MANAKULA VINAYAGAR INSTITUTE OF TECHNOLOGY

An Autonomous Institution

Affiliated to Pondicherry University, Approved by AICTE, New Delhi,
Accredited by NBA, New Delhi and NAAC with 'A' Grade
Kalitheerthalkuppam, Puducherry- 605 107.

Bachelor of Technology

ROBOTICS AND AUTOMATION

CURRICULUM AND SYLLABUS

(2025-26)

B.Tech. (Robotics and Automation)

2025-2026

CURRICULUM

SEMESTER I							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
Induction Program							
Theory							
1	25UMAT11	Matrices and Calculus	BS	3	1	0	4
2	25UPHT14	Physical science for robotic engineers	BS	3	0	0	3
3	25UMET13	Fundamentals of Mechanical Engineering	ES	2	1	0	3
4	25URAT14	Fundamentals of Electronic Devices	ES	3	0	0	3
Integrated course							
5	25UCSI16	Programming in C	ES	2	0	4	4
6	25UHSI16	Professional Communication for Engineers	HS	1	0	4	3
Practical							
7	25UPHP14	Physical science lab	BS	0	0	2	1
8	25UGEP18	Design Thinking & Idea Lab	ES	0	0	2	1
9	25UGEP19	Engineering Graphics and Auto CAD	ES	0	0	2	1
Employability Enhancement Course							
10	25UPCE11	Career Development Skills	EEC	0	0	2	0
Mandatory Course							
11	25UMCC11	IKS – Concepts and applications in Engineering and Science	MCC	1	0	1	0
12	25UMCC12	Environmental Sciences and Sustainability	MCC	2	0	0	0
Total Credits							**23**

SEMESTER II							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
Theory							
1	25UMAT21	Differential equations and Transforms	BS	3	1	0	4
2	25UHST22	Universal Human Values II	HS	2	0	0	2
3	25URAT23	Electrical circuits and machines	ES	3	0	0	3
4	25URAT24	Sensors and Actuators	PC	3	0	0	3
Integrated course							
5	25UCSI25	Problem solving using Python	ES	2	0	4	4
Practical							
6	25URAP26	Electrical and Electronics Lab	ES	0	0	2	1
7	25URAP27	Sensors and Actuators Lab	PC	0	0	2	1
8	25UGEP28	Fabrication lab	ES	0	0	2	1
Employability Enhancement Course							
9	25UPCE21	Communication Skills	EEC	0	0	2	0
10	25UCCC22	Certification Course I	CCC	0	0	4	0
Mandatory Course							
11	25UMCC21	IKS in Humanities and Social Science	MCC	1	0	1	0
12	25UMCC22	Holistic Wellness	MCC	0	0	1	0
Total Credits							**19**

Manakula Vinayagar Institute of Technology Dept. of Robotics and Automation

27/10/25

Head of the Department
Department of Robotics and Automation
Manakula Vinayagar Institute of Technology
Madagadipet, Puducherry-605 107.

SEMESTER - I

25UMAT11	MATRICESAND CALCULUS	Category	L	T	P	Credit
Course Prerequisite		**BSC**	**3**	**1**	**0**	**4**

HigherSecondary Level Mathematics

Course Objective

- To understandand gaintheknowledge of matrixalgebra, partialdifferentiation, double integration,tripleintegration and theirapplication, curl, divergence.
- Tofamiliarwith vector differentialoperators, integral theorems (Green's, Stoke's, Gaussdivergence).

Course Outcome

On the successful completion of the course, students will be able to

CO1	Find eigenvalues and eigenvectors, verify the Cayley-Hamilton theorem, and perform orthogonal diagonalization.	Apply (K3)
CO2	Compute partial derivatives, determine total derivatives, Jacobians, employTaylor's series, and find extremes of functions of two variables.	Apply (K3)
CO3	Demonstrate proficiency in evaluating double integration and triple integration and using them to compute area and volume.	Apply (K3)
CO4	Compute gradients, divergence, curl, directional derivatives, and apply vector identities to solve vector field problems.	Apply (K3)
CO5	Apply Green's theorem, Stoke's theorem and Gauss divergence theorem.	Apply (K3)

SYLLABUS

UNITIMATRICES (12)

Eigenvaluesand Eigen vectors ofarealmatrix, Characteristic equation, PropertiesofEigen valuesand Eigenvectors-Cayley-HamiltonTheorem, Diagonalizationofmatrices. Reductionof a quadraticformto canonicalformby orthogonaltransformation -Nature ofquadraticforms

UNITII FUNCTIONS OF SEVERAL VARIABLES (12)

Partial derivatives-Total derivative- Differentiation of implicit functions, Change of variables-Jacobians and their properties-Taylor's series for functions of two variables- Maxima and minima, Lagrange's method of undetermined multipliers**.**

UNIT IIIINTEGRAL CALCULUS (12)

Multiple Integral – Change of order of integration (Cartesian form). Applications: Areas as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form).

UNIT IV VECTOR DIFFERENTIATION (12)

Scalar and vector valued functions-gradient, tangent plane – directional derivative-divergence and curl- scalar and vector potentials. Statement of vector identities-simple problems

UNIT V VECTOR INTEGRATION (12)

Line, surface and volume integrals- statements of Green's, Stoke's and Gauss Divergence theorems – verification and evaluation of vector integrals using them.

TOTAL PERIODS: 60

TEXT BOOKS

1. Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.

REFERENCE BOOKS

1. Bali. N., Goyal. M and Watkins. C, "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain. R.K and Iyengar. S.R.K, "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
3. Narayanan. S and Manicavachagom Pillai. T. K, "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
4. Ramana. B.V, "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
5. Sivaramakrishna Das. P, Vijayakumari. C, "Engineering Mathematics", PearsonEducation India, 4th Edition 019.

Online Courses/NPTEL/SWAYAM:

1. https://nptel.ac.in/courses/111106051 **Topics Covered**: Eigen values, Eigenvectors, Diagonalization, Cayley-Hamilton Theorem, Quadratic forms.
2. https://nptel.ac.in/courses/111104124 **Topics Covered:** Partial Derivatives, Jacobians, Taylor Series, Maxima & Minima, Lagrange Multipliers.
3. https://nptel.ac.in/courses/111104121 **Topics Covered:** Double and Triple Integrals, Change of Order, Applications to Area and Volume.
4. https://nptel.ac.in/courses/111103070 **Topics Covered:** Gradient, Divergence, Curl, Tangent Plane, Vector Identities.
5. https://nptel.ac.in/courses/111107108 **Topics Covered:** Line, Surface, Volume Integrals, Green's, Stoke's, Gauss Divergence Theorems.

CO-PO -PSO Mapping

COs		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		3	2	2	2						1		1
CO2		3	2	2	2						1		1
CO3		3	2	2	2						1		1
CO4		3	2	2	2						1		1
CO5		3	2	2	2						1		1

Assessment Methodology	Assessment Tools	Marks
Continuous Assessment Test	Written Test / Quiz/Assignment	25
Problem based Assignment	Moodle / Google form	5
Simulation (Python/MATLAB/Scilab) Based Project assignment	Demo and viva	5
Attendance	Attendance record	5
Total		**40**

25UPHT14	PHYSICAL SCIENCE FOR ROBOTIC ENGINEERS	Category	L	T	P	Credit
		BSC	3	0	0	3

Course Prerequisite

- Higher Secondary Physics (Mechanics, Kinematics, Dynamics and Electromagnetism)
- Basics of Engineering Mathematics (Differentiation, Integration, Vectors)
- Fundamentals of Engineering Mechanics

Course Objective

- To introduce the fundamental principles of mechanics and kinematics applied to robotic motion.
- To apply force, work, energy, and dynamics in the analysis of robotic systems.
- To explore wave phenomena, lasers, and Fiber optics relevant to robotic communication and sensing.
- To apply heat transfer, thermal expansion, and thermal management in robotic components.
- To understand material properties and smart material applications in robotic design.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Describe the basic principles of mechanics and kinematics relevant to robotic motion	Understand (K2)
CO2	Apply Newton's laws and energy concepts to evaluate forces, stability and dynamics in robotic mechanisms	Apply (K3)
CO3	Explain wave behavior, laser operation, and fiber optic principles for robotic communication and sensing	Understand(K2)
CO4	Apply heat transfer principles to propose thermal management solutions for robotic components.	Apply (K3)
CO5	Identify and classify engineering and smart materials used in robotic structures and components	Remember (K1)

SYLLABUS

UNIT IMECHANICS OF ROBOTIC MOTION (12)

Physical quantities, dimensionsand unit systems – Vectors, scalars and coordinate systems – Linear and angular motion – Position, velocity and acceleration analysis – Kinematics of rigid bodies – Motion trajectories in industrial manipulators and mobile platforms – Transformation matrices for robotic motion – Degrees of freedom and workspace analysis.

UNIT IIDYNAMICS AND ENERGY IN ROBOTIC SYSTEMS (12)

Newton's laws applied to robotic mechanisms – Force analysis on joints and end-effectors – Friction in robotic grippers and locomotion – Work, power and energy balance – Potential and kinetic energy in linkages – Impulse-momentum principle – Stability in mobile robots – Collision and impact dynamics – Basics of vibration in robotic arms.

UNIT III WAVES, LASERS AND FIBER OPTICS (12)

Oscillatory motion – Forced and damped oscillations – Plane progressive waves – Wave equation – Laser principles: population inversion, Einstein coefficients, optical amplification – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture, acceptance angle – Types of optical fibers – Losses in optical fibers – Fiber optic sensors: pressure and displacement.

UNIT IV THERMAL PHYSICS (12)

Transfer of heat energy – Thermal expansion of solids and liquids – Expansion joints – Bimetallic strips – Thermal conduction, convection and radiation – Heat conduction in solids – Thermal conductivity – Forbe's and Lee's disc method: theory and experiment – Conduction through compound media (series and parallel) – Thermal insulation – Applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT V MATERIAL SCIENCE FOR ROBOTICS (12)

Classification of engineering materials – Properties: strength, toughness, stiffness, hardness, wear resistance – Metals, polymers, ceramics, composites for robotic applications – Lightweight materials for mobile and aerial robots – Smart materials: shape memory alloys, piezoelectric and magneto strictive materials – Tribology in robotic joints – Surface coatings for wear reduction – Biocompatible and nanomaterials – Material selection for optimal robotic design.

TOTAL PERIODS: 60

TEXTBOOKS

1. Azar, Reza N. Theory of Applied Robotics: Kinematics, Dynamics, and Control. 3rd ed. Cham: Springer, 2021.
2. Beiser, Arthur. Concepts of Modern Physics. 8th ed. New York: McGraw-Hill, 2003.
3. Gaur, R.K., and S.L. Gupta. Engineering Physics. 8th ed. New Delhi: Dhanpat Rai Publications, 2017

REFERENCE BOOKS

1. Lynch, Kevin M., and Frank C. Park. Modern Robotics: Mechanics, Planning, and Control. Cambridge: Cambridge University Press, 2017.
2. Craig, John J. Introduction to Robotics: Mechanics and Control. 4th ed. Boston: Pearson, 2018.
3. Saleh, Bahaa E. A., and Malvin Carl Teich. Fundamentals of Photonics. 3rd ed. Hoboken, NJ: Wiley, 2019.
4. Nag, P.K. Engineering Thermodynamics. 6th ed. New Delhi: McGraw-Hill Education, 2017.
5. Callister, William D., Jr., and David G. Rethwisch. Materials Science and Engineering: An Introduction. 10th ed. Hoboken, NJ: Wiley, 2018.

Online Courses/NPTEL/SWAYAM:

https://archive.nptel.ac.in/courses/112/105/112105249/

https://youtu.be/jab5panFHTo

CO-PO -PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1					1		3	2
CO2	3	3	3	2	2					1		3	3
CO3	2	2	2	3	3					1		2	3
CO4	2	2	3	2	2					1		3	3
CO5	2	1	2	2	3					1		2	3

Assessment Methodology	**Assessment Tools**	**Marks**
Continuous Assessment Test	Written Test / Quiz/Assignment	25
MCQ unit wise 10 questions	Moodle / Google form	5
Virtual lab-based assignment	Demo and viva	5
Attendance	Attendance record	5
Total		**40**

25UMET13	FUNDAMENTALS OF MECHANICAL ENGINEERING	Category	L	T	P	Credit
		ESC	2	1	0	2

Course Prerequisite

- Engineering Physics / Materials Science
- Basic Thermodynamics
- Engineering Mechanics

Course Objective

- To provide students with foundational knowledge in mechanical engineering principles relevant to robotics, including robot structural design, material selection based on environmental conditions, mechanical components, manufacturing processes, and basic concepts of thermodynamics and fluid mechanics, thereby enabling them to understand and contribute effectively to the design and development of robotic systems.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Explain the laws of thermodynamics and the working principles of energy conversion devices and cycles	Understand (K2)
CO2	Identify the properties of fluids, types of fluid flow, and common hydraulic machines.	Remember (K1)
CO3	Determine principal stresses, shear force, bending moment, and stresses due to flexural and torsional loading	Apply (K3)
CO4	Analyze particle motion and apply energy, momentum, and impact principles to solve dynamics problems.	Apply (K3)
CO5	Select appropriate manufacturing processes and apply suitable machining, forming, and joining operations for given engineering applications.	Apply (K3)

YLLABUS

UNIT I INTRODUCTION TO THERMODYNAMICS & ENERGY CONVERSION DEVICES(12)

Work, Heat, Equilibrium, Enthalpy, Entropy, Internal Energy, Laws of thermodynamics, Heat cycles – Carnot, Otto and Diesel, Properties of Steam. Boilers, Steam and Gas Turbines, SI and CI Engines, Refrigeration and Air Conditioning.

UNIT II FLUID MECHANICS AND MACHINERY (12)

Fluid Properties and Fluid Statics, Types of Fluid Flow, Work and Energy of Moving

Fluids,Hydraulic Pumps, Hydraulic Turbines.

UNIT III MECHANICS OF MATERIAL(12)

Materials and Mechanical Properties, Stress and Strain Concepts, Stress-Strain Diagrams for Ductile and Hard Materials, Principal Stresses and Strains, Shear Force and Bending Moments, Flexural and Torsional Loading.

UNIT IV KINEMATICS AND KINETICS OF PARTICLES(12)

Equations of motion – Rectilinear motion, curve linear motion, relative motion, D'Alembert's principle, work-Energy equation – conservative forces and principle of conservation of energy, Impulse – momentum, Impact – Direct central impact and oblique central impact

UNIT V MANUFACTURING PROCESSES (12)

Types of Manufacturing Processes, Machining Operations, Turning, Drilling, Milling and Grinding, Forming and Forging Operations, Joining Processes, Soldering, Brazing and Welding.

TOTAL PERIODS: 60

TEXT BOOKS

1. D. S. Kumar., "Fundamentals of Mechanical Engineering and Mechatronics", S.K. Kataria & Sons, 2021.
2. R. K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 2019.Publishing Company, Chennai 2008.

REFERENCE BOOKS

1. Sadhu Singh, "Principles of Mechanical Engineering", S. Chand, 2010.
2. P. K. Nag, "Engineering Thermodynamics", McGraw Hill Education, 2017.
3. S. S. Rattan, "Theory of Machines", McGraw Hill Education, 2019.
4. S. S. Rattan, "Strength of Materials", McGraw Hill Education, 2017.

Online Courses/NPTEL/SWAYAM:

https://archive.nptel.ac.in/courses/112/105/112105123/
https://archive.nptel.ac.in/courses/112/105/112105206/
https://archive.nptel.ac.in/courses/112/105/112105268/
https://archive.nptel.ac.in/courses/112/107/112107219/

CO-PO -PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3								1	2	3
CO2	3	2					2				1	2	2
CO3	3	2	2			2	2				1	1	3
CO4	2											2	2
CO5	2						1					3	2

Assessment Methodology	Assessment Tools	Marks
Continuous Assessment Test	Written Test / Quiz/Assignment	25
Assignments / Quiz / Participation	Problem-solving assignment	5
Simulation / Practical Component	Demo and report	5
Attendance	Attendance record	5
Total		**40**

25URAT14	FUNDAMENTALS OF ELECTRONIC DEVICES	Category	L	T	P	Credit
		ESC	3	0	0	3

Course Prerequisite

Basic Electrical Engineering

Course Objective

- To understand semiconductor physics and device operation principles.
- To analyze characteristics of diodes, transistors, and FETs under various conditions.
- To develop circuit analysis skills using device models and equivalent circuits.
- To explore semiconductor device applications in circuits and systems.
- To introduce advanced semiconductor technologies and emerging device structures.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Explain PN-junction diode operation, characteristics, temperature effects, and breakdown mechanisms.	Understand(K2)
CO2	Understand principles and applications of specialized diodes, power devices, and optoelectronic devices.	Understand(K2)
CO3	Analyze BJT configurations, apply h-parameters, and evaluate switching characteristics.	Apply (K3)
CO4	Compare JFET and MOSFET operation, analyze characteristics, and apply small-signal models.	Analyze(K3)
CO5	Explore advanced semiconductor structures and specialized devices for modern applications.	Understand(K2)

SYLLABUS

UNIT I PN-JUNCTION DIODE (12)

Operation of PN-Junction Diode, Diode Equation, Volt-Ampere (V-I) Characteristics, Temperature Dependence of V-I Characteristics, Ideal Versus Practical Diode, Static and Dynamic Resistances, Breakdown Mechanisms in semiconductor Diodes, Diode Switching Characteristics, Zener Diode Characteristics.

UNIT II POWER AND DISPLAY DEVICES (12)

Principle and Operation of Tunnel Diode, Varactor Diode, Schottky Barrier Diode, DIAC, TRIAC, SCR, and Uni-Junction Transistor (UJT), Photodiode, LED.

UNIT III TRANSISTOR (12)

PNP-NPN Transistors Operation, BJT Symbol, Transistor as an Amplifier, Common Emitter, Common Base and Common Collector Configurations, and its H-Parameters, Thermal Runaway, Transistor as a switch, Transistor switching times, Limits of Operation, BJT Specifications.

UNIT IV FIELD EFFECT TRANSISTOR (12)

Junction Field Effect Transistor: Construction, Principle of Operation, Symbol - Pinch-Off Voltage – Volt-Ampere Characteristics, Small Signal Model of JFET & MOSFET, MOSFET Characteristics in Enhancement and Depletion Modes, Application of Transistor.

UNIT V SPECIAL SEMICONDUCTOR DEVICES (12)

Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, LASER diode, LDR, CCD.

TOTAL PERIODS: 60

TEXT BOOKS

1. Electronic Devices and Circuits - J. Millman, Christos C. Halkias, 1991 edition, 2008, TMH.
2. Electronic Devices and Circuits- R.L. Boylestad and Louis Nashelsky, 9th edition, 2006, PHI.
3. Electronic Devices and Circuits – David A. Bell, Fifth Edition, 2008, Oxford University press.

REFERENCE BOOKS

1. Integrated Electronic - J.Millman and C.C.Halkias, Satyabratajit, 2nd edition, 1998, TMH.
2. Electronic Devices and Circuits - K. Lal kishore, 2nd edition, 2005, BSP.
3. Introduction to Electronic Devices and Circuits – Rober T. Paynter, PE
4. Electronic Devices and Circuits – S. Salivahan, N.Suresh Kumar, A. Vallavaraj, 2nd Edition, 2008, TMH.

Online Courses/NPTEL/SWAYAM:

https://nptel.ac.in/courses/113106062

https://nptel.ac.in/courses/108108112

https://nptel.ac.in/courses/108108122

https://nptel.ac.in/courses/108107586

CO-PO -PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2								2	2
CO2	3	1	2	2								2	2
CO3	3	2	2	2								2	2
CO4	3	2	2	2								2	2
CO5	3	3	2	2								2	2

Assessment Methodology	Assessment Tools	Marks
Continuous Assessment Test	Written Test / Quiz/Assignment	25
Application based Hobby circuits	Presentations	5
Simulation (TCAD, PSPICE, LT SPICE) Project based assignment	Demo and viva	5
Attendance	Attendance record	5
Total		**40**

25UCSI16	PROGRAMMINGINC	Category	L	T	P	Credit
		ES	3	0	2	4

CoursePrerequisite

Basic programming skills.

CourseObjective

- To impart theknowledgeof basic programming constructs of C language,arraysand strings, functions,structures, pointers and input/outputfilehandling.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Demonstrate knowledgeon C Programming constructs and develop simple programinCusing basic constructs.	Understand(K2)
CO2	Apply arraysand string operations to solvebasic problems usingC	Apply(k3)
CO3	Develop modularprograms using functions, recursion, and pointers	Apply(k3)
CO4	Implement user-defineddata types using structures, unions, and managememory dynamically.	Apply(K3)
CO5	Implementfileoperations and manage memory dynamically using pointers and preprocessor directives.	Apply(K3)

SYLLABUS

UNITI INTRODUCTION TO PROGRAMMING PARADIGMS: (9)

Introduction to programming paradigms – Applications of C Language – Structure of C program – C programming: Data Types – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions – Input/Output statements, Assignment statements-Decision making statements –Switch statement– Loopingstatements– Preprocessor directives– Compilation process **.**

UNIT II DECISION MAKING, ARRAYS AND STRINGS (9)

Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays – String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS (9)

Modular programming– Function prototype, function definition, function call, Built-in functions (string

functions, math functions) –Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing:

UNIT IV STRUCTURES AND UNION (9)

Structure – Nested structures – Pointer and Structures – Array of structures – Self-referential structures – Dynamic memory allocation – Singly linked list – typedef – Union – Storage classes and Visibility.

UNIT V FILE MANAGEMENT AND DYNAMIC MEMORY ALLOCATION (9)

Files- Types of file processing, I/O Operations of File, Random access file, Command line arguments. Dynamic memory allocation- Linked list, types, Preprocessor directive, Macro substitution, Compiler

TOTAL PERIODS: 45

TEXTBOOKS:

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. E. Balagurusamy, “Programming in C”McGraw-Hill, 8th Edition, 2019.
3. Kernighan, B.WandRitchie,D.M, “TheC Programming language”, Second Edition, Pearson

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, 8thedition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, 2nd Edition, Oxford University Press, 2013.

Online Courses/NPTEL/SWAYAM:

https://www.coursera.org/learn/c -for-everyone

https://onlinecourses.swayam2.ac.in/cec24_cs05/preview

https://onlinecourses.npt el.ac.in/noc22_cs40/ preview

https://nptel.ac.in/courses/108107586

PRACTICE EXERCISES:

1. Study of Compilation and execution of simple C programs
2. Simple computational problems using arithmetic expressions (Arithmetic Operations, Area & circumference of a circle)
3. Problems involving if-then-else structures (ODD/EVEN numbers, Greatest Numbers)
4. Iterative problems e.g., sum of series (Factorial, Sum of Digits)
5. 1D and 2D, multi-dimensional arrays, traversal
6. Matrix problems, String operations (Addition, Subtraction, Multiplication, Palindrome StringOperations, String Handling Functions)
7. Simple functions (nCr Program, Swapping using call-by-reference)

CO-PO Mapping

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	1	2	–	–	–	2	–	1
CO2	3	2	3	2	2	–	–	–	1	–	1
CO3	3	2	3	3	2	–	–	–	2	–	1
CO4	3	2	3	3	3	–	–	–	2	–	1
CO5	3	2	3	2	3	–	–	–	2	–	1

Assessment Methodology	**Assessment Tools**	**Marks**
Theory Test		15
Coding assignments	Online submission	10
Mini project implementation	Code demo and documentation	10
Model Practical		10
Attendance	Attendance record	5
Total		50

25UHSI16	PROFESSIONAL COMMUNICATION FOR ENGINEERS	Category	L	T	P	Credit
		HS	1	0	4	3

Prerequisite:

Basics of English Language

Course Objective

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To build on students' English language skills by engaging them in listening, speaking andgrammar learning activities that are relevant to authentic contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs,definitions, essays and user manuals.
- To use language efficiently in expressing their opinions via various media.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Understand and demonstrate the use of foundational communication skills such as introductions, telephone etiquette, email writing, and interpreting technical messages in professional contexts.	Understand(K2)
CO2	Understand and narrate personal and reported events using appropriate structure and vocabulary. Interpret and summarize content from podcasts, biographies, blogs, and reports in spoken and written form.	Understand (K2)
CO3	Explain product and process descriptions through listening and reading. Effectively describe, instruct, and present products/processes in both spoken and written formats.	Understand (K2)
CO4	Interpret scientific talks, articles, and non-verbal data like charts and graphs. Summarize information and make clear recommendations through spoken and written communication.	Apply (K3)
CO5	Analyze multiple viewpoints in debates, discussions, and coherently through group discussions, role plays, and essay writing. Attend interview with assertiveness	Analyze(K4)

SYLLABUS

UNIT I INTRODUCTION TO COMMUNICATION (3)

EFFECTIVE COMMUNICATION:

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

FUNDAMENTALS OF COMMUNICATION:

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Who/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

LAB ACTIVITY: Extempore (Oral), Conversation on asking directions, Listening – Telephone conversation; Speaking Self-introduction; Telephone conversation – Video conferencing etiquette. (**12)**

UNIT II NARRATION AND SUMMATION (3)

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

LAB ACTIVITY: Listening – Travel podcast; Speaking – Narrating and sharing personal experiences through a podcast, Autobiography of a famous Personality**(12)**

UNIT III DESCRIPTION OF A PROCESS / PRODUCT (3)

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

LAB ACTIVITY: Listening – Railway / Airport Announcements, Travel Vlogs; Speaking – Describing a place or picture description**(12)**

UNIT-IV VISUALIZATION AND CLASSIFICATION (3)

Listening – TED talks Speaking – Interviewing a celebrity/Famous Personality Reading – Company profiles, Business Letters Vocabulary– Discourse Markers, Linking words and Phrases Collocation. Grammar – Pronouns, Conjunction, Preposition Writing – Interpretation of Charts and Graphs

LAB ACTIVITY: Picture Description, about purchasing a product, Summarizing a TED talk, Role play, Narrating an unforgettable event**(12)**

UNIT V EXPRESSION COMMUNICATION (3)

Listening – Watching Movies / Listening to Dialogues and Conversations Speaking – Role play, Panel Discussion, Debate Reading – Blogs, Novels, Short Stories Vocabulary – Phrasal Verbs Grammar– Simple/Compound/Complex Sentences, Error Spotting, Punctuation. Writing – Descriptive Essay, Dialogue Writing

LAB ACTIVITY: Listening /Reading Comprehension, Developing a story using given Vocabulary, Mini Presentation on General topic (ICT tools), Group Discussion**(12)**

Text Book

1. Technical Communication: Principles and Practice Meenakshi Raman & Sangeeta Sharma Oxford University Press 3rd Edition (or latest)

2. Communication SkillsSanjay Kumar & Pushp Lata, Oxford University Press 2nd Edition (2015)

3.Effective Technical Communication*:* M. Ashraf Rizvi, McGraw-Hill Education 2nd Edition (2017)

Reference Book & Web Resources

1.A Course Book on Technical English by Lakshmi Narayanan, Scitech Publications (India) Pvt. Ltd.

2. English For Technical Communication (With CD) By Aysha Viswamohan, McGrawHill Education, ISBN : 0070264244.

3. Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House.

4. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	1	-	-	2	-	-	-	-	**3**	2		1
CO2	1	2	-	-	2	-	-	2	-	**3**	2		1
CO3	1	2	-	-	-	-	-	1	-	**3**	2		1
CO4	1	3	-	-	3	-	1	2	-	**3**	2		1
CO5	1	2	-	-	2	-	1	3	-	**3**	2		1

Assessment Methodology	**Assessment Tools**	**Marks**
Test		15
Listening and reading Comprehension	Online tool	5
Speaking assessment (Oral)	review	10
Online assessment test	Online tool	10
Content creation Competition	Peer review	5
Attendance	Attendance record	5
Total		**50**

25UPHP14	PHYSICAL SCIENCE LAB	Category	L	T	P	Credit
		BS	0	0	2	1

Prerequisite

Basic knowledge of elasticity, heat conduction, light properties is essential.

Course Objective

- To provide an experimental foundation for the theoretical concepts introduced in the lectures
- To help students understand the role of direct observation in physics and to distinguish between inferences based on theory and the outcomes of experiments
- To introduce the concepts and techniques which have a wide application in experimental science

Course Outcome

On the successful completion of the course, students will be able to

CO1	Determine fundamental physical constants using classical and modern physics experiments.	Apply (K3)
CO2	Evaluate mechanical properties of materials through experimental methods.	Evaluate (K4)
CO3	Analyze thermal, optical, and fluid properties using standard laboratory techniques.	Analyze(K4)
CO4	Apply wave and laser-based methods for precise measurement of physical parameters.	Apply(K3)
CO5	Interpret and validate experimental results with theoretical concepts in physics.	Analyze(K4)

SYLLABUS

LIST OF EXPERIMENTS

1. Determination of Acceleration due to Gravity using a Simple Pendulum.
2. Determination of Moment of Inertia using a Torsional Pendulum
3. Determination of Young's modulus of given material by non-uniform bending method.
4. Determination of viscosity of the given liquid using Poiseuille' s method.
5. Determination of Thermal conductivity of a bad conductor –Lee's Disc method
6. Determination of the thickness of a given thin material– Air wedge method

7. Determination of the wavelength of Laser and particle size of given powder
8. Determination of the angle of divergence of a laser beam using semiconductor
9. Determination of band gap of a semiconductor diode.
10. Determination of radius of curvature of lens Newtons ring method.

Text Book

1. Arora, C. L. 2001. Practical Physics. New Delhi: S. Chand & Company Ltd.
2. Worsnop, B. L., and H. T. Flint. 1971. Advanced Practical Physics for Students. London: Methuen & Co. Ltd.

Reference Book & Web Resources

1. Prakash, Indu, and Ramakrishna. 2016. A Text Book of Practical Physics. New Delhi: Kitab Mahal.
2. Kumar, S. Suresh. 2013. Engineering Physics Practicals. New Delhi: Vikas Publishing House.
3. Gupta, S. L., and V. Kumar. 2010. Practical Physics. Meerut: Pragati Prakashan.
4. Ghatak, Ajoy. 2017. Optics. 6th ed. New Delhi: McGraw Hill Education.
5. Pillai, S. O. 2015. Solid State Physics. 8th ed. New Delhi: New Age International Publishers.

Web resources

1. https://vlab.co.in
2. https://ocw.mit.edu
3. https://nptel.ac.in/courses/115
4. http://hyperphysics.phy-astr.gsu.edu

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	0	3	0	1	1	1	1	0	2	1	0
CO2	2	2	2	0	0	0	1	1	1	0	2	1	0
CO3	2	2	2	2	0	0	1	1	1	0	2	1	0
CO4	2	1	1	1	0	0	1	1	1	0	1	0	0
CO5	2	2	1	1	1	0	1	1	1	0	1	0	0

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	5
STEM based model creation	Presentation	5
Attendance	Attendance record	10
Total		60

25UGEP19	ENGINEERING GRAPHICS and Auto CAD	Category	L	T	P	Credit
		ES	0	0	4	2

Course Prerequisite

Basic knowledge of geometry and fundamentals of computer operation.

Course Objective

This laboratory course provides hands-on training in engineering drawing techniques and the use of AutoCAD software. The objective is to equip students with the skills to produce accurate 2D

Course Outcome

On the successful completion of the course, students will be able to

CO1	Use drawing instruments and follow BIS standards in manual drawings.	Understand(K2)
CO2	Develop orthographic and isometric projections manually	Analyze(K4)
CO3	Create and modify 2D drawings using AutoCAD	Apply(K3)
CO4	Generate sectional and dimensioned views in AutoCAD.	Evaluate(K4)
CO5	Apply CAD tools to visualize and plot engineering components.	Apply(K3)

SYLLABUS

LIST OF PRACTICAL EXERCISES

1. Introduction to drawing instruments, BIS conventions, and lettering.
2. Geometrical constructions using instruments.
3. Orthographic projection of simple objects (manual drawing).
4. Isometric drawing of regular solids (manual drawing).
5. Sectional views of solids (manual drawing).
6. Introduction to AutoCAD: Interface, basic settings, and units.
7. Drawing tools in AutoCAD: Line, Circle, Arc, Rectangle, Polygon.
8. Modify tools in AutoCAD: Move, Copy, Mirror, Rotate, Trim, Extend.
9. Using Layers, Text, and Dimensioning in AutoCAD.
10. Creating orthographic projections in AutoCAD.
11. Creating isometric views in AutoCAD.
12. Creating sectional views and hatching in AutoCAD.
13. Plotting and printing drawings in AutoCAD.

Mini-project: Preparing a combined sheet of manual and CAD drawings

Text Book

1. Bhatt, N. D. 2014. Engineering Drawing, Charotar Publishing House.
2. Jolhe, Dhananjay A. 2017.Engineering Drawing with AutoCAD. New Delhi: Tata McGraw-Hill.

Reference Book & Web Resources

1. Gill, P. S., and J. S. Dhillon. 2015. Engineering Drawing. Ludhiana: Katson Books.
2. Venugopal, K., and V. Prabhu Raja. 2011. Engineering Graphics. New Delhi: New Age International Publishers.
3. Luzadder, Warren J., and Jon M. Duff. 1993. Fundamentals of Engineering Drawing. Upper Saddle River, NJ: Prentice Hall.
4. AutoDesk. 2025. "Official Tutorials." https://www.autodesk.com/learning.
5. French, Thomas E., Charles J. Vierck, and Robert J. Foster. 2004. Engineering Drawing and Graphic Technology. New York: McGraw-Hill.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3		-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	3	-	3	-	-	-	-	-	-	1	-
CO4	-	-	2	-	2	-	-	-	-	-	-	1	-
CO5	-	-	-	-	2	-	-	-	-	-	-	1	-

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Real Model Drawing	Review	5
CAD Simulation Test		5
Attendance	Attendance record	10
Total		60

25UGEP18	DESIGN THINKING AND IDEA LAB	Category	L	T	P	Credit
		ES	0	0	2	1

Course Prerequisite

Basic Knowledge of Science and interest in creative problem solving

Course Objective

- To introduce students to the principles, methodologies, and frameworks of design thinking for solving real-world problems.
- To cultivate user-centric, empathetic, and creative thinking through experiential learning and hands-on activities.
- To enable students to prototype, test, and present innovative solutions using collaborative tools and idea lab resources.

SYLLABUS

Course Outcome

On the successful completion of the course, students will be able to

CO1	Explain the fundamental concepts and stages of Design Thinking and their relevance to problem solving.	Understand (K2)
CO2	Describe different learning styles, memory processes, and the role of empathy in user-centric design	Understand K2
CO3	Apply engineering tools such as schematic design, PCB layout, 3D printing, and laser cutting to create prototypes.	Apply (K3)
CO4	Analyze real-world user challenges and evaluate creative problem-solving approaches to develop innovative product designs.	Analyze(K4)
CO5	Interpret feedback from prototype testing and iteratively improve the design to better align with user needs.	Analyze(K4)

UNIT I: Learning, Emotions, and Foundations of Design Thinking (3)

Understanding the learning process, Kolb's learning styles, Assessing and interpreting learning types, Understanding the memory process, Memory retention issues, Memory enhancement techniques, Understanding emotions – experience and expression, Assessing and applying empathy, Definition and need for Design Thinking.

Writing Skills: Emails/letters introducing oneself-Tone, structure, grammar

UNIT II: Ideation, Product Design, and Prototyping (3)

Objectives of Design Thinking, Stages of Design Thinking with examples (Empathize, Define, Ideate, Prototype, Test), Understanding creative thinking, Understanding problem-solving, Testing creative problem-solving, Engineering product design process, Examples of innovative product designs, Introduction to prototyping and its purpose, Rapid prototyping and testing methods.

UNIT III: Customer-Centric Innovation and Iterative Design (3)

Understanding individual uniqueness, Team activities for diversity appreciation, Real-life customer challenge examples, Applying Design Thinking to improve customer experience, Parameters of customer-centric product experience, Aligning product design with user expectations, Feedback loop and user testing, User-focused design and ergonomic considerations, Final product pitch and presentation.

UNIT IV:List of Lab Activities and Experiments (Phase-1) (3)

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as softwood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.

UNIT V:List of Lab Activities and Experiments (Phase-2) (3)

1. Familiarity and use of welding equipment.
2. Familiarity and use of normal and wood lathe.
3. Embedded programming using Arduino and/or Raspberry Pi.
4. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
5. Discussion and implementation of a mini project.
6. Documentation of the mini project (Report and video).
7.

Text Book

1. Tim Brown,Change by Design: How Design Thinking Creates New Alternatives for Business and Society**,** Harper Business, 2009.
2. Karl T. Ulrich and Steven D. Eppinger,Product Design and Development, McGraw-Hill Education, 2015.

Reference Book

1. Peter G. Rowe, Design Thinking: Understanding How Designers Think and Work**,** MIT Press, 1991.
2. Don Norman, The Design of Everyday Things, Basic Books, 2013.
3. Tom Kelley and David Kelley, Creative Confidence: Unleashing the Creative Potential Within Us All, Crown Business, 2013.
4. Todd Zaki Warfel, Prototyping: A Practitioner's Guide, Rosenfeld Media, 2009.
5. Clive L. Dym, Patrick Little, Elizabeth J. Orwin, Engineering Design: A Project-Based Introduction**,** Wiley, 2011.

Web Resources

https://onlinecourses.nptel.ac.in/noc23_mg72

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	1	2	1	1	-	2	1	-
CO2	2	2	1	1	3			1	1	-	1	1	-
CO3	3	2	3	2	1	1	1	1	2	-	2	1	-
CO4	3	3	3	3	3	1	1	1	2	-	2	1	-
CO5	3	3	3	-	-	1	2	1	1	-	2	1	-

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model /Prototype Evaluation	Rubric-based evaluation	15
Viva / Presentation		5
Virtual Lab / Online Assignment	Review	5
STEM-Based Model Creation		5
Attendance	Attendance record	10
Total		60

25UPCE11	CAREER DEVELOPMENT SKILLS	Category	L	T	P	Credit
		EEC	0	0	2	1

Preamble/ Course Objective

To empower students with the skills for self-discovery, goal achievement, effective time management, and personal effectiveness, alongside foundational knowledge in career planning, emotional intelligence, higher education, competitive exams, and entrepreneurship

Prerequisite: Basic communication skills and foundational knowledge of workplace behavior

Course Outcome

On the successful completion of the course, the students will be able to

CO1	Help students assess themselves, explore career options, and set actionable goals through structured planning.
CO2	Develop motivation, enhance personality effectiveness, and instill discipline for personal and professional growth.
CO3	Build awareness and practice of grooming, hygiene, positive attitudes, manners, and professional behaviour.
CO4	Strengthen self-awareness, time and stress management, and emotional intelligence for balanced personal development.
CO5	Introduce students to higher education paths, competitive exams, and the fundamentals of entrepreneurship and business planning

SYLLABUS

UNIT I **(10)**

Career Planning: Introduction to Career Planning - Self-Assessment for Career Planning - Exploring Career Options- Developing a Career Plan;

Goal Settings: Understanding Goal Setting - Setting Effective Goals - Action Plan Development - Practical Exercises

UNIT II **(10)**

Motivation – I: Definition and Importance of Motivation - Types of Motivation - Theories of

Motivation - Factors Affecting Motivation

Personality Effectiveness: Components of Personality Effectiveness - Communication Skills - /Interpersonal Skills - Practical Exercises

Building Personality and Discipline: Introduction to Personality Development - Building Positive Habits - Discipline and Self-Control - Practical Application

UNIT III **(10)**

Grooming, hygiene and Cleanliness: Personal Hygiene Practices - Body Grooming Techniques - Environmental Cleanliness - Mental and Social Impact of Grooming and Hygiene.

Attitudes, Manners and Behaviour: Understanding Attitudes - Developing Positive Attitudes - Manners and Etiquette - Procedures and Protocols

UNIT IV **(10)**

Self- Awareness & Self Confidence: Introduction to Self-Awareness- Understanding Strengths and Weaknesses- Building Self-Confidence- Practical Application

Time Management: Introduction to Time Management - Planning and Prioritizing Tasks-Overcoming Procrastination- Practical Time Management

Stress Management: Understanding Stress- Stress Management Techniques-Coping Strategies- Practical Application

Emotional Intelligence: Introduction to Emotional Intelligence- Managing Emotions- Social Awareness and Relationship Management-Practical Exercises

UNIT 5 **(8)**

Introduction to Higher Education, Competitive exams: Overview of Higher Education- Competitive Exams Overview - Exam Preparation Techniques

Introduction to Entrepreneurship: Understanding Entrepreneurship- Developing a Business Idea - Business Planning

Text Book

1. Soft skills for Managers by Dr. T. KALYANA CHAKRAVATHI

2.Personal Development and Soft Skills by BARUN K MITRA, Oxford Higher Education

Reference Book

1. The Emotionally Intelligent Workplace by DANIEL GOLEMAN.
2. Communication skills and soft skills an integrated approach by E. SURESH KUMAR, P. SREEHARI, J SAVITHRI.
3. Top Talking in English (international communication skills) by CHARLES T. RAJENDRA
4. Soft skills by RAJ LAKSHMI SURYAVANSHI, Gurucool Publishing

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1								**2**	**2**	**2**	**2**
CO2					**2**			**2**			**2**
CO3							**2**	**2**			**2**
CO4								**2**	**2**		**2**
CO5						**2**	**2**				**2**

Assessment Methodology	**Assessment Tools**	**Marks**
Resume & Cover Letter	Instructor Evaluation	10
Interview Simulation	Mock Interview	10
Grooming &Behaviour Demo	Role Play Assessment	10
Emotional & Time Management	Stress Management Activity	10
Career Portfolio & Reflection		10
Presentation Skills		5
Attendance	Attendance record	5
Total		60

25UMCC1	ENVIRONMENTAL SCIENCE & SUSTAINABILITY	Category	L	T	P	Credit
		MCC	0	0	2	0

Course Prerequisite

Basic knowledge of chemistry, biology, and physics

Course Objective

This course provides comprehensive understanding of environmental science principles and sustainability concepts essential for engineering professionals. The objectives are to:

- Understand fundamental concepts of environmental science and ecology
- Analyze environmental problems and their engineering solutions
- Develop awareness about sustainable development and green technologies
- Explore renewable energy systems and waste management strategies
- Foster environmental consciousness and responsible engineering practices

CourseOutcome

CO1	Understand fundamental principles of environmental science and	Understand (K2)
CO2	Analyze various types of pollution and their impact on human health and environment	Analyze(K4)
CO3	Apply principles of sustainable development in engineering design and decision-making	Apply(K3)
CO4	Evaluate renewable energy technologies and waste management	Evaluate(K4)
CO5	Design environmentally sustainable solutions for engineering problems	Design(K4)

SYLLABUS

UNIT I: Introduction to Environmental Science and Ecology (6 Hours) - Definition, scope and importance of environmental science - Structure and function of ecosystems - Biogeochemical cycles: Carbon, nitrogen, phosphorus, sulfur cycles - Biodiversity and its conservation - Environmental impact assessment principles

UNIT II: Environmental Pollution and Control (6 Hours) - Air pollution: Sources, effects, and control measures - Water pollution: Industrial and domestic sources, treatment methods - Soil pollution: Causes, effects, and remediation techniques - Noise pollution: Sources, effects, and control - Solid waste management: 3R principles, waste-to-energy

UNIT III: Sustainable Development and Green Technologies (6 Hours) - Concept of sustainable development and SDGs - Life cycle assessment (LCA) principles - Green building concepts and LEED certification - Cleaner production and industrial ecology - Environmental management systems (ISO 14001)

UNIT IV: Renewable Energy and Climate Change (6 Hours) - Solar energy systems: Photovoltaic and thermal applications - Wind energy: Technology and site assessment - Hydroelectric and geothermal energy systems - Climate change: Causes, effects, and mitigation strategies - Carbon footprint and carbon trading mechanisms.

UNIT V: Environmental Regulations and Case Studies (6 Hours) - Environmental laws and regulations in India - Environmental clearance procedures - Corporate environmental responsibility - Case studies of environmental disasters and lessons learned - Future trends in environmental technology

Text Book

1. G. Tyler Miller Jr., "Environmental Science: Working with the Earth", Cengage Learning, 2019
2. C. Anil Kumar, "Environmental Science and Engineering", PHI Learning, 2018
3. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2017

Reference Book & Web Resources

1. Richard T. Wright, "Environmental Science: Toward a Sustainable Future", Pearson, 2017
2. Daniel B. Botkin, "Environmental Science: Earth as a Living Planet", Wiley, 2018
3. Central Pollution Control Board - www.cpcb.nic.in
4. Ministry of Environment and Forests - www.moef.gov.in
5. UN Environment Programme - www.unep.org
6. NPTEL Environmental Science Courses - nptel.ac.in

CO-PO Mapping

COPOMapping											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	1	-	-	1	-	2	1	2	1	3
CO2	3	2	2	1	2	-	1	1	2	2	3
CO3	3	3	2	2	2	1	2	2	2	2	2
CO4	2	2	2	2	3	2	3	2	3	3	3

Assessment Methodology	Assessment Tools	Marks
Conceptual Understanding	Written test / quiz on ecology & resources	10
Pollution & Control	Case study, poster / infographic	10
Sustainability Practices	Field survey, SDG mapping report	10
Climate & Energy	Debate, carbon-footprint calculation, infographic	10
Environmental Law & Ethics	Short report, viva / MCQ	10
Presentation Skills	Rubric-based seminar / report evaluation	5
Attendance	Attendance record	5
Total		60

25UMCC12	IKS CONCEPTSANDAPPLICATIONS IN ENGINEERING ANDSCIENCE	Category	L	T	P	Credit
		MCC	0	0	2	0

CoursePrerequisite

- Basic understanding of scienceand engineering fundamentals

CourseObjective

- Familiarizestudents with traditional Indianknowledgesystems and their scientific foundations
- Explorethe integration of ancient wisdom with modern engineering practices
- Understand sustainabletechnologies and innovations rooted in Indian traditions
- Develop appreciation forindigenousknowledgein solving contemporary challenges
- Fosterresearch mindset towards validating and modernizing traditional practices

CourseOutcome

CO1	UnderstandthehistoricaldevelopmentandscientificbasisofIndian KnowledgeSystems	Understand
CO2	Analyzetraditional Indian practices in mathematics, astronomy, metallurgy, andmedicine	Analyze
CO3	ApplyIKSprinciplestocontemporaryengineering and scientific problems	Apply
CO4	EvaluatethesustainabilityaspectsoftraditionalIndiantechnologies	Evaluate
CO5	Createinnovativesolutionsbyintegrating traditionalknowledge with modern science	Create

SYLLABUS

UNITI INTRODUCTIONTO INDIAN KNOWLEDGE SYSTEMS(6)

Historical overviewofIndian Knowledge Systems-Scientific methodology in ancient India – Majortextsand scholars:Vedas,Upanishads,Charaka Samhita, Sushruta Samhita-Transmissionand preservationof knowledge- Contemporary relevanceandglobal recognition.

UNITII: MATHEMATICS AND ASTRONOMY INANCIENT INDIA(6)

Indiancontributionstomathematics:Zero,decimal system,trigonometry- Aryabhata, Brahmagupta, Bhaskara’s contributions- Astronomicalobservationsand calendarsystems- Navigationtechniques andgeographicalknowledge- Applicationsinmodern engineering calculations

UNITIII: METALLURGY, MATERIALS, AND ARCHITECTURE(6)

AncientIndian metallurgy: Iron pillarof Delhi, Wootz steel-Traditional building materials and techniques -Architectural marvels: Structuralengineering principles-Waterharvesting and management systems-Sustainable construction practices.

UNITIV:RENEWABLE ENERGY ANDCLIMATE CHANGE(6)

Ayurveda: Principlesandscientific validation-Traditionalagriculturalpracticesandcrop management–Biodiversityconservationmethods- Foodpreservationtechniques- Biotechnology applications in traditional practices.

UNIT V:INTEGRATION WITH MODERN SCIENCE AND TECHNOLOGY(6)

Validating traditional knowledge through modern scientific methods - Case studies of successfulIKS-modernscienceintegration-Intellectualpropertyandtraditionalknowledge protection - Research opportunities and career prospects- Futuredirections andchallenges

TEXTBOOKS:

1. Subhash Kak, "The Natureof Physical Reality", Mount Meru Publishing,2016
2. B.V. Subbarayappa,"Indian Astronomy: A SourceBook", Nehru Centre, 2008
3.KapilaVatsyayan, "TraditionalIndianArtand Culture",CambridgeUniversityPress,2015

REFERENCE BOOKS&WEB RESOURCES

1. P. Divakaran,"TheMathematicsofIndia:Concepts,Methods,Connections",Springer, 2018
2. S.N. Sen, "Ancient Indian History and Civilization", NewAgeInternational, 2010
3. National Mission for Manuscripts-www.namami.gov.in
4. Digital Library ofTraditional Ecological Knowledge-www.frlht.org
5. CSIRTraditionalKnowledgeDigital Library-www.tkdl.res.in

CO-PO Mapping

CO-POMapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	1	-	2	1	2	1	3
CO2	3	2	2	1	2	-	1	1	2	2	3
CO3	3	3	2	2	2	1	2	2	2	2	2
CO4	2	2	2	2	3	2	3	2	3	3	3
CO5	3	3	3	3	3	2	2	2	3	3	2

Assessment Methodology	Assessment Tools	Marks
Continuous Assessment	Quizzes, short assignments, concept mapping, reflectionjournals on ancient texts and scholars	15
Case Study / Report Writing	Analytical report on IKS integration in modern science, IP protection, or sustainable practices	10
Presentation / Seminar	Oral presentation on topics like ancient metallurgy, astronomy, or Ayurveda applications	10
Project / Model Demonstration	Mini-project or model based on traditional engineering or agricultural techniques	10
Group Discussion / Role Play	Role play on ancient knowledge transmission, group discussion on contemporary relevance	10
Attendance	Attendance record	05
Total		60

SEMETER II

25UMAT21	DIFFERENTIAL EQUATIONS AND TRANSFORMS	Category	L	T	P	Credit
		BS	3	1	0	4

Course Prerequisite: Matrices and Calculus

Course Objective

- To introduce mathematical tools to solve first order differentiation equations.
- To gain knowledge of problem-solving techniques of PDE.
- To understand concept of the Laplace transform.
- To inculcate the computation knowledge in Laplace transforms.
- To acquaint with Fourier Transform techniques used in a wide variety of situations involving functions that are not necessarily periodic.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Solve higher order differential equations	Apply(K3)
CO2	Formulate and solve various types of partial differential equations	Apply(K3)
CO3	Apply Laplace transforms and initial and final value theorems to solve engineering problems involving step, impulse and periodic functions.	Apply(K3)
CO4	Apply Laplace transforms to solve ordinary differential equations with constant coefficients and simultaneous ordinary differential equations	Apply(K3)
CO5	Apply Fourier transform techniques, including Fourier integral theorem, properties of Fourier transforms, convolution, and Parseval's identity	Apply(K3)

SYLLABUS

UNIT I ORDINARY DIFFERENTIAL EQUATIONS (12)

Differential Equations (Higher order): Linear differential equations of higher order – withconstant coefficients, the operator D, Euler's linear equation of higher order with variablecoefficients - simultaneous linear differential equations, solution by variation of parameters method.

UNIT II PARTIAL DIFFERENTIAL EQUATIONS (12)

Formation of partial differential equations- Solutions of standard types of first order partial

differential equations- Lagrange's linear equation- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT III LAPLACE TRANSFORM (12)

Existence conditions-Transforms of elementary functions- Properties, Transform of unit step function and unit impulse function -Transforms of derivatives and integrals- Transforms of Periodic Functions- Initial and final value theorems.

UNIT IV INVERSE LAPLACE TRANSFORM (12)

Inverse Laplace Transforms – Properties, Convolution theorem, Application - Solution of ordinary differential equations with constant coefficients -Solution of simultaneous ordinary differential equations.

UNIT V FOURIER TRANSFORM (12)

Fourier Integral theorem (statement only), Fourier transform and its inverse – Properties, Fourier sine and cosine transform - Properties, Convolution and Parseval's identity.

TOTAL PERIODS: 60

Text Book

1. Veerarajan T., "Engineering Mathematics – I and II",Tata McGraw-Hill, New Delhi, 2014 and 2015.
2. Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The National Publishing Company, Chennai 2008.

Reference Book & Web Resources

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.
3. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.

Online Courses/NPTEL/SWAYAM:

1. https://nptel.ac.in/courses/111106139
2. https://nptel.ac.in/courses/111101153
3. https://nptel.ac.in/courses/111107119

CO-PO -PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2					1		1		
CO2	3	2	2	2					1		1		
CO3	3	2	2	2					1		1		
CO4	3	2	2	2					1		1		
CO5	3	2	2	2					1		1		

Assessment Methodology	Assessment Tools	Marks
Continuous Assessment		25
Mathematical modeling assignment	Analytical solution presentation	5
Transform applications project (MATLAB/Python)	Demo and viva	5
Attendance	Attendance register	5
Total		**40**

5UHST22	UNIVERSAL HUMAN VALUES-II	Category	L	T	P	Credit
		HS	0	0	2	2

Course Prerequisite: UNIVERSAL HUMAN VALUES-I

Course Objective

- To enable students to grasp the relevance of value-based living for personal and societal well-being.
- To help students identify the components of human existence and differentiate their individual needs.
- To promote an understanding of key human values that foster harmonious relationships.
- To develop an awareness of the symbiotic relationship between humans and nature.
- To encourage ethical and humanistic behaviour, particularly in professional and social contexts.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Understand the importance of value education in achieving happiness, prosperity, and holistic human development.	Understand(K2)
CO2	Distinguish between the needs of the self and the body to ensure inner harmony and well-being.	Understand(K2)
CO3	Illustrate trust, respect and justice in the family and society build harmony in human relationships.	Understand(K2)
CO4	Recognize the interconnectedness and mutual fulfilment among all orders of nature to live in harmony with existence.	Remember (K1)
CO5	Describe the importance of ethical conduct based on natural acceptance of human values.	Understand(K2)

SYLLABUS

UNIT I INTRODUCTION TO VALUE EDUCATION: (9)

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education); Understanding Value Education; Self-exploration as the Process for Value Education; Continuous Happiness and Prosperity – the Basic Human Aspirations; Happiness and Prosperity – Current Scenario; Method to Fulfill the Basic Human Aspirations: Exploring Natural Acceptance

UNIT II HARMONY IN THE HUMAN BEING (9)

Understanding Human Being as the Co-existence of the Self and the Body; Distinguishing between the Needs of the Self and the Body; Exploring the Difference of Needs of Self and Body; The Body as an Instrument of the Self; Understanding Harmony in the Self; Harmony of the Self with the Body; Programme to Ensure Self-regulation and Health; Exploring Harmony of Self with the Body.

UNIT III HARMONY IN THE FAMILY AND SOCIETY (9)

Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' – as the Right Evaluation; Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society; Vision for the Universal Human Order.

UNIT IV HARMONY IN THE NATURE/EXISTENCE: (9)

Understanding Harmony in the Nature; Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature: Exploring the Four Orders of Nature; Realizing Existence as Co-existence at All Levels; The Holistic Perception of Harmony in Existence: Exploring Co-existence in Existence.

TEXT BOOKS

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethic", Excel Books, 2nd Revised Edition, New Delhi, 2019.

2. RR Gaur, R Asthana, G P Bagaria, "Teachers" Manual for A Foundation Course in Human Values and Professional Ethics", Excel Books, 2nd Revised Edition New Delhi, 2019.

REFERENCE BOOKS:

1. Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak," Jeevan Vidya" 1999.

2. A.N. Tripathi, "Human Values" New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth".

Web Resources:

1.https://nptel.ac.in/courses/109/104/109104115/

2. https://www.ugc.ac.in/pdfnews/8504234_Value-Education.pdf

3. https://www.aicte-india.org/sites/default/files/UHV%20Model%20Curriculum.pdf

4. http://www.rguktn.ac.in/value-education

Mapping with Programme Outcomes													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1						3		3					
CO2						3	3	3			3		
CO3						3		3	3				
CO4						3	3	3		3			
CO5											3		

Assessment Methodology	**Assessment Tools**	**Marks**
Continuous Assessment		25
Case study analysis	Group discussion and report	5
Value-based project proposal	Presentation and peer evaluation	5
Attendance	Attendance register	5
Total		**40**

25URAT23	ELECTRICAL CIRCUITS AND MACHINES	Category	L	T	P	Credit
		ESC	3	1	0	3

Course Prerequisite

Basic knowledge of Physics (electricity and magnetism), elementary Mathematics (algebra and calculus), and fundamental concepts of electrical quantities (voltage, current, resistance, power*).*

Course Objective

To provide foundational knowledge of electrical circuits and machines by introducing basic laws, analysis techniques, network theorems, transient behaviour, and the principles of operation, characteristics, and applications of transformers, DC machines, and AC machines in engineering and automation.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Apply fundamental laws, conversion techniques, analysis methods, network theorems, and transient response analysis to DC electrical circuits.	Apply (K3)
CO2	Analyze AC circuits using mesh and nodal analysis; evaluate resonance, transient response and three-phase systems.	Apply (K3)
CO3	Understand the concepts of magnetic circuits and transformer operation, and apply basic methods to analyze transformer performance and applications.	Understand(K2)
CO4	Understandthe construction, operation, types, characteristics, and control of DC machines, and their applications in robotics.	Understand(K2)
CO5	Understandthe construction, operation, types, and control of AC machines, with applications in robotics.	Understand(K2)

SYLLABUS

UNIT I DC CIRCUITS (12)

Ohm's Law-Kirchhoff's Laws: KCL and KVL -Star-Delta (Y-Δ) and Delta-Star (Δ-Y) Conversion-Mesh Analysis and Nodal Analysis for DC circuits - Network Theorems: SuperpositionTheorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem -Transient Response of RL,RCand RLC Series Circuit with DC Excitation.

UNIT II AC CIRCUITS (12)

Fundamental of AC circuits -Active, reactive, and apparent power - Power Factor -Mesh and Nodal Analysis of AC Circuits -Series and Parallel Resonance in RLC Circuits - Transient Response of RL, RC and RLC Series Circuit with Sinusoidal & Exponential Excitation -Three-Phase Circuits: Balancedandunbalancedsystems, Star (Y) and Delta (Δ) Connections, Star-delta transformation– Three Phase Power Measurement using Two Wattmeter method.

UNIT III MAGNETIC CIRCUITS AND TRANSFORMERS (12)

Magnetic Circuits: Concept of MMF, flux and magnetic reluctance, Self and mutual inductances, Dot convention, coefficient of coupling and coupled circuits. Single-phase transformer: Construction, working principle, EMF equation, ideal transformer, no-load and load operation-Equivalent circuit and phasor diagram-Voltage regulation, losses, and efficiency of transformer.

UNIT IV DC MACHINES (12)

Construction of DC Machines - Working Principle of DC Generator: EMF Equation - Working Principle of DC Motor: Torque Equation, Back EMF - Types of DC Machines -Performance Characteristics of DC Motors - Starting of DC Motors:3-point Starter ,4-point Starter-Applications of DC motors in robotics and automation.

UNIT V AC MACHINES (12)

Three-Phase Induction Motors **:**Construction and operating principle -Types: Squirrel cage and slip ring - Torque-speed characteristics -Starting and speed control methods-Single-Phase Induction Motors :Construction and principle of operation – Types of single-phase Induction motor.

TOTAL PERIODS: 60

TEXT BOOKS

1. Kothari, D. P., and I. J. Nagrath. Basic Electrical Engineering. Vol. 2. Tata McGraw-Hill Education, New Delhi, 2010.

2.Wildi, Theodore. Electrical machines, drives, and power systems. Pearson Educactión, 2006

REFERENCE BOOKS

1. William, H. A. R. T., Jack E. Kemmerly, and Steven M. Durbin. Engineering circuit analysis. McGraw-Hill Higher Education, 2007.
2. Charles K. Alexander and Matthew N.O. Sadiku**,***Fundamentals of Electric Circuits*, McGraw-Hill Education.
3. Bimbhra, P. S., and G. C. Garg. Electrical machines-I. Khanna Publishing House, 2014.
4. J Chapman, Stephen. "Electric Machinery Fundamentals." (2004).
5. D.C. Kulshreshtha**,***Basic Electrical Engineering*, McGraw-Hill Education.

Online Courses/NPTEL/SWAYAM:

https://onlinecourses.nptel.ac.in/noc23_ee81

https://onlinecourses.nptel.ac.in/noc21_ee24

CO-PO -PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	-	2	-
CO2	3	3	2	2	2	-	-	-	-	-	-	2	1
CO3	3	3	2	2	2	-	-	-	-	-	-	3	2
CO4	3	3	2	2	2	-	-	-	-	-	-	3	3
CO5	3	3	2	2	2	-	-	-	-	-	-	3	3

Assessment Methodology	**Assessment Tools**	**Marks**
Continuous Assessment		25
Assignments / Quiz / Participation	Problem-solving assignment	5
Simulation analysis (MATLAB/Multisim)	Demo and report	5
Attendance	Attendance register	5
Total		**40**

25URAT24	SENSORS AND ACTUATORS	Category	L	T	P	Credit
		PCC	3		0	3

Course Prerequisite

- Basic knowledge of Physics and Electronics at the higher secondary level.
  Familiarity with basic electrical measurements and circuit theory.
- Understanding of fundamental mechanical engineering concepts such as force, motion, and torque.

Course Objective

- Introduce measurement systems and transducer characteristics.
- Develop knowledge of displacement, pressure, and temperature sensors.
- Familiarize with advanced sensors and robotic applications.
- Explain construction, working, and selection of motors and actuators for robotics.
- Equip with skills for integrating sensors and actuators into robotic systems.

Course Outcome

On the successful completion of the course, students will be able to

CO1	Explain the elements of measurement systems and classify transducers based on their characteristics.	Understand (K2)
CO2	Analyze the working principles and performance parameters of displacement, pressure, and temperature sensors.	Analyze(K4)
CO3	Evaluate advanced sensors and apply sensor fusion techniques in robotic applications.	Apply (K3)
CO4	Compare different types of electric motors and actuators and select appropriate ones for specific robotic systems.	Understand (K2)
CO5	Perform actuator sizing calculations and integrate sensors and actuators into robotic systems through case studies.	Apply (K3)

SYLLABUS

UNIT 1 : Science of Measurement & Basic Transducers (9)

Measurement System & Instrumentation:Elements of a measurement system, functional block diagram, Classification of measuring instruments. Transducers: Classification & Characteristics-

Classification: active/passive, analog/digital, contact/non-contact., Static characteristics: accuracy, precision, sensitivity, resolution, linearity, hysteresis. Dynamic characteristics: speed of response, time constant, fidelity. Errors & Calibration- Types of errors: systematic, random, gross; methods to minimize. Statistical analysis: mean, standard deviation, uncertainty. Calibration methods: primary and secondary standards.

UNIT II: DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS (9)

Displacement Measurement- Strain Gauge: gauge factor, sensing elements, configuration, unbonded strain gauge. Capacitive transducer: various arrangements. Inductive transducer, LVDT: principle, characteristics, applications. Pressure Measurement -Bourdon tube, diaphragm, piezoresistive pressure sensors (intro). Temperature Measurement -RTD: materials & range, resistance vs. temperature characteristics. Thermistor: characteristics, applications. Thermocouple: types, characteristics, laws of thermoelectricity

UNIT III ADVANCED SENSORS AND ROBOTIC APPLICATIONS (9)

Vision Sensors: RGB cameras, Stereo vision, Time-of-Flight (ToF) cameras, Structured light sensors, LiDAR (Light Detection and Ranging): principles, types (2D, 3D), and robotic applications, Basics of image processing for robotic vision systems. Tactile and Force Sensors: Pressure sensors, Torque sensors, Piezoelectric sensors, Force-torque sensors for robotic manipulators and grippers. Environmental Sensors: Temperature sensors, Humidity sensors, Gas sensors. Navigation Sensors:Compass (Magnetometer), GPS, RFID,Inertial Measurement Units (IMU), Wheel encoders. Sensor Fusion Techniques: Basic concepts of sensor fusion, KalmanFilter: brief introduction and role in sensor fusion.

UNIT IV: Electric Motors for Robotics (9)

DC Motors: Brushed DC: construction, torque-speed characteristics, applications.

Brushless DC (BLDC): electronic commutation, hall sensors, advantages.

AC Motors : Permanent Magnet Synchronous Motors (PMSM): principle, advantages.

Servo Motors: DC servo and AC servo, working, feedback, closed-loop control. Stepper Motors : Permanent magnet, variable reluctance, hybrid; step angle, micro stepping.

UNIT V:Linear and Special Actuators with Integration(9)

Linear Actuators: Electric linear actuators: screw-driven, belt-driven; selection factors. Piezoelectric Actuators:Principle, micro-motion applications. Motor Drivers & Feedback Devices:H-bridge, ESC, servo drivers; encoders, resolvers. Actuator Selection &Integration: Sizing calculations (torque, speed, safety factors). Coupling with gearboxes, thermal considerations. Applications & Case Studies: Actuator choice in manipulators, mobile robots, autonomous systems.

TOTAL PERIODS:45

TEXT BOOK

1. McGraw-Hill Education, 5th Edition.” Measurement Systems: Application and Design”
2. Renganathan, S.“TransducersEngineering”Allied Publishers.
3. Lentin Joseph“Learning Robotics using Python”Packt Publishing.
4. D. Patranabis“Sensors and Transducers”PHI Learning Pvt. Ltd., 2nd Edition.
5. Bolton, W.“Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”Pearson Education, 7th Edition.

REFERENCE BOOK

1. R. K. Rajput“Instrumentation and Control Systems”S. Chand Publishing.
2. John Turner & Martyn Hill“Instrumentation for Engineers and Scientists” Oxford University Press
3. SabrieSoloman“Sensors Handbook”McGraw-Hill Education.
4. Ramesh S. Gaonkar“Microprocessor Architecture, Programming, and Applications with the 8085”Penram International Publishing
5. Ghosh, A.K.“Introduction to Measurements and Instrumentation”PHI Learning Pvt. Ltd..

Online Courses/NPTEL/SWAYAM:

https://archive.nptel.ac.in/courses/108/108/108108147/

https://onlinecourses.nptel.ac.in/noc21_ee32/preview

CO-PO -PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	2	–	–	–	–	1	1	3	2
CO2	3	3	2	1	2	–	–	–	–	1	1	3	2
CO3	3	3	2	2	3	–	1	–	–	1	1	3	3
CO4	3	2	2	2	3	–	–	–	1	2	2	3	3
CO5	3	3	3	2	3	–	1	–	1	2	2	3	3

Assessment Methodology	**Assessment Tools**	**Marks**
Continuous Assessment Test		25
Real time based Sensor application – mini project	Hardware demo and report	5
Instrumentation simulation (MATLAB/LabVIEW/Multisim)	Demo and viva	5
Attendance	Attendance Register	5
Total		**40**

25UCSI25	PROBLEM SOLVING USING PYTHON	Category	L	T	P	Credit
		ES	2		4	4

Preamble/ Course Objective

To introduce fundamental programming concepts using Python for problem-solving, data handling, control structures, and basic web development.

Prerequisite: None Course

Course Outcome

On the successful completion of the course, students will be able to

CO1	Understand the fundamental Python syntax and control structures to develop simple programs and algorithms	Understand (K2)
CO2	Construct modular programs using functions and string operations	Understand (K2)
CO3	Implement basic and advanced data structures (list, tuple, set, dictionary) to solve real-world problems	Apply (K3)
CO4	Develop file-handling routines, reusable modules, and object-oriented programs for small applications.	Apply (K3)
CO5	Use Python libraries (NumPy, Matplotlib, OpenCV, PySerial) to interface with sensors and perform automation or simulation tasks.	Apply (K 3)

SYLLABUS

UNIT I: Python Fundamentals and Control Structures (9)

Introduction to Python and IDEs (IDLE, Anaconda, Jupyter, VS Code); Basic syntax, indentation, and keywords; Data types: int, float, string, boolean; Variables and input/output operations; Operators and expressions; Conditional statements (if, if-else, if-elif-else); Looping structures: for, while, break, continue; Flowcharts and pseudocode for algorithm design; Fundamentals of computing and algorithm development: statements, control flow, functions, and recursion**.**

Illustrative problems: find minimum in a list, insert a card into a sorted list, number guessing game, Towers of Hanoi.

UNIT II: Functions, Strings, and Algorithmic Thinking (9)

Function definition and invocation, parameters and return values, function composition, recursion, local and global scope; String creation, indexing, slicing, string methods, immutability; String

module usage and operations.

Illustrative problems: swap values of two variables, check palindrome, calculate distance between two points, compute square root, GCD, and exponentiation using functions.

UNIT III: Data Structures – Lists, Tuples, Sets, and Dictionaries (9)

List creation, indexing, slicing, list methods; Tuple creation, immutability, tuple packing/unpacking; Set operations: creation, membership, union, intersection, difference; Dictionary structure, key-value operations, updating and iteration; Differences between data structures; Nested data structures; Iteration using for/while; List/set/dictionary comprehensions.

Illustrative problems: basic list operations, frequency count using dictionary, remove duplicates with sets, store and retrieve data using dictionaries, find common elements, iterate over nested structures.

UNIT IV: File Handling, Modules, and Object-Oriented Programming (9)

File operations: open, read, write, close; Text file processing and manipulation; Working with Python standard modules: math, random, os; Creating and importing user-defined modules; Object-oriented programming concepts: defining classes and creating objects; Constructors (__init_) and destructors; Encapsulation, basic inheritance, and polymorphism

Illustrative problems: read/write data from files, handle invalid inputs gracefully, build and use reusable custom modules, resistor color code decoder, basic circuit component manager.

UNIT V: Python Libraries for Robotics and Automation (9)

Introduction to NumPy- creating and manipulating arrays, performing mathematical and matrix operations, Matplotlib - 2D plotting for visualization of sensor data, control signals, and system behavior, OpenCV basics- image loading, color-to-grayscale conversion, edge detection techniques;Python in automation: serial communication with external hardware using PySerial, basic sensor interfacing;Overview of simulation environments: introduction to PyBullet or ROS-Py for robotics simulation and control.

Illustrative applications: plot sensor data using Matplotlib, detect edges in images with OpenCV, send and receive data over serial using PySerial, simulate simple robotic motion in PyBullet/RO.

Text Book

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and programming”, 1st Edition, BCS Learning & Development Limited, 2017.

Reference Book & Web Resources

1. Paul J. Deitel , Harvey Deitel "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. Wes McKinney,Python for Data Analysis, 2nd Ed., O'Reilly Media.
4. Lentin Joseph,Mastering ROS for Robotics Programming, 2nd Ed., Packt Publishing.

Web link(s):

1. https://python.swaroopch.com/
2. https://goalkicker.com/PythonBooks/PythonNotesForProfessionals.pdf
3. https://www.w3schools.com/python/
4. https://diveintopython3.problemsolving.io/

CO-PO -PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1			-	-	-	-	-	-	2	3
CO2	3	2	3	-		-	-	-	-	-	-	1	3
CO3	3	2	3	1	1	1	1	-	-	-	1	2	3
CO4	3	2	3	2	2	-	-	-	-	-	1	2	3
CO5	3	2	3	2	3	1	-	-	-	-	1	2	3

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Mini Project – Real-Time Python Application		5
Simulation / Lab Exercise		5
Attendance	Attendance Register	5
Total		**40**

25URAP26	ELECTRICAL AND ELECTRONICS LAB	Category	L	T	P	Credit
		ESC	0	0	2	1

COURSE PREREQUISITE

- Fundamental concepts of electrical circuits, machines, and electronic components.
- basic knowledge of logic gates and Boolean algebra in analyzing digital circuits.

Course Objective

- Understand and verify fundamental electrical laws and circuit behaviors
- Perform load tests and analyze performance characteristics of electrical machines
- Apply speed control techniques and power measurement methods in electrical systems
- Explore semiconductor device characteristics and their applications in basic circuits
- Design and test basic analog and digital electronic circuits for signal processing and logic operations

Course Outcome

On the successful completion of the course, students will be able to

CO1	Verify electrical laws and theorems through circuit-based experiments	(Apply – K3)
CO2	Analyze the performance characteristics of transformers, DC motors, and induction motors under different loading conditions.	(Analyze – K4)
CO3	Demonstratespeed control techniques for DC motors using field and armature control methods**.**	(Apply – K3)
CO4	Construct and testanalog electronic circuits using diodes, BJTs, and amplifiers.	(Apply – K3)
CO5	ImplementandverifyBoolean expressions and basic combinational logic circuits such as adders and subtractors	(Apply – K3)

SYLLABUS

LIST OF EXPERIMENTS

PART A – ELECTRICAL EXPERIMENTS

1. Verification of Ohm's Law and Kirchhoff's Laws
2. Series and Parallel Resonance in RLC Circuits
3. Load Test on a Single Phase Transformer
4. Load Test on DC Shunt motor.
5. Speed Control of DC Motor (Armature/Field control methods)
6. Measurement of Three-Phase Power using Two-Wattmeter Method
7. Load Test on a Three Phase Induction Motor

PART B – ELECTRONICS EXPERIMENTS

1. Study of PN Junction Diode Characteristics (Forward and Reverse Bias)
2. Zener Diode Voltage Regulation
3. Input and Output Characteristics of BJT in CE Configuration
4. Half Wave and Full Wave Rectifiers with and without Filter
5. Construction and Testing of a Simple RC Coupled Amplifier
6. Logic Gates – Verification of Truth Tables (AND, OR, NOT, NAND, NOR, XOR)
7. Implementation of Boolean Expressions and Basic Combinational Circuits (Adder, Subtractor)

TEXT BOOKS

1. Susan S. Mathew and Saji T. Chacko. Fundamentals of Electrical and Electronics Engineering (with Lab Manual). New Delhi: Khanna Publishing House, 2021.
2. Bernstein, Gary H. An Introduction to Electrical Engineering with Lab Activities. New York: McGraw-Hill Education, 2018.

REFERENCE BOOKS

1. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. 11th ed. Upper Saddle River, NJ: Pearson, 2013.
2. Mehta, V.K., and Rohit Mehta. Principles of Electronics. New Delhi: S. Chand & Company Ltd., 2020.
3. Chapman, Stephen J. Electric Machinery Fundamentals. 5th ed. New York: McGraw-Hill Education, 2012.
4. Kulshreshtha, D.C. Basic Electrical Engineering. New Delhi: Tata McGraw-Hill Education, 2009.
5. Sudhakar, A., and Shyammohan S. Palli. Circuits and Networks: Analysis and Synthesis. 5th ed. New Delhi: McGraw-Hill Education, 2015.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1								1	1	
CO2	3	3	2								2	1	
CO3	3	3	2								2	1	
CO4	3	3	2								3	1	
CO5	3	3	2								3	1	

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	10
Attendance	Attendance Register	10
Total		60

25UGEP28	FABRICATION LAB	Category	L	T	P	Credit
		ES			2	1

Course Objective

- To explore open-source tools and techniques for modern fabrication and prototyping
- To develop practical skills in electronics design, simulation, and PCB fabrication
- To understand software prototyping methodologies and rapid development techniques
- To gain hands-on experience with digital fabrication tools like 3D printing and laser cutting
- To integrate multiple technologies for complete product development and demonstration

Course Outcome

On the successful completion of the course, students will be able to

CO1	Understand open-source principles and effectively use open-source tools for electronics and software development	Understand (K2)
CO2	Design and simulate electronic circuits using open-source tools and develop functional PCBs	Create (K6)
CO3	Develop software prototypes and user interfaces using modern development frameworks and no-code platforms	Create (K6)
CO4	Create physical prototypes using digital fabrication techniques including 3D printing and laser cutting	Create (K6)
CO5	Integrate electronics, software, and mechanical components to demonstrate complete functional prototypes	Evaluate (K5)

SYLLABUS

UNIT I INTRODUCTION TO OPEN-SOURCE TOOLS AND TECHNIQUE(3)

Explore the concept of open-source, its underlying principles and its contrast with proprietary software. Discuss the advantages of using open-source tools, such as lower costs, increased innovation, educational value, and community support. Walk through to the commonly used open-source tools for electronics design (KiCad, FreeCAD), software development (Python, Eclipse), and fabrication (Cura, LinuxCNC).

Practical Activities: - Installation and setup of open-source tool suite - Comparison exercise between open-source and proprietary tools - Community platform exploration (GitHub, forums, documentation)

UNIT II ELECTRONICS FUNDAMENTALS AND TOOLS(6)

Introduction to basic electronic components (resistors, capacitors, transistors, etc.). Understanding of electronic circuits and their functions. Hands-on practice with CircuitJS and Falstad. Simulating and analysing electronic circuits. Introduction to Arduino and Raspberry Pi, exploring their capabilities and applications. Designing PCBs using KiCad and EasyEDA. Understanding PCB fabrication processes.

Practical Activities: - Circuit simulation using CircuitJS and Falstad - Arduino programming and interfacing exercises - Raspberry Pi setup and basic projects - PCB design workflow using KiCad - PCB fabrication process demonstration

UNIT III SOFTWARE PROTOTYPING AND TOOLS (6)

Benefits of rapid prototyping in product development. Iterative design and testing. Wireframing tools (Balsamiq, Figma). UI design tools (Sketch, Figma). Programming languages (Python, JavaScript). Testing frameworks (Selenium). No-code platforms (Bubble, Adalo, Wix, AppGyver). Building functional prototypes without extensive coding.

Practical Activities: - Wireframe creation using Figma - Mobile app prototype using no-code platforms - Simple web application development - User testing and iteration exercises - API integration in prototypes

UNIT IV FABRICATION AND PROTOTYPING (7)

Overview of fabrication techniques (3D printing, laser cutting, CNC machining). Prototyping methods for physical products, using tools like Blender, TinkerCAD, or Fusion 360. Creating 3D models for physical prototypes. Hands-on experience with laser cutting and engraving. Understanding their applications and limitations.

Practical Activities: - 3D modeling using TinkerCAD and Fusion 360 - 3D printing workflow and hands-on printing - Laser cutting design and fabrication - Material selection and testing - Post-processing and finishing techniques

UNIT V SIMULATION & DEMONSTRATION (8)

Integrated project demonstration, explaining the design process, technical choices, and outcomes. Simulation showcase to demonstrate their understanding of various technical tools and prototyping techniques.

Practical Activities: - Integrated project development - System integration and testing - Documentation and presentation preparation - Peer review and feedback sessions - Final demonstration and evaluation

TOTAL PERIODS: 30

TEXT BOOKS

1. Neil Gershenfeld, “Fab: The Coming Revolution on Your Desktop”, Basic Books, 2007.
2. Anna Kaziunas France, “Make: 3D Printing Projects”, Maker Media, 2016.

REFERENCE BOOKS

1. Massimo Banzi, “Getting Started with Arduino”, 3rd Edition, Maker Media, 2014.
2. Simon Monk, “Programming the Raspberry Pi”, 2nd Edition, McGraw-Hill, 2016.
3. Shawn Wallace, “KiCad Like a Pro”, Independently Published, 2019.
4. Ryan Whitwam, “Beginning 3D Printing”, Apress, 2015.

Online Resources

- KiCad Documentation
- Arduino Project Hub
- Thingiverse 3D Models
- Figma Design Resources
- Fusion 360 Learning

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	3	2	2	2	2	1	3	2	2
CO2	3	2	3	3	3	2	1	3	2	1	2	3	3
CO3	2	2	3	2	3	2	1	3	3	2	3	3	3
CO4	2	2	3	3	3	2	1	3	2	1	2	3	2
CO5	3	3	3	3	3	3	2	3	3	2	3	3	3

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
PCB design and fabrication	Working prototype demo	5
3D Model contest	Review	5
Attendance	Attendance Register	10
Total		60

25UPCE21	COMMMUNICATION SKILLS	Category	L	T	P	Credit
		EEC			2	1

Preamble/ Course Objective:

Ability to plan and manage their career paths effectively. It focuses on developing self-assessment, goal setting, and decision-making skills. Students will learn to research career options and align them with personal strengths and values.

Prerequisite: Carrier Development Skills

Course Outcome

On the successful completion of the course, the students will be able to

CO1	Develop sustained motivation and enhance interpersonal skills for effective communication and teamwork.
CO2	Build active listening and conversation skills essential for collaborative and respectful team interactions
CO3	Strengthen reading comprehension and writing clarity through critical analysis and audience-focused expression.
CO4	Improve public speaking and presentation skills while fostering self-assessment through SWOT analysis.
CO5	Promote team collaboration and communication through practical activities like debates and group problem-solving

SYLLABUS

UNIT I: **(10)**

Motivation – II: Intrinsic vs. Extrinsic Motivation- Goal Setting and Achievement - Building and Sustaining Motivation

Interpersonal skills: Effective Communication - Active Listening - Conflict Resolution - Teamwork and Collaboration

UNIT II: **(10)**

Listening Skills: Roles and Responsibilities in a Team - Building Trust and Respect Among Team Members – Effective Team Communication

Conversation skills: Starting and Maintaining a Conversation - Non-Verbal Communication Cues- Active Listening and Responding.

UNIT III: **(10)**

Reading Skills: Skimming and Scanning Techniques – Critical reading and Interpretation

Writing Skills: Grammar and Syntax - Clarity and Conciseness- Audience Awareness

UNIT IV: **(10)**

Presentation Speaking Skills: Speech Structure and Organization – Verbal Delivery Techniques

Public speaking skills: Confidence and overcoming Anxiety –Effective message Delivery

SWOT Analysis: Identifying Internal Factors – Analyzing External Factors

UNIT V: **(8)**

Team Building: Roles and Responsibilities in a team – Communication and Trust – Conflict resolution and Problem Solving

Active Sessions: Debate – Picture Connector

Text Books

1. Soft skills for Managers by Dr. T. KALYANA CHAKRAVATHI.
2. Personal Development and Soft Skills by BARUN K MITRA, Oxford Higher Education

Reference Book

1. The Emotionally Intelligent Workplace by DANIEL GOLEMAN.
2. Communication skills and soft skills an integrated approach by E. SURESH KUMAR, P. SREEHARI, J SAVITHRI.
3. Top Talking in English (international communication skills) by CHARLES T. RAJENDRA
4. Soft skills by RAJ LAKSHMI SURYAVANSHI, Gurucool Publishing

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1:								2	2	2	2
CO2:									3	3	
CO3:										3	
CO4:								2		2	2
CO5:									3	3	

Assessment Methodology	Assessment Tools	Marks
Continuous Assessment	Quizzes, reflective journals, Assignments	15
Role-Play / Group Discussion	Role-play rubric,peer feedback forms	10
Presentation / Public Speaking	Presentation rubric	10
SWOT Analysis & Report	self-assessment sheet	10
Debate / Active Session	Debate rubric	5
Attendance	Attendance Register	10
Total		60

25UMCC21	IKS IN HUMANITIES AND SOCIAL SCIENCE	Category	L	T	P	Credit
		MCC	0	0	2	0

Course Objective

This course explores Indian Knowledge Systems in the context of humanities and social sciences, providing students with a deeper understanding of India's intellectual heritage. The objectives are to:

- Understand the philosophical foundations of Indian knowledge traditions
- Explore Indian contributions to social sciences, literature, and arts
- Analyze the relevance of ancient wisdom in contemporary social contexts
- Develop appreciation for cultural diversity and heritage
- Foster critical thinking about knowledge systems and their applications

Course Prerequisite

Basic understanding of Indian history and culture

Course Outcome

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

CO1	Understand the philosophical foundations and methodologies of Indian knowledge systems in humanities
CO2	Analyze Indian contributions to literature, arts, social organization, and governance systems
CO3	Apply principles from Indian philosophical traditions to contemporary social and ethical issues
CO4	Evaluate the relevance and adaptability of traditional knowledge in modern social contexts
CO5	Create connections between ancient wisdom and contemporary challenges in society

SYLLABUS

Module I: Philosophical Foundations of Indian Knowledge Systems(6)

Darshanas (Schools of Philosophy): Samkhya, Yoga, Nyaya, Vaisheshika, Mimamsa, Vedanta - Epistemology in Indian philosophy: Pramanas (means of knowledge) - Ethics and moral philosophy in Indian traditions - Concept of Dharma, Artha, Kama, and Moksha - Comparative study with Western philosophical traditions.

Module II:Indian Literary and Artistic Traditions (6)

Sanskrit literature: Vedas, Upanishads, Puranas, Epics (Ramayana, Mahabharata) - Classical poetry and drama: Kalidasa, Bhartrhari, Bhasa - Regional literature and folk traditions - Indian classical music and dance: Theoretical foundations - Visual arts: Sculpture, painting, and architectural styles - Aesthetics in Indian tradition: Rasa theory and Alamkara shastra

Module III:Social Organization and Governance (6)

Ancient Indian social structure and organization - Varna and Ashrama systems: Historical context and evolution - Village self-governance: Panchayati Raj origins - Arthashastra: Principles of statecraft and administration - Justice system: Dharmashastra and Rajadharma - Economic systems: Trade, agriculture, and crafts

Module IV: Educational Systems and Knowledge Transmission (6)

- Gurukula system: Teacher-student relationship - Ancient universities: Nalanda, Takshashila, Vikramshila - Oral tradition and preservation of knowledge - Women's education in ancient India - Integration of spiritual and material learning - Comparison with modern educational approaches

Module V: Contemporary Relevance and Applications (6)

Indian knowledge systems in modern governance - Traditional conflict resolution mechanisms - Environmental consciousness in Indian traditions - Community-based development models - Gender studies: Women in Indian philosophical traditions - Relevance of Indian ethics in corporate governance - Cultural preservation and modernization challenge

Text Book

1. S. Radhakrishnan, "Indian Philosophy", Oxford University Press, 2008
2. A.L. Basham, "The Wonder That Was India", Rupa Publications, 2017
3. Kapila Vatsyayan, "Traditional Indian Art and Culture", Cambridge University Press, 2015

Reference Book & Web Resources

1. Heinrich Zimmer, "Philosophies of India", Princeton University Press, 1989
2. Romila Thapar, "Early India: From the Origins to AD 1300", Penguin Books, 2015
3. K.M. Munshi, "The History and Culture of the Indian People", Bharatiya Vidya Bhavan
4. Digital Library of India: https://www.dli.gov.in
5. Sahapedia - Encyclopedia of Indian Culture: https://www.sahapedia.org
6. Indian Council of Historical Research: https://ichr.ac.in
7. Archaeological Survey of India: https://asi.nic.in

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	-	-	1	-	2	2	2	3	3	-	-
CO2	2	2	1	1	2	1	2	3	3	3	3	-	-
CO3	2	2	2	2	3	2	3	3	3	3	3	-	-
CO4	2	2	2	2	3	3	3	3	3	3	3	-	-
CO5	3	3	3	3	3	3	3	3	3	3	3	-	-

Assessment Methodology	Assessment Tools	Marks
Thematic Essay Writing	Essay Rubric	15
Cultural Interpretation Project	Project Rubric	10
Comparative Analysis Presentation	Peer Feedback Form	10
Case Study Report	Case Study Rubric	10
Interactive Seminar / Debate	Debate Rubric	10
Attendance	Attendance Register	05
Total		60

25UMCC22	HOLISTIC WELLNESS	Category	L	T	P	Credit
		MCC	0	0	1	0

Course Prerequisite

- Basic physical fitness and medical clearance

Course Objective

This course promotes physical fitness, mental well-being, and holistic development ofstudents. The objectives are to:

- Develop physical fitness and motor skills through sports activities
- Learn yoga techniques for stress management and mental clarity
- Understand the importance of physical activity for academic performance
- Promote teamwork, leadership, and sportsmanship
- Establish lifelong habits for health and wellness

Course Outcome

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

CO1	Demonstrate improved physical fitness and coordination through regular sports participation
CO2	Apply yoga techniques for stress management and mental well-being
CO3	Exhibit teamwork, leadership, and fair play in sports activities
CO4	Analyze the relationship between physical activity and academic performance
CO5	Develop personal fitness plans for lifelong health and wellness

SYLLABUS

UNIT I: Introduction to Physical Fitness (3 Hours)

Importance of physical fitness for students - Components of fitness: strength, endurance, flexibility, coordination - Fitness assessment and goal setting - Safety guidelines and injury prevention - Warm-up and cool-down techniques

UNIT II: Sports Activities (9 Hours)

Option A: Team Sports (Choose any two) - Cricket: Basic skills, rules, and match play - Football: Fundamental techniques and game strategies - Basketball: Shooting, dribbling, and team coordination - Volleyball: Serving, spiking, and court positioning - Badminton: Strokes, footwork, and doubles play

Option B: Individual Sports (Choose any two) - Athletics: Running, jumping, and throwing events - Table Tennis: Basic strokes and match play - Tennis: Forehand, backhand, and court coverage - Swimming: Basic strokes and water safety - Cycling: Technique and endurance building.

UNIT III: Yoga and Mindfulness (3 Hours)

Introduction to yoga philosophy and benefits - Basic yoga asanas (postures): Sun salutation, standing poses, seated poses - Pranayama (breathing techniques): Deep breathing, alternate nostril breathing - Meditation and mindfulness practices - Relaxation techniques and stress management

Practical Activities

Sports Training Sessions: - Skill development workshops - Regular practice sessions - Inter-class tournaments - Sports day participation - Fitness challenges and competitions

Yoga Sessions: - Daily morning yoga practice - Guided meditation sessions - Breathing exercise workshops - Stress relief techniques - Mindfulness activities

Text Book

1. "Complete Guide to Physical Fitness" - Physical Education Department Manual
2. B.K.S. Iyengar, "Light on Yoga", Harper Thorsons, 1991

Reference Book & Web Resources

1. "Sports Training Principles" by Frank W. Dick, A&C Black, 2007
2. Swami Muktibodhananda, "Hatha Yoga Pradipika", Yoga Publications Trust, 2012
3. Yoga Alliance - Professional Yoga Resources: https://www.yogaalliance.org
4. Sports Authority of India Training Materials
5. Olympic training videos and resources
6. Isha Foundation Yoga Programs: https://isha.sadhguru.org

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	1	-	1	2	2	2	1	-	-
CO2	-	-	-	-	2	-	2	2	2	2	2	-	-
CO3	-	-	-	-	2	2	3	3	3	3	3	-	-
CO4	1	1	-	1	2	1	2	2	2	2	2	-	-

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO5	-	-	-	1	3	2	3	3	3	3	3	-	-

Assessment Methodology	**Assessment Tools**	**Marks**
Physical Fitness & Goal Setting	Personal fitness plan submission	15
Sports Skills & Participation	Peer evaluation during games	10
Yoga & Mindfulness	Demonstration of yoga asanas and pranayama	10
Practical Record / Wellness Journal	Daily or weekly log of sports practice, yoga sessions, and fitness activities	10
Presentation / Viva	Short seminar or viva on personal wellness plan, safety guidelines, or mindfulness benefits	10
Attendance	Attendance Register	05
Total		60