understand engineering drawings.
3	To learn the features of CAD software & conversion of 3D views & 2D views.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply the projection of points and lines located in different quadrants	K2
2	Prepare multi view orthographic projections of objects by visualizing them in different positions	K3
3	Plot sectional views and develop surfaces of a given object.	K3
4	Prepare pictorial drawings using the principles of isometric projection	K3
5	Sketch simple drawing using CAD tools.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	1	-	-	-	-	-	-	3	2	-	-	1	-	-	-	-	-	-	3	-	-
2	3	3	2	1	-	-	-	-	-	3	2	2	-	2	-	-	-	-	-	-	3	-	-
3	3	3	2	2	1	-	-	-	-	3	2	2	1	2	-	-	-	-	-	-	3	2	-
4	2	3	3	2	1	-	-	-	-	2	2	3	1	3	-	-	-	-	-	-	3	2	-
5	2	3	3	3	2	-	-	-	-	2	3	3	2	3	-	-	-	-	-	-	3	3	2

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Projection of Points, Lines & Planes**	Introduction: Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of a line. Inclination of lines with reference planes. True length and true inclinations of line inclined to both the reference planes. Projections of plane lamina of geometrical shapes - Plane lamina parallel to one of the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.	12
2	**Projection of Solids**	Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cube, Tetrahedron, Cone and Cylinder only. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.	10
3	**Section and Development of Solids**	Sections of Solids: Sections of Prisms, Pyramids, Cone and Cylinder only, with axis in vertical position and cut by different section planes. True shape of the sections. (Exclude true shape given problems). Development of Surfaces: Development of surfaces of the solids and solids cut by different section planes. (Exclude problems with through holes)	11
4	**Isometric & CAD**	Isometric Projection: Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere and their combinations. Computer Aided Drawing (CAD): Introduction, Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software. (CAD, only internal evaluation)	12

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL.	Name of Book	Name of Author/s	Publisher	Year
1.	Engineering Graphics	Varghese, P. I.	V I P Publishers	2018
2	Engineering Graphics	John, K. C.	Prentice Hall India Publishers	2017
3	Engineering Drawing	Bhatt, N., D.	Charotar Publishing House Pvt Ltd.	2019
4	Engineering Graphics	Anilkumar, K. N.	Adhyuth Narayan Publishers	2022

REFERENCE				
SL.	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Graphics with AutoCAD	Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K.	Prentice Hall India Publishers	2020
2	Engineering Graphics	Benjamin, J.	Pentex Publishers	2016
3	Engineering Drawing & Graphics	Venugopal, K.	New Age International Publishers	2011
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/noc25_me173/preview			
2	https://onlinecourses.nptel.ac.in/noc24_me140/preview			
VIRTUAL LAB/SIMULATION TOOLS				
1	CAD Software			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1. Projection of Points, Lines & Multi View Projections. (12 Hrs)	Part 1	Projection of Points	Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. Projection of points in different quadrants	4
	Part 2	Projection of Lines	Projection of straight lines inclined to one plane and inclined to both planes. Trace of a line. Inclination of lines with reference planes.	2
	Part 3	Line inclined to both the planes	True length and true inclinations of line inclined to both the reference planes.	3
	Part 4	Projection of Planes	Projections of plane lamina of geometrical shapes - Plane lamina parallel to one of the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.	3
2. Projection of Solids (10 Hrs)	Part 1	Simple solids	Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder only.	3
	Part 2	Solid inclined to HP	Projection of solids with axis inclined to Horizontal panes.	2
	Part 3	Solid inclined to VP	Projection of solids with axis inclined to Vertical panes.	2
	Part 4	Solid inclined to both the planes	Projection of solids with axis inclined to both reference planes.	3
3. Section and Development of Solids (11 Hrs)	Part 1	Section of plane with HP	Sections of Prisms, Pyramids, Cone and Cylinder only, with axis in vertical position and cut by HP section planes. True shape of the sections.	3

	Part 2	Section of plane with VP	Sections of Prisms, Pyramids, Cone and Cylinder only, with axis in vertical position and cut by VP section planes. True shape of the sections.	3
	Part 3	Development of surfaces	Development of surfaces of the solids and solids	3
	Part 4	Development of truncated solids	Development of surfaces of the solids cut by different section planes.	2
4. Isometric & CAD (12 Hrs)	Part 1	Isometric view	Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere.	3
	Part 2	Isometric Projection	Isometric scale - Isometric Projections of Prisms, Pyramids, Cone, Cylinder, Sphere.	2
	Part 3	Combination of solids	Combination of solids of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere of Isometric View and Projection.	3
	Part 4	Computer Aided Drawing (CAD)	Introduction, Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software.	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Technical Drawing Practice	Practice projection of points and lines located in different quadrants; identify errors and prepare neat engineering sheets.	6	1	CO1	WK, WK, WK3	PO1, PO2, PO5
2	Planes	Prepare different planes, Projections of plane lamina of geometrical shapes.	6	1	CO1	WK, WK, WK4	PO1, PO2, PO3, PO5
3	Sectional and Development Drawing	Prepare sectional and development views of prisms, pyramids, and cylinders, showing true shape and surface development.	6	3	CO3	WK, WK, WK5	PO1, PO2, PO3, PO5
4	CAD Practice	Use any CAD software to create 2D drawings of simple mechanical components and convert them into 3D isometric projections.	6	4	CO4, CO5	WK, WK, WK, WK7	PO1, PO2, PO3, PO5, PO11
5	Reflective Journal	Maintain a report documenting learning progress, challenges, and solutions across all modules.	6	All	CO1–CO5	WK, WK9	PO11

TERM WORK ACTIVITIES (15 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Drawing & Modelling Assignments	Complete detailed drawings of points, lines, and solids manually; construct 3D models of simple solids (prisms, pyramids, cones, cylinders) using chart paper.	5	1, 2, 3	CO1, CO2, CO3	WK1, WK2, WK3, WK4	PO1, PO2, PO5
2	Sectional & Development Drawing	Prepare sectional views and develop surfaces of prisms, pyramids, cones, cylinders, showing true shape and surface development.	5	3	CO3	WK3, WK4, WK5	PO1, PO2, PO3, PO5
3	CAD Project	Create 2D and 3D isometric projections of simple components using CAD software; submit a report with screenshots and observations.	5	4	CO4, CO5	WK4, WK5, WK6	PO1, PO2, PO3, PO5, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**60%**
Learning Activity (Self Learning, Drawing Sheet, Assignments, Module Test, Tutorials)	50 %
Attendance	10 %
Internal Examination	40 %
Course Project	NA
End Semester Examination	**40%**
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN

Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	**U**	**A**	**An**	**E**	**C**	
1	Projection of Points, Lines & Planes	12		10					10
2	Projection of Solids	10			10				10
3	Section and Development of Solids	11			10				10
4	Isometric & CAD	12		10					10

This shall be treated as a general guideline for students and teachers for distribution of marks.

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		1			
Part	**No. of Questions/Module**	**Total No. of Questions**	**Max. marks/ Question**	**Part Summary**	**Total Marks**
A	2 (Including Choice)	8	10	4 x 10	40
TOTAL MARKS					**40**

Course Code	Course Name				Credits
J1ESP105	**FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING**				**4**
Regulation	2026	L: T:P:H:S	3:0:2:0:5.5	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	ES	Course delivery Mode		Theory + Practical	
Scheme of Evaluation		CIE: 60 Marks	ESE: 40 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	NIL				

COURSE OBJECTIVE	
1	Introduce the fundamental concepts and basic theorems in Electrical Engineering.
2	Introduce essential electrical machines, power supply systems, renewable energy resources, and safety practices
3	To explain the fundamentals of electronic circuits, digital electronics, and communication systems, and to familiarize students with emerging technologies such as ZigBee, WiMAX, PAN, 5G, 6G, and IoT.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain fundamental concepts and theorems in electrical engineering	K2
2	Apply fundamental electrical circuit laws and concepts (Ohm's law, Kirchhoff's laws, AC/DC circuits, and three-phase systems) to solve basic electrical engineering problems	K3
3	Explain the construction, operating principles, and applications of electrical motors, transformers, renewable energy sources, and safety devices	K2
4	**Apply** the principles of electronic devices and circuits to **analyze** the characteristics and operation of BJTs and FETs, **construct and test** basic electronic circuits using standard components and instruments, and **design and implement** simple PCB-based systems using appropriate tools and techniques.	K4
5	Apply the principle of digital electronics and communication systems to analyze the functioning and applications of wired and wireless technologies such as AM, FM, GSM, Bluetooth, ZigBee, WiMAX, PAN, 3G–6G, and IoT.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	3	-	-	2	2	-	-	3	3	-	-	-	-	-	-	-	-	2	-	-	-
2	3	3	3	2	-	2	2	-	-	3	3	2	-	-	-	-	-	-	-	2	-	-	-
3	3	3	3	2	-	2	2	-	-	3	3	3	2	-	-	-	-	-	-	2	-	-	-
4	3	2	3							3	3	3		3				2		2			
5	3	2	3		2					3	3	2		2				2		2			

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	Fundamental Concepts and Basic theorems in Electrical Engineering	DC Circuits: Basic Definitions of electrical quantities, Components in Electric circuits, Resistance in Series and Parallel, Voltage and current divider rule (Simple numerical problems) Ohm's Law and Kirchhoff's laws, (Simple numerical problems) Faraday's laws of Electromagnetic induction, Generation of Alternating Voltage, Representation of ac voltage and currents, sinusoidal waveforms: frequency, time period, average, & RMS values and form factor of waveform, (Simple numerical problems) Three phase AC systems: Representation of three phase voltages; star and delta connections, relation between line and phase voltages, line and phase currents. (Simple numerical problems)	13
2	Components and systems in Electrical Engineering	Generation of electrical energy: Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description) Electrical supply system: simple layout of Generation, transmission and Distribution of power Distribution system: Feeder, distributor, service mains Introduction to renewable energy resources: Solar-Photovoltaic, wind Transformers: Construction and Working principle of a single-phase Transformer Electrical Motor: Construction, principle of operation, Different types of motors, applications Earthing: Need for earthing, Types of earthing; pipe earthing, plate earthing. Safety devices: MCB, ELCB	12
3	Introduction to Electronic devices	Introduction to Electronic devices: Passive and active components in electronics (Resistor, Capacitor, inductor, Diode, BJT, FET). Block diagram of DC power supply. Construction, working and V -I Characteristics of BJT, Input output characteristics of CE configuration, Comparison of CE, CB and CC configurations. Transistor as a switch, Transistor as an amplifier (Circuit diagram and working), Introduction to FET.	10
4	Digital Electronics and communication systems.	Modern Electronics and its applications: General block diagram of a communication system. Basic concepts of Wired communication, Introduction to Wireless Communication, Evolution, Wireless LAN, Bluetooth, Zig-Bee and Personal Area Networks. Broadband Wireless Access-WiMax Technology, Wireless spectrum allocation and Standards. Number Systems- Decimal, Binary, Octal and hexadecimal, and their conversions. Introduction to IoT and its applications.	15

LIST OF EXPERIMENTS (20 Hours)		
Instructions • Minimum 10 Experiments are mandatory • Students should maintain a record of the lab experiments		
Sl. No.	**Experiment**	**CO**
ELECTRICAL (Minimum of 5 Experiments to be done)		
1	Verification of Ohms, Law, and Measurement of resistances	2
2	Verification of Kirchhoff's laws	2
3	Verification of voltage division and Current division rules	1, 2
4	Measurement of amplitude frequency, time period of a sinusoidal waveform and hence to calculate, average, rms, peak factor and form factor	1
5	A) Demonstrate the precautionary steps adopted in case of Electrical shocks. B) Identify different types of cables, wires, switches, fuses, fuse carriers, C) Identify MCB, ELCB and MCCB, familiarize the ratings.	3
6	A) Identify battery specifications using different types of batteries. (Lead acid, Li Ion, NiCd etc.) B) Familiarize different types of earthing (Pipe, Plate Earthing, Mat Schemes) and ground enhancing materials (GEM).	3
7	Wiring a single lamp controlled by Single switch	3
ELECTRONICS (Minimum of 5 Experiments to be done)		
1	**Identification of Electronic Components and Circuit Representation.** (Identify and classify electronic components based on their specifications and represent electronic circuits using BIS/IEEE standard symbols, along with interpretation of datasheets of discrete components and ICs.)	CO4
2	**Familiarization and Application of Testing Instruments and Tools**. - (Multimeter, Function generator, Power supply, CRO, DSO. Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station)	CO4
3	**Testing of Electronic Components using Multimeter** - Test and analyze electronic components such as **resistor, capacitor, diode, transistor, and JFET** using a multimeter and verify their functionality.	CO4
4	**Assembly of Electronic Circuits using Surface Mount Technology (SMT)** Assemble and test electronic circuits using **SMT components** and appropriate **soldering/ desoldering techniques** with proper safety precautions.	CO4
5	**Study and Simulation of a Communication System** Analyze the functional blocks of a communication system and simulate signal transmission and reception using appropriate software tools.	CO4
6	**Demonstration and Study of Wireless Communication Technologies** Demonstrate and analyze wireless communication using technologies such as WLAN, Bluetooth, and ZigBee, and compare their characteristics and applications.	CO5
7	**Implementation of a Basic IoT System** Implement a simple IoT system for LED control or sensor monitoring using suitable hardware/software platforms.	CO5
8	**Design of Electronic Circuits using EDA Tools** Design and simulate electronic circuits using EDA tools such as KiCad or XCIRCUIT, and generate circuit schematics/layouts.	CO5

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL.	Name of Book	Name of Author/s	Publisher	Year
1	Basic Electrical Engineering	D. P Kothari and I. J Nagrath	Tata McGraw Hill	2019
2	Basic Electrical Engineering	V. K. Mehta, Rohit Mehta	S. Chand &Company, Limited	2006
3	Electrical Design Estimating and Costing	K B Raina and S K Bhattacharya	New Age International Publishers	2024
4	Basic Electronics and Linear Circuits	N N Bhargava D C, Kulshreshtha	McGraw Hill	2017
5	Digital Fundamentals	Thomas L. Floyd	Pearson Education	2020

REFERENCE

SL.	Name of Book	Name of Author/s	Publisher	Year
1	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill	2019
2	Electrical Engineering Fundamentals	Del Toro V	Pearson Education	2019
3	Electrical Systems Design	M K Giridharan	I K International Publishing House Pvt. Ltd	2022
4	Electronics: A Systems Approach	Neil Storey	Pearson	2017
5	Principles of Electronic Communication Systems	Louis E. Frenzel	McGraw Hill	2023

VIDEO LINKS

1	Fundamentals of Electrical Engineering- https://nptel.ac.in/courses/108105112
2	Transformer Basics- https://www.youtube.com/watch?v=NkRk_xaRwjg&t=16s
3	https://www.youtube.com/watch?v=kGDQkbNsC9w
4	https://www.youtube.com/watch?v=OUcKJuMSSW4
5	https://nptel.ac.in/courses/122106025, https://youtu.be/w8Dq8blTmSA, Lecture Series on Basic Electronics by Prof. T.S.Natarajan, Department of physics, IIT Madras
6	https://www.youtube.com/watch?v=HOpaW2Ungcc&list=PLp6ek2hDcoNAUpqc3DUj4U5hcipc2idZ5&index=11
7	https://www.youtube.com/watch?v=itiOpVqSi0A&list=PLp6ek2hDcoNAUpqc3DUj4U5hcipc2idZ5&index=32

VIRTUAL LAB/SIMULATION TOOLS	
1	https://bes-iitr.vlabs.ac.in/List%20of%20experiments.html
2	Falstad Circuit Simulator: https://www.falstad.com/circuit/
3	Tinkercad Circuits: https://www.tinkercad.com/circuits

COURSE CONTENTS AND LECTURE SCHEDULE (50 HOURS)

Module	Part	Part Name	Topics Covered	Hours
1. Fundamental Concepts and Basic theorems in Electrical Engineering	Part 1	DC Circuits-Simple Concepts and Components	Basic Definitions of electrical quantities, Components in Electric circuits, Resistance in Series and Parallel, Voltage and current divider rule	3
	Part 2	Ohms Law and Kirchhoff's Laws	Ohm's Law and Kirchhoff's laws, Simple numerical problems	3
	Part 3	Electromagnetic induction and Alternating Quantities	Faraday's laws of Electromagnetic induction, Generation of Alternating Voltage, Representation of ac voltage and currents, sinusoidal waveforms: frequency, time period, average, & RMS values and form factor of waveform, Simple numerical problems	4
	Part 4	Three phase AC systems	Representation of three phase voltages; star and delta connections, relation between line and phase voltages, line and phase currents. Simple numerical problems	3
2.Components and systems in Electrical Engineering	Part 1	Generation of electrical energy	Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description) Introduction to renewable energy resources: Solar- Photovoltaic, wind	4
	Part 2	Electrical supply system	simple layout of Generation, transmission and Distribution of power Distribution system: Feeder, distributor, service mains	2
	Part 3	Electrical Components	Construction and Working principle of a single-phase Transformer Electrical Motor: Construction, principle of operation, Different types of motors, applications	3
	Part 4	Earthing and Safety	Earthing: Need for earthing, Types of earthing; pipe earthing, plate earthing; Safety devices: MCB, ELCB	3

3. Introduction to Electronic devices (10 Hrs)	Part 1	Electronic Components and Power Supply	Passive and active components: Resistors, Capacitors, Inductors, Diodes, BJTs, FETs. Block diagram of a DC power supply.	5
	Part 2	Transistor Characteristics and Configurations	Construction, working, and V–I characteristics of BJT. Input and output characteristics of CE configuration. Comparison of CE, CB, and CC configurations. Transistor Performance Parameters.	5
4. Digital Electronics and communication systems. (15 Hrs)	Part 1	Communication Systems Fundamentals	General block diagram of a communication system.	2
	Part 2	Wired and Wireless Communication	Basic concepts of wired and wireless communication. Evolution of wireless systems. Overview of WLAN, Bluetooth, ZigBee, PAN. Broadband Wireless 3Access – WiMAX. Wireless spectrum allocation and standards.	7
	Part 3	Cellular and Advanced Communication Systems	Applications and evolution trends. Basic concept, architecture, and applications of IoT in modern communication systems.	3
	Part 4	Digital Electronics Fundamentals	Number systems: Decimal, Binary, Octal, Hexadecimal and conversions.	3

SELF LEARNING ACTIVITIES (25 Hrs)

Sl.	Activity	Description	Time	Module	CO	WK	PO
1	**Simulation/ Virtual Lab**	Simulation tutorials on Ohm's Law and KCL/KVL using software like Multisim, PSpice, Falstad or any other Circuit Simulator or virtual lab	4	1	1, 2	WK1 WK2 WK3	PO1 PO2 PO4
2	**Technical Video Presentation**	Watch short documentary clips on how each power plant works and prepare a table comparing efficiency, cost, and environmental impact of each plant.	3	2	3	WK1 WK4 WK5 WK7	PO2 PO3 PO6 PO11
3	**Technical Video Presentation**	Watch video simulations of 1-pahse and 3-phase generation, rotation of phasors.	2	1	1	WK3 WK4	PO1
4	**Application**	List 10 real-world applications of electrical motors in your home, college or any other places you visit frequently. Identify which type is likely used in each and give proper justification.	4	2	3	WK4 WK6	PO1 PO2
5	**Exploratory Virtual Lab Study**	Independently explore online virtual labs (IITB, Falstad, or TINA-TI) to observe the behavior of basic electronic components such as diodes, transistors, and operational amplifiers. Record key observations related to voltage/current characteristics and performance trends. *(Focus: concept familiarization, no formal evaluation)*	8	1	CO4	WK3	PO1, PO2
6	**Technical Review & Presentation**	Prepare a concise report or presentation on emerging technologies such as ZigBee, WiMAX, PAN, 5G, 6G, or IoT, highlighting their key features and relevance in modern communication systems. *(Focus: independent research and communication skills)*	4	2	CO5	WK6 , WK7	PO4, PO10

TERM WORK ACTIVITIES (30 Hrs)							
Sl.	**Activity**	**Description**	**Time**	**Module**	**CO**	**WK**	**PO**
1	**Technical Visit and Report**	Visit the Roof top Solar power plant installed in the college and submit a report	5	2	3		
2	**Experimentation**	Demonstrate electromagnetic induction using a coil, magnet, and galvanometer.	3	1	2		
3	**Assignment**	Prepare a poster regarding electrical safety for humans, equipment and building	4	2	3		
4	**Analog Circuit Simulation and Verification**	Simulate and verify the performance of analog circuits such as half-wave, full-wave rectifiers, filters, and transistor amplifiers using Multisim or TINA-TI. Compare simulated waveforms with theoretical predictions and submit a lab report. *(Focus: structured analysis and performance evaluation)*	9	1	CO4	WK3, WK4	PO1, PO2
5	**Digital Circuit Implementation**	Design and simulate basic digital logic circuits and Boolean expressions using logic gates. Verify truth tables and timing responses through software simulation. *(Focus: formal design verification and documentation)*	9	2	CO5	WK5	PO1, PO3

RUBRICS FOR TERM WORK EVALUATION						
Sl.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Simulation	Correct, optimized, and complete implementation with proper documentation.	Implementation mostly correct; minor optimization issues.	Partial implementation with minor errors.	Incomplete or contains major functional errors.	No valid implementation attempted.
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

LAB EVALUATION RUBRICS							
Sl.	**Criteria**	**Weightage**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Preparation & Pre-Lab Work	30%	Comes fully prepared with pre- lab work completed; demonstrates clear understanding of objectives and procedure.	Minor gaps in pre-lab preparation; understands most objectives and procedures.	Partial pre-lab work done; limited understanding of objectives.	Minimal preparation; weak understanding of experiment.	No preparation; unable to explain objectives/ procedure.
2	Experimental Skills & Performance	40%	Performs experiment independently with precision, follows correct procedure	Performs experiment with minor guidance, procedure is mostly correct.	Needs frequent guidance; some procedural errors.	Struggles with procedure require constant help.	Unable to perform experiment correctly even with help
3	Analysis, Interpretation and Documentation	30%	Analyze, Interpret and Document results correctly	Minor interpretation issues.	Some errors in analysis; interpretation superficial.	Major errors in calculations; misinterprets results. Errors in Documentation	No meaningful analysis/interpretation.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**60%**
Lab Evaluation	30 %
Learning Activity (Self Learning, Term Work, Assignments,)	10%
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**40%**
Total	100

TABLE OF SPECIFICATIONS FOR ESE QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Fundamental Concepts and Basic theorems in Electrical Engineering	13	3	4	3	-	-	-	10
2	Components and systems in Electrical Engineering	12	-	5	5	-	-	-	10
3	Introduction to Electronic devices	10	-	5	5	-	-	-	10
4	Digital Electronics and communication systems.	15	-	5	5	-	-	-	10
This shall be treated as a general guideline for students and faculty for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper			2		
Part	No. of Questions/ Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	1 (No choice)	4	3	4x 3	12
B	2 (Including Choice)	8	7	4 x 7	28
TOTAL MARKS					**40**

Course Code	Course Name				Credits
J1HWP126	**HEALTH AND WELLNESS**				**1**
Regulation	2026	L:T:P:H:S	1:0:1:0:2	Notional Learning Hours/Semester	30
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW)					
Course Type	TP	Course delivery Mode			Theory & practical
Scheme of Evaluation		CIE:100 Marks	ESE: 0 Marks	Total Marks:100	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	To provide essential knowledge on physical activity, health, and wellness**.** To ensure students understand body systems, exercise principles, nutrition, mental health, and disease management.
2	To educate students on the benefits of yoga, the risks of substance abuse and basic first aid skills. To equip students with the ability to lead healthier lifestyles.
3	To enable students to design effective and personalized exercise programs.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply the FITT principle to design a basic exercise programme by relating the functions of the respiratory, cardiovascular, and musculoskeletal systems to the components of health-related physical fitness and appropriate exercise intensity levels.	K3
2	Apply principles of balanced nutrition and wellness to evaluate dietary choices and recommend appropriate lifestyle modifications for improving physical and mental health.	K3
3	Apply yogic practices and lifestyle management strategies to prevent and manage common hypokinetic diseases and musculoskeletal disorders, and assess the health consequences of psychoactive substance abuse.	K3
4	Describe first aid procedures, including primary survey, CPR, and the Heimlich maneuver, to manage common sports injuries and medical emergencies effectively.	K2

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1		2	2	-	-	-	-	-	-	-	2	1	-	-	-	2	1	-	1	1			
2	-	1	2	2	-	-	2	-	1	-	1	2	2	-	-	3	2	2	2	2			
3	1	1	2	-	-	-	2	-	2	1	1	1	-	-	-	3	2	3	1	1			
4	2	-	2	1	-	2	2	-	1	-	1	1	1	-	1	3	-	2	2	2			
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																							

Module	Title	Topics	Hours
1	Introduction to Physical Activity and Body Systems	Introduction of the importance of physical activity in daily life. Human Body Systems related to Physical activity and its functions: Respiratory System - Cardiovascular System. Musculoskeletal System and the Major Muscle groups of the HumanBody. Quantifying Physical Activity Energy Expenditure and Metabolicequivalent of task (MET) Exercise Continuum: Light-intensity physical activity, Moderate - intensity physical activity, Vigorous -intensity physical activity. Defining Physical Activity, Aerobic Physical Activity, Anaerobic Physical Activity, Exercise and Health-Related Physical Fitness. FITT principle to design an Exercise programme Components of Health related Physical Fitness: - Cardiorespiratory Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	5
2	Health, Wellness, and Nutrition	Concept of Health and Wellness: Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health. Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet, Carbohydrate & the Glycemic Index Animal & Plant - based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals	3
3	Yoga, Lifestyle Diseases, and Substance Abuse	Lifestyle management strategies to prevent / manage common hypokinetic diseases and disorders - Obesity - cardiovascular diseases (e.g., coronary artery disease, hypertension) - Diabetes Osteoporosis, Musculoskeletal disorders (e.g., osteoarthritis, Low back pain, Kyphosis, lordosis, flat foot, Knock knee).Meaning, Aims and objectives of yoga - Classification and importance of of Yogic Asanas (Sitting, Standing, lying) Pranayama and Its Types - Active Lifestyle and Stress Management Through Yoga Understanding on substance abuse and addiction - Psychoactive substances & its ill effects- Alcohol- Opioids- Cannabis -Sedative - Cocaine -Other stimulants, including caffeine -Hallucinogens - Tobacco -Volatile solvents.	4

4	First Aid and Sports Injuries	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider First aid measures for: - Cuts and scrapes - Bruises - Sprains - Strains - Fractures - Burns - Nosebleeds. First Aid Procedures: Cardiopulmonary Resuscitation (CPR) - Heimlich Maneuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain)	3

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Foundations of Nutrition	Bhavana Sabarwal	Commonwealth Publishers	1999
2	Anatomy and physiology in health and illness.	Ross and Wilson	Waugh, A., & Grant, A.	2022

REFERENCE

Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Fit to be Well Essential Concept	Thygerson, A. L., Thygerson, S. M., & Thygerson, J. S.	Jones & Bartlett Learning.	2018
2	Introduction to physical education, fitness, and sport.	Siedentop, D., & Van der Mars, H.	Human kinetics.	2022
3	Substance Use Disorders. Manual for Physicians.	Lal, R., & Ambekar, A. (2005).	National Drug Dependence TreatmentCentre, New Delhi	2005
4	The exercise health connection-how to reduce your risk of disease and other illnesses by making exercise your medicine.	Nieman, D. C., & White, J. A	Public Health	1998
5	ACSM's resource manual for guidelines for exercise testing and prescription.	Lippincott Williams& Wilkins.	American College ofSports Medicine.	2012
6	Exercise Physiology: energy, nutrition and human performance.	Katch, F. I., Katch, V. L., & McArdle, W. D.	Lippincott Williams & Wilkins	2010

VIDEO LINKS

1	https://youtu.be/GdyGcPCl5cs?si=LYHNNxDt1D7p4lpq
2	https://youtu.be/Zlk2BvPtySo?si=-2rCDuIwiUanCcM4

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1.Introduction to Physical activity and Body systems (5 Hrs)	Part 1	Introduction to Physical activity	Major benifits of physical activity, Essential measures before and after exercise	1
	Part 2	Respiratory system and vital exercise performance	Anatomy and Physiology of the respiratory system, Vital exercise for respiratory health	1
	Part 3	Cardio Vascular system and Exercise	Anatomy and Physiology of Cardio vascular system, Cardio vascular health and Exercise.	1
	Part 4	Musculoskeletal system and Exercise	Anatomy and physiology Musculoskeletal system, Musculoskeletal system and Exercise	1
	Part 5	FITT principle to design an Exercise programme	Components of Health related Physical Fitness: - Cardiorespiratory Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	1
2.Concept of Health and Wellness (3 Hrs)	Part 1	Concert of health and wellness	Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health.	1
	Part 2	Human welfare and sports, Concept of balanced Diet	Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet	1
	Part 3	Different Dietary options and essential Vitamins and minerals	Carbohydrate & the Glycemic Index Animal & Plant - based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals	1
3. Yoga and Substance abuse (4 Hrs)	Part 1	lifestyle management through Yoga	Lifestyle management strategies to prevent / manage common hypokinetic diseases and disorders - Obesity - Cardiovascular diseases (e.g., coronary artery disease, hypertension) - Diabetes - Osteoporosis - Musculoskeletal disorders (e.g., osteoarthritis, Low back pain, Kyphosis, lordosis , flat foot, Knock knee)	2
	Part 2	Yoga - Meaning, Aim and objectives	Meaning, Aims and objectives of yoga - Classification and importance of of Yogic Asanas (Sitting, Standing, lying) Pranayama and Its Types - Active Lifestyle and Stress Management Through Yoga	1
	Part 3	Understanding substance abuse	Understanding on substance abuse and addiction - Psychoactive substances & its ill effects- Alcohol- Opioids- Cannabis -Sedative - Cocaine -Other stimulants, including caffeine -Hallucinogens - Tobacco -Volatile solvents.	1

4.First aid and sports injuries (3 Hrs)	Part 1	First Aid	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider	1
	Part 2	Different first aid measures	First aid measures for: - Cuts and scrapes - Bruises - Sprains - Strains - Fractures - Burns - Nosebleeds. First Aid Procedures: Cardiopulmonary Resuscitation (CPR) - Heimlich Maneuver - Applying a sling	1
	Part 3	Sports injuries: Classification	Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain	1

SELF LEARNING ACTIVITIES (30 Hrs)

Sl No.	Activity	Description	Time	Module	CO	WK	PO
1	NPTEL video analysis and submission of case study	Submission of a case study in the topic of Exercise in children and adolescents or Role of Exercise in disease management	6	1	CO1	WK1, WK2, WK3	PO1, PO2, PO5
2	Dietary Analysis and Nutrition Journal	Maintain a 7-day food diary and analyze macronutrient and micronutrient intake using online tools; submit a written report on dietary habits and suggested improvements.	6	2	CO2	WK4, WK6	PO1, PO6, PO8
3	Yoga and Mindfulness Practice Log	Practice a set of yogic asanas and pranayama regularly for 4 weeks; maintain a reflective journal documenting postures practiced, duration, and health benefits observed.	6	3	CO3	WK3, WK6	PO6, PO7, PO8
4	First Aid Scenario Simulation Report	Study and document appropriate responses to 5 first-aid emergency scenarios including CPR, choking, fractures, burns, and bleeding; prepare a structured emergency response guide.	6	4	CO4	WK2, WK5	PO6, PO9
5	Personal Fitness Assessment and Exercise Program Design	Measure individual fitness components (resting heart rate, flexibility, muscular endurance); evaluate results against norms and design a 6-week personalized exercise program using FITT principles.	6	1	CO1	WK1, WK3	PO1, PO2, PO9

TERM WORK ACTIVITIES (15 Hrs)							
Sl.No.	Activity	Description	Time	Module	CO	WK	PO
1	Physical Fitness Testing and Report	Conduct standard fitness tests (sit-and-reach, push-up test, 3-minute step test); record results, compare against age-based norms, and submit a written fitness report with recommendations.	5	1	CO1	WK2, WK4	PO4, PO9
2	Yoga Asana and Pranayama Demonstration	Demonstrate a sequence of 5 yogic asanas (one from each category: sitting, standing, lying) and one pranayama technique; explain the health benefits of each posture demonstrated.	5	3	CO3	WK3, WK6	PO6, PO9
3	First Aid and CPR Practical Demonstration	Demonstrate the primary survey (ABC), CPR on a training manikin, Heimlich maneuver, wound dressing for cuts and burns, and application of a sling; assessed by instructor using a standardized checklist.	5	4	CO4	WK2, WK5	PO6, PO9

RUBRICS FOR TERM WORK EVALUATION						
Sl. No.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Subject Knowledge and Accuracy	Demonstrates thorough and accurate understanding of all concepts with no errors.	Shows good understanding with only minor errors.	Shows adequate understanding with some conceptual errors.	Shows limited understanding with several notable errors.	Little or no understanding of the subject evident.
2	Practical Skill Performance	Demonstrates all required practical skills correctly and with confidence.	Performs most practical skills correctly with minor lapses.	Performs skills adequately but with noticeable inconsistencies.	Struggles with most practical skills; requires repeated guidance.	Unable to perform practical skills correctly.
3	Record / Report Quality	Comprehensive, well-organized report with thorough data analysis and clear conclusions.	Clear, well-structured report with adequate detail and logical conclusions.	Satisfactory report with basic information but limited analysis.	Incomplete report with minimal information and poor structure.	Very poor or no report submitted.

4	Participation and Engagement	Consistently active and enthusiastic participation in all practical activities.	Regular participation with only occasional lapses in engagement.	Participates adequately when required; moderate engagement.	Rarely participates; frequently needs encouragement from instructor.	Does not participate in activities even when prompted.
5	Attendance and Punctuality	Attends all practical sessions on time with no absences.	Attends most sessions; rarely late with no unexcused absences.	Acceptable attendance with a few minor absences or instances of tardiness.	Poor attendance; frequently absent or consistently late.	Very poor attendance; misses most practical sessions.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Attendance	10 %
Case Study/Micro project/Presentation	40 %
Activity evaluation	50 %
Total	100 Marks

Course Code	Course Name				Credits
J1ESL117	**PROGRAMMING IN C WORKSHOP**				**1**
Regulation	2026	L:T:P:H:S	0:0:2:0:1	Notional Learning Hours/Semester	30
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	PL	Course delivery Mode		Practical	
Scheme of Evaluation		CIE: 100 Marks	ESE: -	Duration of ESE: Nil	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	Familiarize students with the syntax and semantics of the C programming language.
2	Enable students to apply control structures, arrays, strings, pointers, and functions in real-world programming tasks.
3	Introduce the concepts of structures and file handling for data management.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Demonstrate the foundational concepts of C programming including data types, operators, control structures, and loop constructs to develop logically structured programs.	K3
2	Design and implement modular programs using user-defined functions and manipulate arrays with standard searching and sorting algorithms to solve computational problems.	K3
3	Apply string handling techniques and substring operations using built-in and custom functions to process and manipulate character data effectively.	K3
4	Utilize pointers, structures, and dynamic memory allocation to manage complex data representations and optimize memory usage in C programs.	K3
5	Develop C programs to perform file handling operations including creation, reading, writing, and modification of files for persistent data storage and retrieval.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	-	3	2	3	-	3	-	1	-	3	3	3	-	-	-	-	-	-	-	3	1	3	-
2	-	3	-	3	-	3	-	1	-	3	3	3	-	-	-	-	-	-	-	3	1	3	-
3	-	3	-	3	-	3	-	1	-	3	3	3	-	-	-	-	-	-	-	3	1	3	-
4	-	3	-	3	-	3	-	1	-	3	3	3	-	-	-	-	-	-	-	3	1	3	-
5	-	3	-	3	-	3	-	1	3	3	3	3	-	-	-	-	1	-	-	3	1	3	-

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Fundamentals of C Programming (Basics, Loops & Control Statements)**	Addition of two numbers, Area of Triangle, Odd or Even, Sum of digits of a number, Fibonacci using whileloop, Armstrong number, Palindrome or not, Factorial of a number.	9
2	**Functions, Arrays & Searching/Sorting**	Sum of three numbers using functions, Area of a triangle using functions, Calculator using function, Even number sieving from an array, Matrix addition, Transpose of a matrix, Matrix multiplication, Bubble Sort, Sequential search using functions, Find the largest number in an array using function.	7
3	**Strings & Substring Operations**	String Concatenation, String Palindrome, Substring search and deletion	5
4	**Pointers, structure and dynamic memory allocation, File Handling**	Pointers, Dynamic memory allocation -create nodes for a class and store details of students, Factorial of a number using recursion, File manipulation -file creation, deletion, fseek (),Copying a file, Removing blank spaces in a file	9

LIST OF EXPERIMENTS (36 Hours)

Instructions

- Lab experiments must be implemented in C
- Minimum 20 Experiments are mandatory
- Suitable Data/ Datasets can be used whenever required
- Students should maintain a record of the lab experiments.

Sl. No.	Experiment	CO
1	Write a program to find the Sum of two numbers	CO1,CO2
2	Write a program to find the Area of a Triangle	CO1,CO2
3	Write a program to find the given number is Odd or Even	CO1,CO2
4	Write a program to find the Sum of the digits of a number	CO1,CO2
5	Write a program to find the Fibonacci Sequence Generation Using a While Loop	CO1,CO2
6	Write a program to check whether the given number is an Armstrong number	CO1,CO2
7	Write a program to check the given number is palindrome or not	CO1,CO2
8	Write a program to find the Factorial of a number	CO1,CO2

9	Write a program to find the Sum of three numbers using functions	CO1,CO4
10	Write a program to find the Area of a triangle using functions	CO1,CO4
11	Write a program to implement Calculator using function	CO1,CO4
12	Write a program for Even number sieving from an array.	CO1,CO3
13	Write a program for Matrix addition	CO1,CO3
14	Write a program to find the Transpose of a matrix	CO1,CO3
15	Write a program for Matrix multiplication	CO1,CO3
16	Write a program for Bubble Sort	CO1,CO3
17	Write a program for Sequential search using functions	CO1,CO3
18	Write a program to Find the largest number in an array using function	CO1,CO3
19	Write a program for String Concatenation	CO1,CO3
20	Write a program for String Palindrome	CO1,CO3
21	Write a program for Substring search and deletion	CO1,CO3
22	Write a program for Dynamic memory allocation -create nodes for a class and store details of students.	CO1,CO3
23	Write a program for Factorial of a number using recursion	CO1,CO3
24	Write a program for File manipulation -file creation, deletion, fseek()	CO1,CO5
25	Write a program for Copying a file	CO1,CO5
26	Write a program for Removing blank spaces in a file	CO1,CO5
27	Write a program to swap two numbers using pointers (Call by Reference).	CO1,CO4
28	Write a program to find the largest number in an array using pointers.	CO1,CO4
29	Write a program to calculate the sum and average of an array using pointers.	CO1,CO4
30	Write a program to store and display student details (Name, Roll No, Marks) using structures.	CO1,CO4
31	Write a program to calculate the area of a rectangle using a nested structure (Point structure inside Rectangle structure).	CO1,CO4

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Programming in ANSI C	E. Balagurusamy, Mcgraw Hill	Mc Graw Hill 9/e	2024
2	Programming with C	Schaum Series, Gottfried B.S.,Tata McGraw Hill	Mc Graw Hill 4/e,	2018
REFERENCE				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Computer fundamentals and Programming in C	Anita Goel and Ajay Mittal, Pearson	Pearson	
2	Problem Solving and Program Design in C	Byron S Gottfried	Mc Graw Hill	4/e, 2018
3	C Programming Language	Brian W. Kernighan and Dennis M. Ritchie, Pearson,	Pearson 2/e,	2015
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/noc24_cs43/preview – NPTEL: Programming in C			
2	https://onlinecourses.nptel.ac.in/noc22_cs37/preview – *NPTEL: Problem Solving Through C*			
3	https://www.youtube.com/playlist?list=PLBlnK6fEyqRgMCpWVuFwshJHfVhE-Sv6a – *Gate Smashers: C Programming Complete Course*			
SIMULATION TOOLS				
1	OnlineGDB/Replit(C Compiler and Debugger)			
2	Code::Blocks / Dev C++			
3	Visual Studio Code (with C/C++ extensions)			

SELF LEARNING ACTIVITIES (12 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Extend Basic Programs with User-Defined Conditions	Modify simple programs by adding new conditions or input types	2	1	1	1,2,3	3
2	Create Menu-Driven Applications	Build a single menu-driven program that includes multiple operations	2	2	2	1,3	3
3	Variations of Search/Sort Algorithms	Learn alternatives to the algorithms they implemented.(eg:Binary search,Selection sort)	3	3	3	1,3	3
4	Build File-Based Applications	Create programs that store and retrieve data from files	2	4	5	1,3	3
5	Dynamic Memory Allocation Projects	Modify their dynamic allocation program to store additional fields or allow more operations.	3	5	4,5	1,3	1,3

TERM WORK ACTIVITIES (12 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Multi-Feature Computational Tool	Build a menu-driven tool that combines the major basics of C programming: loops, control statements, functions, string handling, and arrays.	4	All modules	1,2,3	2,3,6,	1,2,3,4, 5,6
2	Student Record Management System	Build a data-storage system using structures, dynamic memory, and file operations.	5	All modules	All CO's	2,3,6,7,8	1,2,3,4, 5,6,
3	Documentation and Presentation	Prepare complete documentation for lab experiments including code documentation,and analyze the changes and present findings using visualization tools	3	All Modules	All CO's	2,3	1,2

RUBRICS FOR TERM WORK EVALUATION							
Sl. No.	**Evaluation Criteria**	**Weigh tage**	**Excellent (100%)**	**Good (80%)**	**Satisfactor y (60%)**	**Needs Improvem ent (40%)**	**Poor (10%)**
1	Understanding & Conceptual Clarity	40%	Demonstrates complete understanding of concepts; applies theory correctly; shows deep comprehensio n	Good understandi ng; minor conceptual gaps; mostly correct application	Basic understandi ng; some confusion; limited application	Weak understandin g; major gaps; incorrect application	No understanding; unable to explain concepts
2	Experimental/P rogramming Skills	30%	Flawless execution; optimal approach; error-free; efficient solution; exceeds requirements	Good execution; minor errors; effective approach; meets requiremen ts	Basic execution; several errors; simple approach; partially meets requiremen ts	Poor execution; major errors; inefficient approach; barely meets requirements	Unable to execute; non-functional; does not meet requirements
3	Analysis, Interpretation, and Documentation.	30%	Professional quality; comprehensiv e; accurate results; well-structured; exceeds expectations	Good quality; mostly accurate; clear structure; meets expectation s	Acceptable quality; some inaccuracie s; basic structure; minimal expectation s met	Poor quality; many inaccuracies; weak structure; below expectations	Unacceptable quality; incorrect; no proper structure

RUBRICS FOR CONTINUOS INTERNAL ASESSMENT							
Sl. No.	**Evaluation Criteria**	**Weigh tage**	**Excellent (100%)**	**Good (80%)**	**Satisfactor y (60%)**	**Needs Improveme nt (40%)**	**Poor (10%)**
1	Preparation & Pre-lab Work	20%	Fully prepared, all tasks completed, clear concepts	Minor gaps, overall understands	Partially completed, some confusion	Minimal effort, weak comprehensio n	No prep, unable to explain
2	Experimental/ Programming Skills	20%	Executes with precision, independent work	Minor help needed, mostly accurate	Frequent help, some errors	Constant help, major errors	Unable to perform
3	Analysis & Interpretation	10%	In-depth analysis, insightful, correct inference	Good analysis, few gaps	Basic interpretati on	Minimal interpretation, errors	No analysis
4	Attendance and Timeliness of record Submission	10%	Professional, clear, well-structured, referenced	Mostly clear, minor errors	Average, lacks clarity	Poor, incomplete	Not submitted
5	Viva	10%	Demonstrates full mastery	Good responses	Can answer basic questions	Struggles with responses	Cannot answer
6	Internal Lab Examination	30%	Marks Scored by the student can be proportionally added to the Assessment based on the weightage.				
RUBRICS FOR END SEMESTER EXAMINATION							
Sl.No.	**Criteria**	**Weigh tage**	**Excellent (5)**	**Good (4)**	**Satisfactor y (3)**	**Needs Improveme nt (2)**	**Poor (1)**
1	Experimental Preparation	20%	Clear plan, correct setup, uses resources wisely	Mostly clear, few oversights	Basic preparation	Disorganize d, unprepared	No attempt
2	Problem Solving/Exec ution	30%	Independently solves, correct methodology	Minor help, approach mostly right	Needs guidance, some mistakes	High dependency, errors	Unable to attempt
3	Output Quality	20%	Results fully correct, well interpreted	Results mostly correct	Partial correctness	Mostly incorrect	No output
4	Inference/Int erpretation (Viva Voce)	20%	All results correctly interpreted, strong insights	Good understan ding	Basic interpretati on	Minimal/inc orrect	No inference
5	Record Submission	10%	Outstanding understanding, all questions answered	Good responses, minor errors	Satisfactor y, basic answers	Poor knowledge, incomplete	Does not submit

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**100%**
Lab Evaluation	50 %
Learning Activity (Self Learning, Term Work)	10%
Attendance	10 %
Internal Examination	30 %
Course Project	NA
End Semester Examination	**-**
Total	**100**

Course Code	Course Name				Credits
J1BST211	**APPLIED LINEAR ALGEBRA FOR COMPUTING**				**3**
Regulation	2026	L: T:P:H:S	3:0:0: 0:3.5	Notional Learning Hours/Semester	90
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Elementary matrix operations				

COURSE OBJECTIVE

1	To introduce the foundational concepts of linear systems, vector spaces and linear transformations relevant to computing applications.
2	To develop analytical skills for solving linear systems, constructing bases and applying inner-product methods through structured study.
3	To apply matrix methods, orthogonalization and linear transformations to real-world computing and data-analysis problems.

COURSE OUTCOMES

	Upon successful completion of this course, students will be able to:	Blooms Level
1	Solve linear systems of equations using Gauss elimination, and compute eigenvalues, eigenvectors and the diagonalization of matrices.	K3
2	Apply the concepts of vector spaces, subspaces, linear independence, basis and dimension, including coordinate representation and change of basis.	K3
3	Make use of inner products, orthogonal projections and the Gram-Schmidt process to construct orthonormal bases and solve least-squares problems.	K3
4	Examine linear transformations and their matrix representations, and determine the kernel, range, rank and nullity of a linear transformation.	K3

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	-	-	-	-	-	-	-	3	3	-	-	2	-	-	-	-	-	2	-	-	-
2	3	3	-	-	-	-	-	-	-	3	3	2	-	2	-	-	-	-	-	2	-	-	-
3	3	3	-	-	-	-	-	-	-	3	3	2	2	2	-	-	-	-	-	2	-	-	-
4	3	3	-	-	-	-	-	-	-	3	3	2	2	2	-	-	-	-	-	2	-	-	-
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																							

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Linear systems of equations**	Row echelon form and rank of a matrix, Solution by Gauss elimination, Fundamental theorem for linear systems- Homogeneous and Non-Homogeneous (without proof), Eigen values and Eigen vectors of matrices, Diagonalization of matrices. **[Text 1: Relevant topics from sections 7.3, 7.4, 7.5, 8.1, 8.4]**	11
2	**Vector Spaces 1**	Vector Spaces, Examples of vector space (R^n and M_{mxn} only) Subspaces, Examples as subspaces of Rn and M_{mxn} , Linear combinations of vectors in a vector space, Spanning sets, Linear dependence and independence, Basis for a vector space, The dimension of vector space, Coordinate representation in R^n, Change of basis in R^n : Transition Matrix **[Text 2: Relevant topics from sections 4.2, 4.3, 4.4, 4.5, 4.7]**	12
3	**Vector Spaces 2**	Vector length and unit vector, Dot product and angle between two vectors, The Cauchy- Schwarz Inequality, Inner product, Examples as R^n and M_{2x2}, Properties of inner products, Definitions of length, distance and angle, Orthogonal projections in inner product spaces, Orthogonal and orthonormal sets, Orthogonal and orthonormal basis, Gram-Schmidt orthonormalization process (without proof), The least squares problem, Solving the least square problems. **[Text 2: Relevant topics from sections 5.1, 5.2, 5.3, 5.4]**	11

4	**Linear Transformations**	Linear Transformations, Properties of linear transformations, Linear Transformation given by a matrix, Rotation in R^2, Projection in R^3, Kernel of a Linear Transformation and its basis, Range of a Linear Transformation and its basis, Rank and Nullity of a Linear Transformation, Sum of Rank and Nullity (without proof), Matrices for Linear Transformations. **[Text 2: Relevant topics from sections 6.1, 6.2, 6.3]**	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL.	Name of Book	Name of Author/s	Publisher	Year
1.	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10th edition, 2016
2	Elementary Linear Algebra	Ron Larson	Cengage Learning	8th edition, 2017

REFERENCE

SL.	Name of Book	Name of Author/s	Publisher	Year
1	Mathematics for Machine Learning	Marc Peter Deisenroth, A. Aldo Faisal & Cheng Soon Ong	Cambridge University Press	1st edition, 2020
2	Linear algebra and learning from data	Gilbert Strang	Wellesley Cambridge Press	1st edition, 2019
3	Elementary Linear Algebra	Stephen Andrilli & David Hecker	Academic Press Inc.	4th edition, 2010

VIDEO LINKS

1	https://nptel.ac.in/courses/111107112
2	https://nptel.ac.in/courses/103105106
3	https://nptel.ac.in/courses/111106135

VIRTUAL LAB/SIMULATION TOOLS

1	Python
2	MATLAB

Course Contents and Lecture Schedule				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1. Linear System of Equations (11 Hrs)	Part 1	**Row Echelon Form and Rank**	Row echelon form, rank of a matrix	3
	Part 2	**Gauss Elimination**	Solution of linear systems by Gauss elimination	3
	Part 3	**Fundamental Theorem**	Fundamental theorem for homogeneous and non-homogeneous systems	2
	Part 4	**Eigen values and Diagonalization**	Eigenvalues, eigenvectors and diagonalization of matrices	3
2.Vector Spaces 1 (12 Hrs)	Part 1	**Vector Spaces and Subspaces**	Vector Spaces, Examples of vector space(R^n and M_{mxn} only) Subspaces, Examples as subspaces of Rn and M_{mxn}	3
	Part 2	**Linear Combinations and Spanning**	Linear combinations, spanning sets	3
	Part 3	**Independence, Basis and Dimension**	Linear dependence and independence, basis, dimension of a vector space	3
	Part 4	**Coordinates and Change of Basis**	Coordinate representation in Rn, change of basis, transition matrix	3
3.Vector Spaces 2 (11 Hrs)	Part 1	**Vectors and Inner Products**	Vector length, unit vector, dot product, Cauchy-Schwarz inequality, inner product	3
	Part 2	**Properties of Inner Products**	Properties of inner products, length, distance and angle	2
	Part 3	**Orthogonal Sets**	Orthogonal projections, orthogonal and orthonormal sets and bases	3
	Part 4	**Gram-Schmidt and Least Squares**	Gram-Schmidt orthonormalization, the least squares problem	3
4.Linear Transformations (11 Hrs)	Part 1	**Linear Transformations**	Linear transformations, properties, transformation given by a matrix	3
	Part 2	**Geometric Transformations**	Rotation in R^2, projection in R^3	2
	Part 3	**Kernel and Range**	Kernel and range of a linear transformation and their bases	3
	Part 4	**Rank, Nullity and Matrices**	Rank and nullity, sum of rank and nullity, matrices for linear transformations	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	**Gauss Elimination Implementation**	Implement Gauss elimination and eigenvalue/eigenvector computation in Python; verify diagonalization on sample matrices and report findings.	8 Hrs	1	CO 1	WK2	PO 1, PO 2, PO 5
2	**Vector Space Exploration**	Investigate spanning sets, linear independence and bases for selected subspaces of R^n; verify dimension and change-of-basis results computationally.	8 Hrs	2	CO 2	WK2	PO 1, PO 2, PO 5
3	**Least Squares Case Study**	Analyse an application of inner products and least-squares fitting from a research paper or data-analysis report; reproduce the Gram-Schmidt-based solution on a small dataset.	7 Hrs	3	CO 3	WK2, WK8	PO 1, PO 2, PO 4, PO 5
4	**Linear Transformation Visualization**	View recommended NPTEL lectures on linear transformations and visualize rotation, projection, kernel and range using a plotting tool; prepare a structured summary.	7 Hrs	4	CO 4	WK2, WK8	PO 1, PO 5, PO 11

TERM WORK ACTIVITIES (15 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Matrix Methods Problem	Solve a curated set of problems on Gauss elimination, rank, eigenvalues, diagonalization, and vector space concepts; present worked solutions with verification using Python.	5 Hrs	1, 2	CO 1, CO 2	WK 2, WK 3	PO1, PO2, PO5
2	Orthogonality & Least Squares Report	Construct orthonormal bases via Gram-Schmidt, compute projections, and solve a real-world least squares problem; submit a structured report with analysis and plots.	5 Hrs	3	CO 3	WK 2, WK 3, WK 4	PO1, PO2, PO3, PO4
3	Linear Transformation Mini-Study	Analyse a set of linear transformations, build their matrix representations, compute rank and nullity, and present a comparative study with a computing-oriented interpretation.	5 Hrs	4	CO 4	WK 2, WK 3, WK 4	PO1, PO2, PO3, PO5, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**40%**
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**60%**
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	**U**	**A**	**An**	**E**	**C**	
1	Linear systems of equations	11	0	3	12				**15**
2	Vector Spaces 1	12	0	3	12				**15**
3	Vector Spaces 2	11	0	3	12				**15**
4	Linear Transformations	11	0	3	12				**15**
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	**No. of Questions/Module**	**Total No. of Questions**	**Max. marks/ Question**	**Part Summary**	**Total Marks**
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					**60**

Course Code	Course Name				Credits
J1BSP112	**PHYSICS FOR INFORMATION SCIENCE**				**4**
Regulation	2026	L:T:P:H:S	3:0:2:0:5.5	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	TP	Course delivery Mode		Theory + Practical	
Scheme of Evaluation		CIE: 60 Marks	ESE: 40 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Basic knowledge of Mathematics, Semiconductor Theory and Modern Physics				

COURSE OBJECTIVE	
1	To equip students with a strong foundation in the fundamentals of Physics, impart this knowledge within the context of Information Science disciplines
2	To cultivate scientific attitudes and critical thinking skills, and enable students to integrate Physics concepts with their core Information Science programs
3	To make the students gain practical knowledge to correlate the theoretical studies and to develop practical applications of engineering

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply the concepts of free-electron theory, Fermi–Dirac Statistics, band theory and superconductivity to identify appropriate engineering applications.	K3
2	Apply the principles of Quantum Mechanics to determine the behaviour of particles in confined potential systems and tunnelling phenomena.	K3
3	Apply the fundamentals of Semiconductor Physics to analyse intrinsic and extrinsic semiconductors and p–n junction characteristics.	K3
4	Apply the principles of semiconductor material behaviour to explain the operation and performance of semiconductor and photonic devices.	K3
5	Apply experimental methods to characterize the properties and performance of semiconductor and photonic devices for engineering applications.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	2	-	-	-	-	-	-	3	2	-	-	-	-	-	-	-	-	2	-	-	-
2	3	2	2	-	-	-	-	-	-	3	2	-	-	-	-	-	-	-	-	2	-	-	-
3	3	2	2	-	-	-	-	-	-	3	2	-	-	-	-	-	-	-	-	2	-	-	-
4	3	2	3	-	-	-	1	-	-	3	2	-	-	-	-	-	-	-	-	2	-	-	-
5	3	2	2	2	-	2	-	1	2	3	2	-	-	2	-	-	2	2	-	2	-	-	-

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Electrical conductivity & Superconductivity**	Classical free electron theory, Fermi Dirac distribution, Variation of Fermi function with temperature, Fermi Energy, Energy bands, Classification of materials into conductor, semiconductor and insulator. Superconductivity, Transition temperature, Critical field, Meissner effect, Type I and Type II Super conductors, BCS Theory, High temperature superconductors (qualitative), Applications of superconductors.	9
2	**Quantum Mechanics**	Introduction, Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Application of uncertainty principle- Absence of electron inside nucleus - Natural line broadening, Wave function – properties - physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one-dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling (Qualitative)	9
3	**Semiconductor Physics**	Intrinsic semiconductor, Derivation of density of electrons in conduction band and density of holes in valence band, Intrinsic carrier concentration, Variation of Intrinsic carrier concentration with temperature, Extrinsic semiconductor (qualitative) Formation of p-n junction, Fermi level in semiconductors- intrinsic and extrinsic, Energy band diagram of p-n junction - Qualitative description of charge flow across a p-n junction - Forward and reverse biased p-n junctions, I-V Characteristics of p-n junction	9
4	**Semiconductor Devices**	Semiconductor devices- Rectifiers- Full wave and Half wave, Zener diode - V I characteristics, Tunnel diode – V I characteristics, Semiconductor Laser - Construction, working and applications, Photonic devices (Qualitative treatment only), Light Emitting Diode - I V characteristics and applications, Photo detectors (Junction and PIN photodiodes), Solar cells - I V characteristics, Efficiency, Stringing of Solar cells to solar panel, applications	9

LIST OF EXPERIMENTS (24 hours)		
Instructions • Minimum 10 Experiments		
Sl. No.	**Experiment**	**CO**
1	Diode characteristics	4, 5
2	Zener diode – V I characteristics	4, 5
3	Half wave rectifier	4, 5
4	Characteristics of LED	4, 5
5	Solar Cell – V I and Intensity Characteristics	4, 5
6	Laser – Determination of wavelength using diffraction grating	4, 5
7	Laser- To measure the wavelength using a millimetre scale as a grating	4, 5
8	CRO -Measurement of frequency and amplitude of wave forms	5
9	Photo diode - V-I Characteristics	4, 5
10	Numerical aperture of optical fiber	5
11	Tunnel diode –V-I characteristics	4, 5
12	Voltage regulation using a Zener diode	4, 5
13	Full wave rectifier	4, 5
14	Determination of band gap energy of a semiconductor	3, 5

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL.	Name of Book	Name of Author/s	Publisher	Year
1.	Engineering Physics	H K Malik and A K Singh	McGraw Hill	2nd Edition, 2017
2	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	7th Edition, 2017
3	A Textbook of Engineering Physics	M N Avadhanulu, P G Kshirsagar, TVS Arum murthy	S. Chand	11th Edition, 2024

REFERENCE				
SL.	Name of Book	Name of Author/s	Publisher	Year
1	Semiconductor Devices Fundamentals	Robert F Pierret	Pearson Education	1995
2	Advanced Semiconductor Fundamental	Robert F Pierret	Pearson Education	2nd Edition, 2002
3	Solid State Electronic Devices	Ben G Streetman and Sanjay Kumar Banerjee	Pearson Education	2010
4	Solid State Physics	S.O. Pillai	New age international publishers	10th Edition, 2022
5	Introduction to Solid State Physics	Charles Kittel	Wiley India Edition	2019
6	Advanced Engineering Physics	Premlet B	Phasor Books	10th Edition ,2017
7	A Text Book of Engineering Physics	I. Dominic and. A. Nahari,	Owl Books Publishers	Revised Edition, 2016
VIDEO LINKS (NPTEL, SWAYAM…)				
1	https://nptel.ac.in/courses/115103108			
2	https://nptel.ac.in/courses/115101107			
3	https://nptel.ac.in/courses/108106181			
4	https://nptel.ac.in/courses/108108112			
VIRTUAL LAB/SIMULATION TOOLS				
1	https://be-iitkgp.vlabs.ac.in			
2	https://vlab.amrita.edu			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
Electrical conductivity & Superconductivity	Part 1	Electrical Conductivity in Metals & Fermi Theory	Classical free electron theory, Fermi Dirac distribution, Variation of Fermi function with temperature	2
	Part 2	Fermi Energy, Energy Bands & Material Classification	Fermi Energy, Energy bands, Classification of materials into conductor, semiconductor and insulator.	2
	Part 3	Superconductivity & Key Properties	Superconductivity, Transition temperature, Critical field, Meissner effect	2
	Part 4	Superconductor Types & Applications	Type I and Type II Super conductors. BCS Theory, High temperature superconductors (qualitative), Applications of superconductors.	3
Quantum Mechanics	Part 1	Quantum Mechanics & Wave Function	Introduction, Concept of uncertainty and conjugate observables (qualitative), Wave function – properties - physical interpretation	2
	Part 2	Uncertainty Principle & Applications	Uncertainty principle, Application of uncertainty principle- Absence of electron inside nucleus - Natural line broadening,	2
	Part 3	Schrodinger equations	Formulation of time dependent and time independent Schrodinger equations	2
	Part 4	Particle in a Box & Tunnelling	Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling (Qualitative),	3
Semiconductor Physics	Part 1	Intrinsic semiconductor	Semiconductor Physics - Intrinsic semiconductor, Derivation of density of electrons in conduction band and density of holes in valence band	3
	Part 2	Carrier Concentration & Extrinsic Semiconductors	Intrinsic carrier concentration, Variation of Intrinsic carrier concentration with temperature, Extrinsic semiconductor (qualitative)	2
	Part 3	P-N Junction & Energy Bands	Formation of p-n junction, Fermi level in semiconductors-intrinsic and extrinsic, Energy band diagram of p-n junction - Qualitative description of charge flow across a p-n junction	2
	Part 4	P-N Junction Bias & I-V Characteristics	Forward and reverse biased p-n junctions, I V Characteristics of p-n junction	2
Semiconductor Devices	Part 1	Rectifiers & Zener Diode	Semiconductor devices- Rectifiers- Full wave and Half wave, Zener diode- V I characteristics	2

	Part 2	Tunnel Diode & Semiconductor Laser	Tunnel diode - V I characteristics, Semiconductor Laser (Construction, working and Applications)	2
	Part 3	Photonic devices – LED & Photodetectors	Photonic devices (Qualitative treatment only), Light Emitting Diode - I V characteristics and applications, Photo detectors (Junction and PIN photodiodes)	3
	Part 4	Solar cell	Solar cells - I V characteristics, Efficiency, Stringing of Solar cells to solar panel, applications	2

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Analysis of Temperature Dependence of the Fermi–Dirac Distribution	Observe the Fermi–Dirac Distribution vs. Temperature simulation, sketch the Fermi function curves at 0 K and 300 K, and briefly explain the effect of temperature on electron occupancy.	3	1	CO 1	WK1 WK2 WK3	PO1 PO2
2	Superconductivity Literature Survey	Survey recent research on high-temperature superconductors and prepare a note on their materials and applications.	5	1	CO 1	WK1 WK2 WK3	PO1 PO2
3	Analysis of wave function in a potential well	Draw a sketch of a typical wave function for a particle in a potential well. Label regions where ψ is positive, negative, or zero. Write a short note explaining what ψ and $\|\psi\|^2$ represent physically	4	2	CO 2	WK1 WK2 WK3	PO1 PO2
4	Study of Quantum Tunneling in Real-World Devices	Observe quantum tunneling through a video or simulation, and illustrate the phenomenon by sketching a potential barrier and indicating the electron tunneling region in a real device such as a tunnel diode or STM.	4	2	CO 2	WK1 WK2 WK3	PO1 PO2
5	Understanding Fermi Level in Semiconductors	Read an article about the Fermi level in intrinsic and extrinsic semiconductors. Draw energy band diagrams for an intrinsic, a p type and an n type semiconductor. Write a short note describing how the Fermi level shifts in each case.	3	3	CO 3	WK1 WK2 WK3	PO1 PO2

6	Observation of Diode I–V Characteristics	Observe a virtual laboratory simulation of the I–V characteristics of a p–n junction diode, and draw the forward and reverse bias characteristics with appropriate labels, including cut-in voltage and reverse saturation current.	4	3	CO 3	WK1 WK2 WK3	PO1 PO2
7	Understanding Solar Cell Operation and Efficiency	Watch an educational video on the working of solar panels and prepare a brief report explaining current generation in solar cells, factors affecting efficiency, and the effect of series and parallel connections on voltage and current.	4	4	CO 4	WK1 WK2 WK3	PO1 PO2
8	Photonic Device Application Exploration	Explore the use of LEDs and semiconductor lasers in information-science applications and prepare a comparative technical note.	3	4	CO 4	WK1 WK2 WK3	PO1 PO2

TERM WORK ACTIVITIES (30 Hrs)							
Sl.	**Activity**	**Description**	**Time**	**Module**	**CO**	**WK**	**PO**
1	Conductivity & Band Theory Study Report	Investigate the conduction behaviour of materials, analyse band-theory concepts and submit a documented study report.	10 Hrs	1	CO 1	WK1 WK2 WK3	PO1 PO2 PO9
2	Quantum Mechanics/ Semiconductor Problem Set	Submit a structured problem set on Quantum Mechanics and Semiconductor Physics with detailed solutions.	10 Hrs	2, 3	CO 2 CO 3	WK1 WK2 WK3	PO1 PO2 PO1 1
3	Photonic Device Performance Project	Conduct experiments on LEDs, solar cells and optical fibre, evaluate device performance and submit a documented project report.	10 Hrs	4	CO 4	WK4 WK6 WK8	PO4 PO5 PO9

RUBRICS FOR TERM WORK EVALUATION						
Sl.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

LAB EVALUATION RUBRICS							
Sl.	**Criteria**	**Weightage**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Preparation & Pre-Lab Work	30%	Comes fully prepared with pre-lab work completed; demonstrates clear understanding of objectives and procedure.	Minor gaps in pre-lab preparation; understands most objectives and procedures.	Partial pre-lab work done; limited understanding of objectives.	Minimal preparation; weak understanding of experiment.	No preparation; unable to explain objectives/procedure.
2	Experimental Skills & Performance	40%	Performs experiment independently with precision, follows correct procedure	Performs experiment with minor guidance; procedure mostly correct.	Needs frequent guidance; some procedural errors.	Struggles with procedure; requires constant help.	Unable to perform experiment correctly even with help
3	Analysis, Interpretation and Documentation	30%	Analyze, Interpret and Document results correctly	Minor interpretation issues.	Some errors in analysis; interpretation superficial.	Major errors in calculations; misinterprets results. Errors in Documentation	No meaningful analysis/interpretation.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**60%**
Lab Evaluation	30 %
Learning Activity (Self Learning, Term Work)	10%
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**40%**
Total	100

TABLE OF SPECIFICATIONS FOR ESE QUESTION PAPER DESIGN										
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Electrical conductivity & Superconductivity,	9	2	5	3				10
2	Quantum Mechanics	9		7	3				10
3	Semiconductor Physics	9	2	5	3				10
4	Semiconductor Devices	9		5	5				10
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper			2		
Part	No. of Questions/ Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	1 (No choice)	4	3	4 x 3	12
B	2 (Including Choice)	8	7	4 x 7	28
TOTAL MARKS					**40**

Course Code	Course Name				Credits
J1EST223	**PROGRAMMING IN PYTHON**				**3**
Regulation	2026	L: T:P:H:S	3:0:0:0:4.5	Notional Learning Hours/Semester	90
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode			Theory
Scheme of Evaluation		CIA: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Programming in C				

COURSE OBJECTIVE	
1	To introduce the fundamental concepts of Python programming and problem-solving techniques.
2	To develop modular programming skills using functions and Python data structures.
3	To apply object-oriented programming concepts for designing reusable software components.
4	To perform file handling and exception handling in Python applications.
5	To provide the programming foundation required for subsequent courses in Data Science, Machine Learning, and Artificial Intelligence.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply Python programming constructs, control structures, and built-in functions to solve computational problems.	K3
2	Develop modular programs using functions, recursion, iterators, generators, and Python data structures.	K3
3	Design object-oriented solutions using classes, inheritance, abstraction, polymorphism, and modular programming concepts.	K3
4	Implement file handling and exception handling mechanisms in Python applications.	K3
5	Perform basic scientific computing, data manipulation, and visualization using NumPy, Pandas, and Matplotlib.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	-	3	2	-	-	-	-	-	-	3	2	-	-	2	-	-	-	-	-	-	-	2	-
2	-	3	2	-	-	-	-	-	-	3	2	2	-	2	-	-	-	-	-	-	-	3	-
3	-	-	2	2	-	-	-	-	-	3	-	3	-	2	-	-	-	-	-	-	-	3	-
4	-	-	-	-	-	2	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	2	-
5	-	3	-	-	-	2	-	-	-	3	2	-	-	3	-	-	-	-	-	-	3	2	-

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Python Programming Fundamentals**	Introduction to Python – Features, Applications, Environment Setup and Jupyter Notebook. Comparison of C and Python – Syntax, Data Types, Memory Management and Typing (Static vs Dynamic). Identifiers, Keywords, Variables and Comments. Numeric, Boolean and String Data Types, Type Conversion. Strings – String Operations, String Methods, String Formatting (f-strings), Split and Join Operations. Input and Output Operations. Operators and Expressions. Built-in Functions and Modules. Decision Making (if, elif, else) and Iteration (for, while, range).	10
2	**Functions and Data Handling in Python**	Designing with Functions – Modular Program Design using Functions, Function Definition, Parameters, Arguments, Scope, Return Values, Recursion and Recursive Function Design. Anonymous Functions – lambda, map, filter and reduce. Iterators and Generators – Basic Concepts. Sequence Data Types: Lists – Creation, Indexing, Slicing, Nested Lists, Operations, Searching, Sorting and List Comprehension. Tuples – Creation and Immutability. Sets – Creation, Operations, Membership, Union, Intersection and Difference. Dictionaries – Creation, Adding/Removing Keys, Accessing and Replacing Values, Traversing and Reverse Lookup.	12
3	**Object-Oriented and Modular Programming in Python**	Object-Oriented Concepts – Classes, Objects, Methods and Attributes. Instance and Class Variables. Constructors (init()). Accessor and Mutator Methods. Encapsulation and Abstraction. Composition and Aggregation with Simple Examples. Design with Classes – Data Modeling Examples. Inheritance – Single Inheritance and Method Overriding. Polymorphism. Abstract Classes using the abc Module. Modular and Package-Based Programming – Importing Modules, Creating User-Defined Modules and Packages, and the use of name == "main".	11
4	**Scientific Computing, Data Manipulation and Visualization**	File Handling – Reading and Writing Text Files. Exception Handling – try, except, else, finally, raise, handling multiple exceptions and user-defined exceptions. NumPy – Basics, Creating Arrays, Arithmetic Operations, Array Slicing, Matrix Operations and Random Numbers. Pandas – Introduction, Creating Series and DataFrames, Reading and Writing CSV Files, Data Selection and Filtering, Handling Missing Values, Basic Data Manipulation and Descriptive Statistics. Matplotlib – Basic and Multiple Plots, Ticks, Labels, Legends and Introduction to Data Visualization Principles.	12

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
S L.	Name of Book	Name of Author/s	Publisher	Year
1	Think Python: How to Think Like a Computer Scientist (2nd ed.)	Allen B. Downey	O'Reilly Media	2016
2	Python Programming: Using Problem Solving Approach	Reema Thareja	Oxford University Press	2017
REFERENCE				
S L.	Name of Book	Name of Author/s	Publisher	Year
1	Head First Python	Paul Barry	O'Reilly Media	2023
2	Learning Python (5th ed.)	Mark Lutz	O'Reilly Media	2013
3	Python Data Science Handbook	Jake VanderPlas	O'Reilly Media	2022
4	Python for Data Analysis (3rd ed.)	Wes McKinney	O'Reilly Media	2022
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs136			
2	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs109			
3	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs107			
VIRTUAL LAB/SIMULATION TOOLS				
1	Python 3 with Jupyter Notebook / Google Colab (docs.python.org/3, jupyter.org)			
2	NumPy (numpy.org/doc), Pandas (pandas.pydata.org/docs), Matplotlib (matplotlib.org/stable)			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1. Python Programming Fundamentals (10 Hrs)	Part 1	Introduction & Python vs C	Introduction to Python – Features, Applications, Environment Setup, Jupyter Notebook; Comparison of C and Python – Syntax, Data Types, Memory Management, Typing.	3
	Part 2	Data Types & Strings	Identifiers, Keywords, Variables, Comments; Numeric, Boolean, String types, Type Conversion; String Operations, Methods, Formatting (f-strings), Split/Join.	3

	Part 3	Operators & I/O	Input and Output Operations; Operators and Expressions; Built-in Functions and Modules.	2
	Part 4	Control Flow	Decision Making (if, elif, else) and Iteration (for, while, range).	2
2. Functions and Data Handling in Python (12 Hrs)	Part 1	Functions & Recursion	Modular Program Design; Function Definition, Parameters, Arguments, Scope, Return Values; Recursion and Recursive Function Design.	3
	Part 2	Functional Tools	Anonymous Functions – lambda, map, filter, reduce; Iterators and Generators – Basic Concepts.	3
	Part 3	Lists & Tuples	Lists – Creation, Indexing, Slicing, Nested Lists, Operations, Searching, Sorting, List Comprehension; Tuples – Creation and Immutability.	3
	Part 4	Sets & Dictionaries	Sets – Operations, Membership, Union, Intersection, Difference; Dictionaries – Keys, Values, Traversing, Reverse Lookup.	3
3. Object-Oriented and Modular Programming in Python (11 Hrs)	Part 1	Classes & Objects	Classes, Objects, Methods, Attributes; Instance and Class Variables; Constructors (init()); Accessor and Mutator Methods.	3
	Part 2	Encapsulation & Composition	Encapsulation and Abstraction; Composition and Aggregation; Design with Classes – Data Modeling Examples.	3
	Part 3	Inheritance & Polymorphism	Inheritance – Single Inheritance, Method Overriding; Polymorphism; Abstract Classes using the abc Module.	3
	Part 4	Modules & Packages	Importing Modules; Creating User-Defined Modules and Packages; use of name == "main".	2
4. Scientific Computing, Data Manipulation and Visualization (12 Hrs)	Part 1	Files & Exceptions	File Handling – Reading and Writing Text Files; Exception Handling – try, except, else, finally, raise, multiple and user-defined exceptions.	3
	Part 2	NumPy	NumPy – Basics, Creating Arrays, Arithmetic Operations, Array Slicing, Matrix Operations, Random Numbers.	3
	Part 3	Pandas	Pandas – Series and DataFrames, Reading/Writing CSV, Data Selection and Filtering, Handling Missing Values, Descriptive Statistics.	3
	Part 4	Matplotlib	Matplotlib – Basic and Multiple Plots, Ticks, Labels, Legends; Data Visualization Principles.	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Python Basics Programming Set	Solve computational problems using data types, strings, operators, and control structures.	6	1	CO1	WK2, WK3	PO1, PO2, PO5
2	Functions & Data-Structure Mini Tasks	Build modular programs using functions, recursion, and list/dict/set/tuple operations.	6	2	CO2	WK2, WK3	PO1, PO3, PO5
3	OOP Modelling Exercise	Design a small class hierarchy demonstrating inheritance, polymorphism, and modular packaging.	6	3	CO3	WK3, WK4	PO1, PO3, PO5
4	Data Analysis with NumPy/Pandas	Read a CSV dataset and perform manipulation, descriptive statistics, and visualization.	6	4	CO5	WK2, WK6	PO1, PO2, PO5
5	Reflective Journal	Document programming progress and prepare a small file-/exception-handling utility.	6	All Modules	CO4	WK6	PO1, PO11

TERM WORK ACTIVITIES (15 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Modular Python Application	Develop a modular Python application using functions and data structures with documentation.	5 Hrs	1,2	CO1, CO2	WK2, WK3	PO1, PO3, PO5
2	OOP Mini-Project	Build an object-oriented mini-project demonstrating classes, inheritance, and exception handling.	5 Hrs	3,4	CO3, CO4	WK3, WK6	PO1, PO3, PO5
3	Data Analytics Report	Analyse and visualize a real dataset using NumPy, Pandas, and Matplotlib; present findings.	5 Hrs	4	CO5	WK2, WK6	PO1, PO2, PO5

RUBRICS FOR TERM WORK EVALUATION						
Sl.	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**40%**
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**60%**
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	**U**	**A**	**An**	**E**	**C**	
1	Python Programming Fundamentals	10	3	6	6				15
2	Functions and Data Handling in Python	12	3	6	6				15
3	Object-Oriented and Modular Programming in Python	11	3	6	6				15
4	Scientific Computing, Data Manipulation and Visualization	12	3	6	6				15
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	**No. of Questions/Module**	**Total No. of Questions**	**Max. marks/ Question**	**Part Summary**	**Total Marks**
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					**60**

Course Code	Course Name				Credits
J1ESP224	**FOUNDATIONS OF COMPUTING: FROM HARDWARE TO WEB DESIGN**				**4**
Regulation	2026	L: T:P:H:S	3:0:2:0:5.5	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	PC	Course delivery Mode		Theory + Practical	
Scheme of Evaluation		CIE: 60 Marks	ESE: 40 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite					

COURSE OBJECTIVE	
1	To introduce the students to the fundamental building blocks of an IT infrastructure including the computing systems, its peripherals, Networking.
2	To familiarize students with the principles of computer communication, network protocols, and security mechanisms essential for reliable data exchange.
3	To make the learners capable of developing and deploying simple and dynamic websites.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Identify the fundamental components and the working of an IT environment.	K2
2	Students should be able to describe memory organization and network hardware devices of computer systems.	K2
3	Explain computer network architecture, and necessary protocols used.	K3
4	Develop simple interactive web pages and validate the inputs.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	2	-	1	2	2	-	1	3	2	1	-	-	1	1	-	-	-	-	3	2	1
2	-	3	3	2	-	2	-	-	-	3	3	2	-	1	-	-	-	-	-	-	3	2	1
3	-	2	3	3	1	3	2	-	-	3	2	2	-	2	1	1	-	-	-	-	3	2	1
4	-	2	3	3	1	3	1	2	2	3	2	3	-	3	-	-	-	2	2	2	3	2	1

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Basic Computer Architecture**	Functional units of a computer, operational concepts, bus structures, software, hardware and firmware. Memory locations and addresses, memory operations, instructions and instruction sequencing, addressing modes, basic processing unit, instruction cycle, execution of a complete instruction, single bus organization, multiple bus organization.	9
2	**Memory Organization and Network hardware devices**	Memory Organization**:** Memory hierarchy, memory locations and addressing, memory access methods, RAM and ROM, SRAM and DRAM, cache memory, virtual memory, associative memory, memory management techniques, memory mapping, secondary storage devices, flash memory, magnetic storage devices. Network Interface Card (NIC), modem, hub, switch, router, bridge, repeater, gateway, wireless access point, firewall devices, Ethernet cables.	9
3	**Network Protocols**	Computer Communications – LAN, MAN, WAN, Client/Server networks, Peer-to-Peer networks, Topologies. Basics of IP addresses-IPv4, IPV6. Internet and network security fundamentals: DHCP, NAT, Network Security, VPN, Internet-, WWW, Web servers.Network protocols-working of HTTP,SMTP, FTP and DNS.	9
4	**Web Design**	Web design: Fundamentals of HTML-Headings- Hyper Link- Images- Special Characters & Horizontal Rules-Lists-Tables-Forms-HTML5 Form input types-HTML5 Audio & video elements. Introduction to CSS- Basic syntax and structure-Inline Styles, Embedded Style Sheets, Linking External Style Sheets- Exploring CSS Selectors- Introduction to Scripting- Programming fundamentals of JavaScript. -Obtaining User Input with prompt Dialogs- Arithmetic- Decision Making-Control Statements- Functions- Arrays	9

LIST OF EXPERIMENTS (24 Hours)

Instructions

- Lab experiments must be implemented in vscode/ Apache Netbeans IDE covering html and for java scripts need XAMPP server also.
- Minimum 12 Experiments are mandatory
- Students should maintain a record of the lab experiments.

Sl. No.	Experiment	CO
1	Identification of Basic Computer Components and their Functions	1
2	Draw and explain a simple network topology (Star/Bus/Ring) showing the use of network devices like hub, switch, and router.	2
3	Connect a Wi-Fi access point and connect your mobile/laptop to it. Check the IP assigned by the DHCP server	2
4	Create a folder named ‘lab1’, store a text file in it, and share it over a local network. Also observe the IP address and MAC address of your system	3

<table>
<tr><td>5</td><td>Installation and Configuration of a Web Server (XAMPP/WAMP) and Hosting a Web Page using local host</td><td>3,4</td></tr>
<tr><td>6</td><td>Design a table in HTML to display the marks of 10 students for 5 subjects. Student name should be the row headings and subject name should be the column headings. Marks can be of your choice. Also the header row with background colour and bold font and other rows without that.</td><td>4</td></tr>
<tr><td>7</td><td>Implement the equivalent HTML code to realize the following.
i. Display a paragraph of text in bold, red colour and in italics
ii. Display an image termed “birds.jpg” with height 100 pixels and width 200 pixels and in the middle of the page; if the image cannot be accessed, a
message “Image Not Found” should be displayed</td><td>4</td></tr>
<tr><td>8</td><td>Create a hyperlink to the URL
"www.mysite.com/birds.jpg". The hyperlink should have the label "Click Here”</td><td>4</td></tr>
<tr><td>9</td><td>Create a static HTML document for your portfolio, which includes the following contents: your name, address, Mobile Number and email address. Also add the details about your college, university, your major and the batch of study. Include a picture of yourself and at least one other image (friend/pet/role model) to the document with a short description about that. Add three paragraphs about your personal history, with links to your social media profile. Also create an ordered list for describing your Skill Set & an unordered list showing your Strengths & Weaknesses.</td><td>4</td></tr>
<tr><td>10</td><td>Organize a sample web page for providing *KTU BTech Honours Regulation 19* for KTU and use embedded Style sheet to apply styles for list, tables and pages.</td><td>4</td></tr>
<tr><td>11</td><td>Implement the CSS code for the following: i) Set the list style for unordered lists to “square “. ii) Set “Flower.gif” as the background image of the page iii) Set dashed border
for the document</td><td>4</td></tr>
<tr><td>12</td><td>Implement the HTML code for obtaining the following table.
<table>
<tr><td colspan="2">Flower Show</td></tr>
<tr><td>Flower Name</td><td>Colour</td></tr>
<tr><td>Red Rose</td><td>Red</td></tr>
<tr><td>White Rose</td><td rowspan="2">White</td></tr>
<tr><td>Jasmine</td></tr>
<tr><td>Sunflower</td><td>Yellow</td></tr>
</table></td><td>4</td></tr>
<tr><td>13</td><td>Create an unordered list in html with values Tea, Coffee, Milk.</td><td>4</td></tr>
<tr><td>14</td><td>Implement JavaScript program to find factorial of a number, use prompt dialog box to get the input from user.</td><td>4</td></tr>
<tr><td>15</td><td>Implement the JavaScript code to solve a quadratic equation by reading the coefficients through the dialog box. Also use the confirm dialog box to check whether the user wants to continue or not.</td><td>4</td></tr>
<tr><td>16</td><td>Implement a JavaScript function greeting () using extemal.js file, to display a welcome message, when you click on a Button in an HTML page.</td><td>4</td></tr>
<tr><td>17</td><td>Implement the different ways of Array declaration in JavaScript..</td><td>4</td></tr>
</table>

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Invitation to Computer Science	G.Michael Schneider, Judith Gersting	Cengage	2/e , 2020
2	The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach	Irv Englander	Wiley	5/e, 2014
3	HTML, CSS, and JavaScript All in One, Sams Teach Yourself	Julie C. Meloni Jennifer Kyrnin	Pearson	3/e, 2020

REFERENCE

Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	The Elements of Computing Systems, second edition: Building a Modern Computer from First Principles	Noam Nisan and Shimon Schocken	The MIT Press	2/e, 2021
2	Peter Norton's Introduction to Computers	Peter Notron	McGrawHill	6/e, 2010
3	Web Design with HTML, CSS, JavaScript and Jquery	Jon Duckett	Wiley	1/e, 2014

VIDEO LINKS

1	https://onlinecourses.swayam2.ac.in/cec19_cs06/preview
2	https://onlinecourses.swayam2.ac.in/nou20_cs05/preview
3	https://nptel.ac.in/courses/106105183
4	https://nptel.ac.in/courses/106106222

VIRTUAL LAB/SIMULATION TOOLS

1	Apache Netbeans IDE/VS code
2	XAMPP

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1. Basic Computer Architecture (9 Hrs)	Part 1	Functional units of a computer	CPU- ALU-Registers- Control Unit	2
	Part 2	operational concepts,	Basic concepts fetch, decode and execute, bus structures, software, hardware and firmware.	3
	Part 3	Memory locations and addresses,	memory operations, instructions and instruction sequencing,	2
	Part 4	Addressing modes	Types of addressing modesbasic processing unit, instruction cycle, execution of a complete instruction, single bus organization, multiple bus organization.	2
2. Memory Organization and network hardware devices (9 Hrs)	Part 1	Memory Hierarchy and Addressing	Memory hierarchy, memory locations and addressing, memory access methods	2
	Part 2	RAM, ROM and Cache Memory	RAM and ROM, SRAM and DRAM, cache memory	2
	Part 3	Virtual Memory and Secondary Storage	Virtual memory, associative memory, memory management techniques, memory mapping, secondary storage devices, flash memory, magnetic storage devices	2
	Part 4	Network Hardware Devices	Network Interface Card (NIC), modem, hub, switch, router, bridge, repeater, gateway, wireless access point, firewall devices, Ethernet cables.	2
3.Computer communications and Network Protocols (9 Hrs)	Part 1	Computer Communications	LAN, MAN, WAN, Client/Server networks, Peer-to-Peer networks, Topologies.	2
	Part 2	Basics of IP addresses	IPv4, IPV6,	1
	Part 3	Internet and network security fundamentals	WWW, Web servers, DHCP, NAT, Network Security, VPN	1
	Part 4	Network protocols	working of HTTP,SMTP,FTP and DNS.	1
4. Web design (9 Hrs)	Part 1	Fundamentals of HTML	Headings- Hyper Link- Images- Special Characters & Horizontal Rules- Lists-Tables-Forms-HTML5	1
	Part 2	Form input types	HTML5 Audio & video elements	1
	Part 3	Introduction to CSS	Basic syntax and structure-Inline Styles, Embedded Style Sheets, Linking External Style Sheets- Exploring CSS Selectors	1
	Part 4	Introduction to Scripting	Programming fundamentals of JavaScript. -Obtaining User Input with prompt Dialogs- Arithmetic- Decision Making-Control Statements- Functions- Arrays	1

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Research on Computer Functional Units	Prepare a diagram and report explaining CPU components – ALU, Registers, and Control Unit.	5	1	CO1	WK1	PO1
2	Exploration of number system conversions	Convert given decimal numbers to binary, octal, and hexadecimal formats.	5	2	CO2	WK8	PO1
3	Web Server Installation and testing	Install XAMPP/WAMP, host a sample webpage, and access via localhost and IP.	5	3	CO4	WK12	PO3, PO5
4	Website Design using HTML5	Design a webpage with headings, links, images, and tables using HTML5.	5	4	CO4	WK14	PO3
5	Enhancing web pages using CSS	Add inline, internal, and external CSS styles to enhance webpage design.	5	4	CO4	WK15	PO3, PO5
6	Self-Reflection Report	Prepare a report summarizing what you learned in each module.	5	All	All	WK18	PO11

TERM WORK ACTIVITIES (30 Hrs)							
Sl. No.	**Activity**	**Description**	**Time**	**Module**	**CO**	**WK**	**PO**
1	Identify Motherboard Components	Watch a video or examine a PC motherboard to identify ROM BIOS, I/O chips, sockets, and buses.	8	1	CO1	WK2	PO1
2	Practice of Linux Commands	Execute basic Linux commands (pwd, ls, cat, mkdir, etc.) and record screenshots.	8	2	CO2	WK6	PO5
3	LAN Design Simulation	Design a small LAN using Cisco Packet Tracer and test using ping.	7	3	CO3	WK10	PO3, PO5
4	Develop Mini Web Project	Combine HTML, CSS, and JavaScript to design a functional webpage or form.	7	4	CO4	WK17	PO3, PO5, PO10

RUBRICS FOR TERM WORK EVALUATION						
Sl. No.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

LAB EVALUATION RUBRICS							
Sl.	**Criteria**	**Weightage**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Preparation & Pre-Lab Work	30%	Comes fully prepared with pre-lab work completed; demonstrates clear understanding of objectives and procedure.	Minor gaps in pre-lab preparation; understands most objectives and procedures.	Partial pre-lab work done; limited understanding of objectives.	Minimal preparation; weak understanding of experiment.	No preparation; unable to explain objectives/ procedure.
2	Experimental Skills & Performance	40%	Performs experiment independently with precision, follows correct procedure	Performs experiment with minor guidance; procedure mostly correct.	Needs frequent guidance; some procedural errors.	Struggles with procedure; requires constant help.	Unable to perform experiment correctly even with help
3	Analysis, Interpretation and Documentation	30%	Analyse, Interpret and Document results correctly	Minor interpretation issues.	Some errors in analysis; interpretation superficial.	Major errors in calculations; misinterprets results. Errors in Documentation	No meaningful analysis/interpretation.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**60%**
Lab Evaluation	30 %
Learning Activity (Self Learning, Term Work, Assignments,)	20%
Attendance	10 %
Internal Examination	40 %
Course Project	NA
End Semester Examination	**40%**
Total	100

TABLE OF SPECIFICATIONS FOR ESE QUESTION PAPER DESIGN										
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Basic Computer Architecture	9	5	5					10
2	Memory Organization and network hardware devices	9	5	5					10
3	Computer communications and Network Protocols	9		7	3				10
4	Web design	9		3	7				10
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper					2
Part	No. of Questions/ Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	1 (No choice)	4	3	4x 3	12
B	2 (Including Choice)	8	7	4 x 7	28
TOTAL MARKS					**40**

Course Code	Course Name				Credits
J1EST205	**ENGINEERING ENTREPRENEURSHIP AND IPR**				**2**
Regulation	2026	L: T:P:H:S	2:0:0: 0:3	Notional Learning Hours/Semester	60
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	Introduce the concepts of innovation, creativity, and entrepreneurship in the context of engineering applications, helping students understand how ideas evolve into viable ventures.
2	Develop the ability to identify real-world engineering problems and apply structured frameworks such as design thinking, problem-solution canvas, and Lean Canvas to create potential business ideas.
3	Equip students with the skills to prepare a simplified business plan, covering aspects such as market analysis, customer validation, financial feasibility, and prototype development.
4	Provide a fundamental understanding of Intellectual Property Rights (IPR) and their application in protecting and commercializing engineering innovations within the start-up ecosystem.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		**Blooms Level**
1	Describe the principles of innovation, ideation, and entrepreneurship, and relate them to the process of developing engineering-based start-ups.	**K2**
2	Identify real-world problems and apply structured approaches such as design thinking and Lean Canvas to generate feasible business ideas.	**K3**
3	Develop a simplified business plan integrating customer validation, market strategy, and prototype planning.	**K4**
4	Apply the concepts and legal procedures of Intellectual Property Rights (IPR) to safeguard and commercialize innovative engineering solutions.	**K3**
5	Demonstrate teamwork, entrepreneurial communication, and creativity through SLA and term evaluation activities such as pitch decks and prototype concepts.	**K4**

COURSE ARTICULATION MATRIX																							
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	2	–	–	–	–	–	3	3	2	2	1	–	–	–	–	1	–	3	2	–
2	2	3	3	2	2	–	–	–	–	3	3	3	2	2	1	–	–	2	–	–	3	3	2
3	2	3	3	2	2	–	–	–	–	3	3	3	2	3	1	–	2	2	2	–	3	3	3
4	2	3	3	2	3	–	–	–	–	3	3	3	3	3	2	1	2	2	2	1	2	3	2
5	3	3	2	2	3	2	–	–	2	2	2	3	3	3	2	3	3	3	3	2	2	2	3
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																							

SYLLABUS			
Module	Title	Topics	Hours
1	Ideation, Innovation & Entrepreneurial Foundation	Introduction to ideation and innovation – concepts, need and importance; design thinking process; types and stages of entrepreneurship; characteristics of successful entrepreneurs; startup ecosystem in India – Startup India, MSME, incubation centers; fundamentals of Intellectual Property Rights (IPR) – patents, trademarks, copyrights, and designs; significance of IPR in engineering and technology ventures.	7
2	Problem Identification and Business Model Design	Problem and solution canvas; identification of real-world problems; customer discovery and need assessment; market segmentation and validation; Lean Canvas and value proposition design; competitor analysis and differentiation strategy; legal and ethical considerations in entrepreneurship.	7
3	Business Plan and Prototype Planning	Elements of a business plan – market analysis, product/service description, operational plan, marketing and financial strategy; Minimum Viable Product (MVP) concept; prototype requirement analysis and development approach; project scheduling and resource planning; risk management and documentation; pitch deck preparation and presentation skills.	8
4	IPR for Innovation and Commercialization	Overview of intellectual property laws; patent filing procedures (Indian and international); patentability criteria and prior art search; copyright and industrial design rights; trademark registration and trade secrets; technology transfer and licensing; commercialization strategies; case studies of Indian startups utilizing IPR; emerging IPR issues in digital and AI-based innovations.	8

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL NO	Name of Book	Name of Author/s	Publisher	Year
1.	Innovation and Entrepreneurship for Engineers	Bharat Bhushan & Seema Bhushan	CRC Press	2016
2	Business Model Generation	Alexander Osterwalder & Yves Pigneur	Wiley	2010
3	The Startup Owner's Manual	Steve Blank & Bob Dorf	Wiley	2020
4	Indian Patent Law	P. Narayanan	Eastern Book Company	2020

REFERENCE

SL NO	Name of Book	Name of Author/s	Publisher	Year
1	Intellectual Property Rights: In the Digital Age	Prabuddha Ganguli	Tata McGraw Hill	2021
2	Start with Why	Simon Sinek	Penguin	2011
3	The Innovator's DNA	Clayton M. Christensen & Jeffrey H. Dyer	Harvard Business Review Press	2019
4	The Startup India Manifesto: A Guide to the Indian Startup Ecosystem	Rashmi Bansal & Deepinder Goyal	Westland Publications	2020

VIDEO LINKS

1	Entrepreneurship - https://nptel.ac.in/courses/110106141
2	Intellectual Property - https://onlinecourses.nptel.ac.in/noc22_hs59
3	Business Fundamentals for Entrepreneurs - https://onlinecourses.nptel.ac.in/noc25_mg13
4	Innovation, Business Models and Entrepreneurship - https://nptel.ac.in/courses/110107094

VIRTUAL LAB/SIMULATION TOOLS

1	**I2E (Idea to Execution) Startup Simulation Tool** - Interactive business simulation used in management and entrepreneurship education. Allows students to experience business model design, pricing, funding, and growth strategies in a virtual environment.
2	**IP India** – Patent Search and Filing Portal (Government of India) - Official Indian Patent Office platform for prior art search, patent filing, and IP management. Enables students to explore patent databases, file provisional applications, and understand the IPR process workflow.
3	**BMC Simulator (Business Model Canvas Simulation Tool)** -Digital tool to practice Business Model Canvas creation, mapping customer segments, value propositions, and revenue streams. Enables collaborative innovation exercises for project-based learning.

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
1.Foundations of Innovation and Entrepreneurship (7 hours)	Part 1	**Introduction to Entrepreneurship**	Definition, scope, and significance of entrepreneurship; evolution of entrepreneurship in engineering; characteristics and competencies of successful entrepreneurs.	2
	Part 2	**Innovation and Creativity**	Concept and importance of innovation; types of innovation (incremental, disruptive, process, and product); creativity techniques; fostering innovation among engineers.	2
	Part 3	**Design Thinking and Ideation**	Stages of design thinking—empathize, define, ideate, prototype, test; idea generation and selection methods; creative problem-solving.	2
	Part 4	**Startup Ecosystem in India**	Overview of Startup India, MSME, and Make in India initiatives; incubation centers, accelerators, and funding opportunities; role of government and private sectors in promoting startups.	1
2.Opportunity Identification and Business Modelling (7 hours)	Part 1	**Problem Identification and Validation**	Identifying engineering and societal problems; converting challenges into opportunities; defining and validating problem-solution fit through user feedback and field studies.	2
	Part 2	**Market Research and Customer Profiling**	Conducting market research; market segmentation, targeting, and positioning; customer persona creation; data collection and validation using survey tools.	2
	Part 3	**Business Model Canvas (BMC)**	Key components of BMC – customer segments, value propositions, key partners, resources, channels, and revenue streams; comparison with Lean Canvas approach.	2
	Part 4	**Competitor and Industry Analysis**	Understanding competitors and industry trends; SWOT analysis, Porter's five forces; developing differentiation and positioning strategies.	1
3. Business Planning and Prototype Development (8 hours)	Part 1	**Business Plan Preparation**	Framework and importance of a business plan; structure – executive summary, business objectives, marketing, operational, and financial plans.	2
	Part 2	**Prototype Planning and Development**	Concept of Minimum Viable Product (MVP); prototype design stages; tools and techniques for rapid prototyping; iterative testing and validation.	2
	Part 3	**Financial and Resource Planning**	Cost estimation, budgeting, and resource allocation; funding sources – bootstrapping, venture capital, crowdfunding; preparing financial projections.	2
	Part 4	**Risk Management and Pitching**	Risk identification and mitigation; crafting effective pitch decks; investor communication and presentation skills; storytelling in entrepreneurial pitches.	2

4. Intellectual Property Rights (IPR) and Commercialization (8 hours)	Part 1	**Introduction to IPR**	Overview and importance of Intellectual Property Rights; types – patents, copyrights, trademarks, industrial designs; role of IPR in promoting innovation and entrepreneurship.	2
	Part 2	**Patent Filing and Legal Aspects**	Patent system in India; criteria for patentability; process of patent filing; patent databases and prior art search; legal procedures and documentation.	2
	Part 3	**Technology Transfer and IP Commercialization**	IP ownership and licensing; technology transfer and commercialization models; IP valuation; protecting intellectual assets in startups.	2
	Part 4	**Case Studies and Emerging Trends**	Case studies of Indian IP-based startups; IPR in AI and digital technology; global IP policies, open-source innovation, and future challenges.	2

SELF LEARNING ACTIVITIES (30 Hrs)

Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	**Lean Canvas Development for a Startup Idea**	Students will identify a real-world engineering or social problem and develop a Lean Canvas model covering value proposition, customer segments, channels, and revenue streams. A brief presentation of the idea and validation findings will be submitted as a report.	8 hrs	2	CO2, CO3	WK3, WK4	PO3, PO4, PO5
2	**Mini Patent Search and IPR Case Study**	Students will perform a prior art search using the Indian Patent Office database or Google Patents for an innovative concept. They will summarize findings and discuss the relevance of IPR to their identified product or startup idea.	7 hrs	4	CO4, CO5	WK1, WK5, WK9	PO6, PO7, PO11

RUBRICS FOR SELF LEARNING ACTIVITIES EVALUATION

Sl.No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	**Understanding of Concept / Application**	Demonstrates deep understanding of entrepreneurial and IPR concepts with clear real-world linkage.	Shows good understanding and applies concepts with minor gaps.	Demonstrates basic understanding but lacks clear practical connection.	Limited understanding; weak linkage between theory and application.	No conceptual understanding demonstrated.

2	**Quality of Analysis and Innovation**	Highly innovative idea or approach with thorough analysis and original insights.	Good innovative approach; analysis is logical and relevant.	Moderate creativity and analysis; lacks depth.	Minimal innovation or analytical reasoning.	No innovation or critical thinking evident.
3	**Use of Tools / Frameworks**	Effectively uses relevant tools (e.g., Lean Canvas, patent search database) with accurate and complete data.	Appropriate use of tools with minor errors or omissions.	Partial use of tools; limited accuracy.	Incomplete or incorrect application of tools/frameworks.	No use of relevant tools or methods.
4	**Documentation and Presentation**	Clear, professional documentation and presentation with visuals and well-structured content.	Good structure; minor errors in formatting or clarity.	Adequate presentation; lacks strong organization or clarity.	Poor structure; weak visual or written presentation.	Unorganized or incomplete submission.
5	**Engagement and Effort**	Demonstrates exceptional initiative, teamwork, and consistent engagement throughout SLA.	Shows good effort and engagement with minor lapses.	Moderate effort; limited team participation.	Minimal participation or incomplete effort.	No effort or engagement demonstrated.

RUBRICS FOR TERM WORK EVALUATION						
Sl.No.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	**Quality of Business Plan / Report**	Business plan is comprehensive, logically structured, and clearly communicates objectives, strategy, and feasibility.	Plan is well-structured with minor gaps in detail or analysis.	Plan covers main points but lacks depth and clarity in certain areas.	Limited scope or incomplete sections; poor analysis.	Lacks structure, detail, or coherence.
2	**Innovation and Practical Feasibility**	Demonstrates a highly innovative idea that is technically and commercially feasible.	Innovative and relevant, but minor gaps in practicality.	Moderate innovation; feasibility is partially addressed.	Weak innovation or limited feasibility assessment.	No innovative or feasible aspect identified.

3	**Prototype / Pitch Deck Design**	Prototype or pitch deck is visually clear, well-organized, and effectively communicates technical and business value.	Clear and informative presentation with minor design flaws.	Adequate presentation but lacks strong clarity or structure.	Poorly organized pitch; unclear concept communication.	Incomplete or missing prototype/ presentation.
4	**Team Collaboration and Role Distribution**	Excellent teamwork with clear roles, mutual coordination, and equal participation throughout the activity.	Good teamwork; minor role imbalance.	Fair participation with some coordination issues.	Weak collaboration or unequal workload distribution.	No evidence of teamwork or coordination.
5	**Communication and Presentation Skills**	Outstanding verbal and visual communication; confident, engaging, and professional delivery.	Clear and confident presentation with minor issues.	Adequate communication; needs improvement in clarity or flow.	Unclear delivery; lacks confidence and organization.	Poor communication; unstructured and unengaging

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No.	**Activity**	**Description**	**Time**	**Module**	**CO**	**WK**	**PO**
1	**Preparation of a Comprehensive Business Plan**	Students will prepare a concise business plan for an innovative engineering startup idea. The plan should include executive summary, product/service description, market analysis, operations plan, and financial overview.	8 hrs	3	CO3, CO5	WK2, WK3, WK4	PO3, PO4, PO5
2	**Prototype Concept / Pitch Deck Presentation**	Teams will design a prototype concept or MVP (conceptual model) and present it through a structured pitch deck. Evaluation based on innovation, feasibility, presentation quality, and teamwork.	6 hrs	3,4	CO3, CO4, CO5	WK3, WK6, WK9	PO6, PO8, PO10

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**40%**
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**60%**
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN

Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	**U**	**A**	**An**	**E**	**C**	
1	Foundations of Innovation and Entrepreneurship	7	5	10					15
2	Opportunity Identification and Business Modelling	7	5	5	5				15
3	Business Planning and Prototype Development	8	2	4	4	5			15
4	Intellectual Property Rights (IPR) and Commercialization	8	5	5	5				15

This shall be treated as a general guideline for students and teachers for distribution of marks.

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN

No: of Sections in the Question paper		2			
Part	**No. of Questions/Module**	**Total No. of Questions**	**Max. marks/ Question**	**Part Summary**	**Total Marks**
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					**60**

Course Code	Course Name				Credits
J1HMP126	**LIFE SKILLS AND PROFESSIONAL COMMUNICATION**				**1**
Regulation	2026	L: T:P:H:S	1:0:1:0:2	Notional Learning Hours/Semester	30
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TP	Course delivery Mode			
Scheme of Evaluation		CIE: 100 Marks	ESE: 0 Marks	Total Marks:100	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	To foster self-awareness and personal growth, enhance communication and interpersonal connection skills, promote effective participation in groups and teams, develop critical thinking, problem-solving, and decision-making skills, and cultivate the ability to exercise emotional intelligence.
2	To equip students with the necessary skills to listen, read, write & speak, to comprehend and successfully convey any idea, technical or otherwise.
3	To equip students to build their profile in line with the professional requirements and standards.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Develop the ability to know & understand oneself, show confidence in one's potential & capabilities, set goals and develop plans to accomplish tasks	K5
2	Develop the ability to communicate and connect with others, participate in groups/teams, empathise, respect diversity, be responsible and understand the need to exercise emotional intelligence	K5
3	Develop thinking skills, problem-solving and decision-making skills	K5
4	Develop listening, reading, writing & speaking skills, ability to comprehend & successfully convey any idea, and ability to analyse, interpret & effectively summarize textual, audio & visual content	K6
5	Develop the ability to create effective presentations through audio-visual mediums with the use of technology tools and initiate effective use of social media platforms & tech forums for content delivery and discussions	K6
6	Initiate profile-building exercises in line with the professional requirements, and start networking with professionals/academicians	K6

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes														
	WK									PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3		3		3												1		3			
2		3	3	3		3								1		3		3		3			
3	3		3		3	3		3			1	1		1				1		1			
4				3	3		3	3	3					1				1		2			
5														2				1		2			
6														1				1					
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																								

SYLLABUS

Table 1. Activities: 76 Marks

Module	Activity	Class room (L) / Self Study (SS)	Week of completion	Group / Individual (G/I)	Marks	Skills	CO
1.1	Group formation and self-introduction among the group members	L	1	G	-	• Connecting with group members • Time management - Gantt Chart	
1.2	Familiarizing the activities and preparation of the time plan for the activities	L	1	G	-		
1.3	Preparation of Gantt chart based on the time plan	SS	1	G	2		
2.1	Take an online personality development test, self-reflect and report	SS	1	I	2	• Self-awareness Writing	CO1

2.2	Role-storming exercise 1: Students assume 2 different roles given below and write about their ● Strengths, ● Areas for improvement, ● Concerns, ● Areas in which he/she hesitates to take advice, ● Goals/Expectations, from the point of view of the following assumed roles ● their parent/guardian/mentor ● their friend/sibling/cousin	L	1	I	2	●Goal setting - Identification of skills and setting goal ●Self-awareness ●Discussion in groups ●Group work- Compiling of ideas ●Mind mapping	CO1
2.3	Role-storming exercise 2: Students assume the role of their teacher and write about the ●Skills required as a B.Tech graduate ●Attitudes, habits, approaches required and activities to be practised during their B.Tech years, in order to achieve the set goals	SS	1	I	2		CO1
2.4	Discuss the skills identified through rolestorming exercise by each one within their own group and improvise the list of skills	L	1	G	2		CO1
2.5	Prepare a mind map based on the role- storming exercise and exhibit/present it in class	SS	2	G	2		CO1
3	Prepare a presentation on instances of empathy they have observed in their own life or in other's life	L	2 to 4	I	2	Empathy	CO2

4.1	Each student connects and networks with a minimum of 3 professionals from industry/public sector organizations/other agencies/NGOs /academia (at least 1 through LinkedIn)	SS	3	I	2	●Workplace awareness ●Listening ●Communication-interacting with people ●Networking through various media including LinkedIn ●Discussion in groups ●Report preparation Creativity Goal setting - Preparation of action plan	
4.2	Interact with them to understand their workplace details including ● workplace skills required ● their work experience ● activities they have done to enhance their employability during their B.Tech years ● suggestions on the different activities to be done during B.Tech years	SS	3	I	4		CO2
4.3	Discuss the different workplace details & work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals Prepare the Minutes of the discussions	SS	3	G	2		CO2
4.4	Report preparation based on the discussions	SS	4	G	3		CO4

4.5	Perform a role-play based on the workplace dynamics assimilated through interactions and group discussions	L	5	G	4		CO3
4.6	Identify their own goal and prepare an action plan for their undergraduate journey to achieve the goal	SS	5	I	2		CO1
5.1	Select a real-life problem that requires a technical solution and list the study materials needed	L	6	G	2		CO3
5.2	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	SS	6	I	2		CO4
5.3	Use any online tech forum to gather ideas for solving the problem chosen	SS	6	G	2		CO5
5.4	Arrive at a possible solution using six thinking that exercise	L	7	G	3		CO3
5.5	Prepare a report based on the problem-solving experience	SS	7	G	2		CO4
6.1	LinkedIn profile creation	SS	1	I	2	Profile-building	CO6
6.2	Resume preparation	SS	8	I	2		CO6
6.3	Self-introduction video	SS	8	I	3		CO6

7	Prepare a presentation on instances of demonstration of emotional intelligence	SS	9	I	2	Emotional intelligence	CO2
8	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	SS	10	G	3	Diversity	CO2, CO5
9	Take online Interview skills development sessions like robotic interviews; self-reflect and report	SS	10	I	2	Interview skills	CO6
10	Take an online listening test, self-reflect and report	SS	11	I	2	Listening skills	CO6
11.1	Activities to improve English vocabulary of students	L	8	I/G	4	• English vocabulary • English language skills • Writing • Presentation • Group work Self-reflection	CO4
11.2	Activities to help students	L	9	I/G	2		CO4
11.3	identify errors in English language usage Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	L	10	I/G	2		CO4
11.4	Write a self-reflection report on the improvement in English language communication through this course	SS	12	I	2		CO4
11.5	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	L	11 to 12	G	2		CO4, CO5

12.1	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Govt. agencies/research institutions/private agencies/NGOs/other agencies	SS	12	G	4	• Audio-visual presentations creations with the use of technology tools • Effective use of social media platforms Profile building	CO2, CO4, CO5
12.2	Upload the video content to podcasting platforms or YouTube	SS	12	G	1		CO5
12.3	Add the link of the podcast in their LinkedIn profile	SS	12	G	1		CO5

Table 2.
Lab hour Activities (P): 24 Marks

Sl No	Activity	Marks	Skill	CO
1	Hands-on sessions on day-to-day engineering skills and a self-reflection report on the experience gained: 1. Drilling practice using electric hand drilling machines. 2. Cutting of MS rod and flat using electric hand cutters. 3. 4. Filing, finishing and smoothening using electrically operated hand grinders. 5. MS rod cutting using Hack saw by holding the work in bench wise. 6. Study and handling different types of measuring instruments. 7. Welding of MS, SS work pieces. 8. Pipe bending practice (PVC and GI). 9. Water tap fitting. 10. Water tap rubber seal changing practice.	**24**	Basic practical engineering skills	**3**

	11. Union and valves connection practice in pipes. 12. Foot valve fitting practice. 13. Water pump seal and bearing changing practice			
2	Language Lab sessions	-	Language Skills	**4**

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Life Skills & Personality Development	Maithry Shinde et.al.	Cambridge University Press	2022
2	Emotional Intelligence: Why it can matter more than IQ	Daniel Goleman	Bloomsbury, Publishing PLC	2020
3	Think Faster, Talk Smarter: How to speak successfully when you are put on the spot	Matt Abrahams	Macmillan Business	2023
REFERENCE				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	English Grammar in Use	Raymond Murphy	Cambridge University Press	2023
2	Life Skills for Engineers	Ramesh S., Vishnu R.G.	Ridhima Publications	2016
3	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2017
VIDEO LINKS				
1	https://www.youtube.com/watch?v=qUUwojhmZOU&t=1s			
2	https://www.youtube.com/watch?v=TjE4IoSyT9U&t=1s			
3	https://www.youtube.com/watch?v=K9b3Z_v8lQI			
VIRTUAL LAB/SIMULATION TOOLS				
1	https://flipgridapp.com/			
2	https://www.canva.com/online-whiteboard/			
3	https://trello.com/			
4	https://www.todoist.com/			

COURSE CONTENTS AND LECTURE SCHEDULE (20 HOURS)				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1.Introduction	**Part 1**	Group creation	Group formation and self-introduction among the group members	1
	Part 2	Activity planning	Familiarizing the activities and preparation of the time plan for the activities	1
	Part 3	Gantt chart	Preparation of Gantt chart based on the time plan	1
2. Skills and Self-awareness	**Part 1**	Role-storming exercise-1	Students assume 2 different roles given below and write about their • Strengths, • Areas for improvement, • Concerns, • Areas in which he/she hesitates to take advice, • Goals/Expectations, from the point of view of the following assumed roles • their parent/guardian/mentor their friend/sibling/cousin **<u>Skills to be developed:</u>** • Goal setting - Identification of skills and setting goal • Self-awareness • Discussion in groups Group work- Compiling of ideas Mind mapping	3
	Part 2	Share and refine skills	Discuss the skills identified through role storming exercise by each one within their own group and improvise the list of skills	1
3. Empathy	**Part 1**	Presentation on empathy	Prepare a presentation on instances of empathy they have observed in their own life or in other's life	2
4. Contextual problem	**Part 1**	Real-life problems	Select a real-life problem that requires a technical solution and list the study materials needed	1
	Part 2	Six thinking hat	Arrive at a possible solution using six thinking hat exercise	1

5. English Language	**Part 1**	English vocabulary	Activities to improve English vocabulary of students	2
	Part 2	Errors in English language	Activities to help students identify errors in English language usage	2
	Part 3	English spelling, pronunciation, and confusing word	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	3
	Part 4	online collaboration tools	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	2

SELF LEARNING ACTIVITIES (10 Hrs)

Sl.No.	Activity	Description	Time	Module	CO	WK	PO
1	Gantt chart preparation	Preparation of Gantt chart based on the time plan	1	1	CO1	1	1
2	Self-awareness Writing	Take an online personality development test, self-reflect and report	1	2	CO1	1	2
3	Role-storming exercise	Students assume the role of their teacher and write about the ● Skills required as a B.Tech graduate ● Attitudes, habits, approaches required and activities to be practised during their B.Tech years, in order to achieve the set goals	1	2	CO1	1	1
4	Goal setting - Preparation	Identify their own goal and prepare an action plan for their undergraduate journey to achieve the goal	1	4	CO1	2	2
5	online - international talks	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	1	5	CO4	4	3
6	Portfolio Personal creation	LinkedIn and Resume profile creation	1	6	CO6	6	5
7	emotional intelligence	Prepare a presentation on instances of demonstration of emotional intelligence	1	7	CO2	2	5
8	diversity aspects	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	1	8	CO2, CO5	7	5

9	Interview skills	Take online Interview skills development sessions like robotic interviews; self-reflect and report	1	9	CO6	6	5
10	listening test	Take an online listening test, self-reflect and report	1	10	CO6	8	7

RUBRICS FOR TERM WORK EVALUATION						
Sl.No.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Completeness	All tasks done with extra depth, innovative additions	All tasks completed, few minor gaps	Most tasks done, limited depth	Some tasks missing or incomplete	Very little completed
2	Technical Accuracy	Algorithms and implementations are correct and efficient	Mostly correct, minor issues	Some conceptual errors	Major conceptual gaps	Incorrect or no implementation
3	Documentation & Presentation	Well-structured, clear, professional	Structured but with small lapses	Understandable but lacks clarity	Poorly structured	No documentation

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**100%**
Lab Evaluation	24%
Learning Activity (Self Learning, Term Work, Assignments,)	76%
Attendance	0 %
Internal Examination	NA
Course Project	NA
End Semester Examination	**0%**
Total	**100**

Course Code	Course Name				Credits
J1CST207	**Discrete Mathematical Structures**				**3**
Regulation	2026	L: T:P:H:S	2:1:0: 0:3.5	Notional Learning Hours/Semester	90
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Basic Knowledge of Sets, Permutations and Combinations				

COURSE OBJECTIVE	
1	To introduce the foundational concepts of relations, functions, lattices, and the principles of mathematical logic.
2	To develop analytical and problem-solving skills in mathematical proofs, induction, and the solution of recurrence relations through structured study.
3	To apply the concepts of group theory and discrete structures to model and solve real-world problems in computing.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain the properties of relations, functions, partially ordered sets, and lattices, and represent them using Hasse diagrams	K3
2	Make use of propositional and predicate logic, rules of inference, and standard proof methods to construct and verify mathematical arguments.	K3
3	Apply mathematical induction and generating functions to model and solve linear recurrence relations.	K3
4	Apply the principles of group theory, including subgroups, homomorphism, and Lagrange's theorem, to analyse algebraic structures relevant to computing.	K3

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	-	-	-	-	-	-	-	3	2	-	-	2	-	-	-	-	-	2	-	-	-
2	3	3	2	-	-	-	-	-	-	3	3	2	-	2	-	-	-	-	-	2	-	-	-
3	3	3	2	2	-	-	-	-	-	3	3	2	-	2	-	-	-	-	-	2	-	-	-
4	3	3	2	2	-	-	-	-	-	3	3	2	-	2	-	-	-	-	-	2	-	-	-
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																							

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Relations and Functions**	Cartesian Product - Binary Relation. Functions – domain, range, one-to-one functions, Function composition and Inverse functions. Principle of Inclusion-Exclusion Properties of Relations—Reflexive Relations, Symmetric Relations, Transitive relations, Anti-symmetric Relations, Partial Order relations, Equivalence Relations, Irreflexive relations. Partially ordered Set – Hasse Diagram, Maximal-Minimal Element, Equivalence Relations and Partitions - Equivalence Class. Lattice - Dual Lattice, Sub lattice, Properties of glb and lub, Properties of Lattice, Special Lattice, Complete Lattice, Bounded Lattice, Completed Lattice, Distributive Lattice. **(Relevant topics from Text 2: sections 5.1, 5.2, 5.6, 7.3, 7.4, 7.6,8.1)**	12
2	**Mathematical logic and proofs**	Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs, Methods of Proving Theorems - Direct proof, Indirect proof (Proof by Contraposition), Proof by Contradiction, Proof by counter examples, The Pigeonhole Principle. **(Relevant topics from Text 1: Sections 1.1,1.2,1.3,1.4,1.5,1.6,1.7 , 6.2)**	11
3	**Induction and Recurrences**	Mathematical Induction, Weak and Strong Induction, Recursive (Inductive) definitions and recurrence relations, Modeling with Recurrence Relations, Solving Linear Recurrence Relations (homogeneous and nonhomogeneous), Generating Functions, Using Generating Functions to Solve Recurrence Relations. **(Relevant topics from Text 1: Sections 5.1,5.2,5.3,7.1,7.2,7.4,)**	11
4	**Group theory**	Groups - Definition, Examples, and Elementary Properties, Abelian group, Permutation group, Subgroup, Homomorphisms, Isomorphisms, and Cyclic Groups, Cosets and Lagrange's Theorem. **(Relevant topics from Text 2: Sections 15.1,15.2,15.3,15.4,15.5)**	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL.NO	Name of Book	Name of Author/s	Publisher	Year
1.	Discrete Mathematics and its Applications	Kenneth H. Rosen, Kamala Krithi Vasan	McGraw Hill	2021
2	Discrete and Combinatorial Mathematics (An Applied Introduction	Ralph P Grimaldi, B V Ramana	Pearson	2014
REFERENCE				
SL.NO	Name of Book	Name of Author/s	Publisher	Year
1	Schaum's Outline of Discrete Mathematics	Marc Lipson, Seymour Lipschutz	McGraw-Hill	2021
2	Discrete Mathematics	Kenneth A. Ross, Charles R.B. Wright	Prentice Hall	2002 5th edition
3	Discrete Mathematics for Computer Scientists and Mathematicians	Joe L Mott, Abraham Kandel, Theodore P Baker	Prentice-Hall India	2009.
VIDEO LINKS				
1	https://nptelvideos.com/lecture.php?id=6033			
2	https://nptelvideos.com/lecture.php?id=6024			
3	https://nptelvideos.com/lecture.php?id=6051			
4.	https://nptelvideos.com/lecture.php?id=6058			
VIRTUAL LAB/SIMULATION TOOLS				
1	Python			
2	GAP (Groups, Algorithms, Programming)			

Course Contents and Lecture Schedule				
Module	Part	Part Name	Topics Covered	Hours
1. Functions, and Relations (12 Hrs)	Part 1	Functions, and Relations	Cartesian Product - Binary Relation. Function – domain, range-one to one function, Function composition and Inverse functions. Principle of Inclusion-Exclusion Properties of Relations- Reflexive Relations, Symmetric Relations, Transitive relations, Anti-symmetric Relations, Partial Order relations, Equivalence Relations, Irreflexive relations.	4
	Part 2	Hasse Diagram	Partially ordered Set – Hasse Diagram, Maximal-Minimal Element, least upper bound (lub), Greatest Lower bound(glb) (Topological sorting Algorithm- excluded).	2
	Part 3	Equivalence Relations and Equivalence Class	Equivalence Relations and Partitions - Equivalence Class	2
	Part 4	Lattice	Lattice - Dual Lattice, Sub lattice, Properties of glb and lub, Properties of Lattice, Special Lattice, Complete Lattice, Bounded Lattice, Completed Lattice, Distributive Lattice.	4
2.Mathematical logic and proofs (11 Hrs)	Part 1	Propositional Logic and Applications	Propositional Logic, Applications of Propositional Logic, Propositional Equivalences	3
	Part 2	Predicates and Quantifiers	Predicates and Quantifiers, Nested Quantifiers, Rules of Inference	3
	Part 3	Introduction to Proofs	Introduction to Proofs, Methods of Proving Theorems - Direct proof, Indirect proof (Proof by Contraposition), Proof by Contradiction, Proof by counter examples,	3
	Part 4	The Pigeonhole Principle	The Pigeonhole Principle.	2
3.Induction and Recurrences (11 Hrs)	Part 1	Mathematical Induction	Mathematical Induction, Weak and Strong induction	2
	Part 2	recurrence relations	Recursive (Inductive) definitions and recurrence relations, Modeling with Recurrence Relations,	3
	Part 3	homogeneous and nonhomogeneous Linear Recurrence Relations	Solving Linear Recurrence Relations (homogeneous and nonhomogeneous)	3
	Part 4	Generating Functions	Generating Functions, Using Generating Functions to Solve Recurrence Relations	3

4. Group theory (11 Hrs)	Part 1	Groups	Groups - Definition, Examples, and Elementary Properties	2
	Part 2	Study of Groups and their types	Abelian group, Permutation group, Subgroup, Cyclic Groups.	4
	Part 3	Homomorphisms and Isomorphisms	Homomorphisms, Isomorphisms	3
	Part 4	Lagrange's Theorem	Cosets and Lagrange's Theorem	2

SELF LEARNING ACTIVITIES (30 Hrs)

Sl.NO	Activity	Description	Time	Module	CO	WK	PO
1	Relations & Lattice Explorer	Use Python to test relations for reflexivity, symmetry, transitivity, and anti-symmetry, draw Hasse diagrams for posets, and verify lattice properties on chosen examples; submit a documented report.	7	1	CO1	WK1 WK2, WK3	PO1, PO2 PO5
2	Logic & Proof Workbook	Construct truth tables, verify propositional equivalences, and produce worked proofs using direct, contrapositive, contradiction, and counter-example methods; include pigeonhole-principle problems.	8	2	CO2	WK1 WK2, WK3	PO1, PO2, PO3
3	Recurrence Solver Study	Model real-world counting problems with recurrence relations, solve homogeneous and nonhomogeneous cases, and apply generating functions; verify solutions computationally and present an analysis.	8	3	CO3	WK1 WK2, WK3, WK4	PO1, PO2, PO3, PO5
4	Group Theory Case Study	Investigate finite groups, subgroups, cosets, and cyclic groups using GAP or Python; verify Lagrange's theorem and study a computing application such as error-detecting codes.	7	4	CO4	WK1 WK2, WK3, WK4	PO1, PO2, PO3, PO5, PO11

TERM WORK ACTIVITIES (15 Hrs)							
Sl.NO	Activity	Description	Time	Module	CO	WK	PO
1	Relations, Lattices & Logic Portfolio	Solve a curated set of problems on relations, posets, lattices, propositional and predicate logic, and proof methods; present complete worked solutions with verification.	5 Hrs	1, 2	CO1 CO2	WK1 WK2 WK3	PO1 PO2 PO3
2	Recurrence Modelling Report	Model a practical problem with recurrence relations, solve it using characteristic roots and generating functions, and submit a structured report with analysis.	5 Hrs	3	CO3	WK1 WK2 WK3 WK4	PO1 PO2 PO3 PO5
3	Group Theory Mini-Study Presentation	Analyse a set of algebraic structures, verify subgroup and coset properties, and present a comparative study with a computing-oriented interpretation of Lagrange's theorem.	5 Hrs	4	CO4	WK1 WK2 WK3 WK4	PO1 PO2 PO3 PO5 PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl. NO	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**40%**
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**60%**
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN

Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	**U**	**A**	**An**	**E**	**C**	
1	**Functions, and Relations**	12		3	12				15
2	**Mathematical logic and proofs**	11		3	12				15
3	**Induction and Recurrences**	11		3	12				15
4	**Group theory**	11		3	12				15

This shall be treated as a general guideline for students and teachers for distribution of marks.

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	**No. of Questions/Module**	**Total No. of Questions**	**Max. marks/ Question**	**Part Summary**	**Total Marks**
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					**60**

Course Code	Course Name				Credits
J1ESL228	**PROGRAMMING IN PYTHON WORKSHOP**				**1**
Regulation	2026	L: T:P:H:S	0:0:2:0:1	Notional Learning Hours/Semester	30
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	PL	Course delivery Mode			Practical
Scheme of Evaluation		CIE: 100 Marks			
Pre-requisite		Nil			

COURSE OBJECTIVE	
1	To provide hands-on practice in Python programming fundamentals, functions, and data structures.
2	To develop skills in object-oriented programming and file handling using Python.
3	To enable scientific computing, data analysis, and visualization using NumPy, Pandas, and Matplotlib.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Develop Python programs using control structures, functions, and built-in data structures.	K3
2	Apply object-oriented programming concepts and file handling techniques in Python.	K3
3	Perform scientific computing tasks using NumPy.	K3
4	Analyze and visualize data using Pandas and Matplotlib.	K4

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	-	2	2	-	-	-	-	-	-	3	2	-	2	3	-	-	-	-	-	-	-	3	-
2	-	-	2	2	-	-	-	-	-	3	-	2	2	3	-	-	-	-	-	-	-	3	-
3	-	2	-	-	-	2	-	-	-	3	2	-	2	3	-	-	-	-	-	-	2	2	-
4	-	3	-	-	-	2	-	-	-	3	3	-	3	3	-	-	-	-	-	-	3	2	-

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Python Programming Fundamentals**	Input and Output Operations, Operators and Expressions, Conditional Statements, Iterative Constructs, String Manipulation, and Problem Solving using Python Programs.	6
2	**Functions and Data Structures**	User-Defined Functions, Recursive Functions, Lambda Functions, Lists, Tuples, Sets, Dictionaries, and Basic Applications of Python Data Structures.	6
3	**Object-Oriented Programming and File Handling**	Classes, Objects, Constructors, Methods, Inheritance, Polymorphism, File Handling Operations, and CSV File Processing.	6
4	**Scientific Computing, Data Analysis and Visualization**	NumPy Arrays and Matrix Operations, Pandas Series and DataFrames, Data Manipulation and Analysis, Matplotlib Plots, and Basic Data Visualization Techniques.	6

LIST OF EXPERIMENTS (24 Hours)

Instructions

Lab experiments must be implemented in Python (Python 3 with Jupyter Notebook / IDLE). Minimum 12 experiments are mandatory. Additional experiments may be conducted as demonstrations or for internal assessment.

Sl. No.	Experiment	CO
1	Develop programs using input/output operations, arithmetic operators, and expressions.	1
2	Implement programs using conditional statements and looping constructs.	1
3	Develop string processing applications involving searching, counting, and formatting operations.	1
4	Implement user-defined functions and recursive functions.	1
5	Develop applications using lists and list comprehensions.	1
6	Perform operations using tuples, sets, and dictionaries.	1
7	Implement applications using lambda functions, map(), filter(), and reduce().	1

8	Create classes and objects with constructors and member functions.	2
9	Implement inheritance and method overriding.	2
10	Demonstrate polymorphism and abstract classes.	2
11	Develop applications for reading and writing text files.	2
12	Process CSV files using Python.	2
13	Perform array and matrix operations using NumPy.	3
14	Create and manipulate Series and DataFrames using Pandas.	4
15	Perform data filtering, descriptive statistics, and missing-value handling using Pandas.	4
16	Generate visualizations using Matplotlib (line, bar, scatter, and histogram plots).	4
17	Mini Case Study: Perform basic data analysis and visualization on a real-world dataset.	3,4

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Think Python: How to Think Like a Computer Scientist (2nd ed.)	Allen B. Downey	O'Reilly Media	2016
2	Python Programming: Using Problem Solving Approach	Reema Thareja	Oxford University Press	2017

REFERENCE

Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Python Data Science Handbook (2nd ed.)	Jake VanderPlas	O'Reilly Media	2022
2	Python for Data Analysis (3rd ed.)	Wes McKinney	O'Reilly Media	2022

VIDEO LINKS

1	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs136
2	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs109
3	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs107

SIMULATION TOOLS

1	Python 3 with Jupyter Notebook / IDLE / Google Colab
2	NumPy, Pandas, Matplotlib libraries

SELF LEARNING ACTIVITIES (3 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Python Practice Problem Set	Self-practice of additional programming problems on control structures, functions, and Python data structures.	2	1,2	1	2,3	1,2,5
2	Dataset Exploration	Self-study to explore a small real-world dataset using Pandas and Matplotlib.	1	4	4	2,6	1,2,5

TERM WORK ACTIVITIES (3 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Lab Record and Data-Analysis Mini-Project	Maintain the complete lab record and develop a small data-analysis mini-project; document and present the work.	3	All Modules	All CO's	2,3,4,6	1,2,5,11

RUBRICS FOR TERM WORK EVALUATION							
Sl. No.	**Evaluation Criteria**	**Weightage**	**Excellent (100%)**	**Good (80%)**	**Satisfactory (60%)**	**Needs Improvement (40%)**	**Poor (10%)**
1	Understanding & Conceptual Clarity	40%	Demonstrates complete understanding of concepts; applies theory correctly; shows deep comprehension	Good understanding; minor conceptual gaps; mostly correct application	Basic understanding; some confusion; limited application	Weak understanding; major gaps; incorrect application	No understanding; unable to explain concepts
2	Experimental/Programming Skills	30%	Flawless execution; optimal approach; error-free; efficient solution; exceeds requirements	Good execution; minor errors; effective approach; meets requirements	Basic execution several errors; simple approach;partially meet requirements	Poor execution; major errors; inefficient approach; barely meets requirements	Unable to execute; non-functional; does not meet requirements

3	Analysis, Interpretation, and Documentation.	30%	Professional quality; comprehensive; accurate results; well-structured; exceeds expectations	Good quality; mostly accurate; clear structure; meets expectations	Acceptable quality; some inaccuracies; basic structure; minimal expectations met	Poor quality; many inaccuracies; weak structure; below expectations	Unacceptable quality; incorrect; no proper structure

RUBRICS FOR CONTINUOS INTERNAL ASESSMENT							
Sl. No.	**Evaluation Criteria**	**Weightage**	**Excellent (100%)**	**Good (80%)**	**Satisfactory (60%)**	**Needs Improvement (40%)**	**Poor (10%)**
1	Preparation & Pre-lab Work	20%	Fully prepared, all tasks completed, clear concepts	Minor gaps, overall understands	Partially completed, some confusion	Minimal effort, weak comprehension	No prep, unable to explain
2	Experimental/Programming Skills	20%	Executes with precision, independent work	Minor help needed, mostly accurate	Frequent help, some errors	Constant help, major errors	Unable to perform
3	Analysis & Interpretation	10%	In-depth analysis, insightful, correct inference	Good analysis, few gaps	Basic interpretation	Minimal interpretation, errors	No analysis
4	Attendance and Timeliness of record Submission	10%	Professional, clear, well-structured, referenced	Mostly clear, minor errors	Average, lacks clarity	Poor, incomplete	Not submitted
5	Viva	10%	Demonstrates full mastery	Good responses	Can answer basic questions	Struggles with responses	Cannot answer
6	Internal Lab Examination	30%	Marks Scored by the student can be proportionally added to the Assessment based on the weightage.				

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**100%**
Lab Evaluation	50 %
Learning Activity (Self Learning, Term Work)	10 %
Attendance	10 %
Internal Examination	30 %
Course Project	**NA**
Total	100