MANAKULA VINAYAGAR
INSTITUTE OF TECHNOLOGY
An Autonomous Institution
Affiliated to Pondicherry University, Approved by AICTE, New Delhi,
Accredited by NAAC with 'A' Grade
Kalitheerthalkuppam, Puducherry- 605 107.

DEPARTMENT OF FOOD TECHNOLOGY

CURRICULUM & SYLLABUS

(FIRST YEAR)

FOR

B.TECH.(FOOD TECHNOLOGY)

R 2025

(With effect from Academic Year: 2025-26)

Head of the Department
Department of Food Technology
Manakula Vinayagar Institute of Tech
Kalitheerthalkuppam, Puducherry - 605

Manakula Vinayagar Institute of Technology
Department of Food Technology

VISION AND MISSION	
INSTITUTE VISION	**DEPARTMENT VISION**
To be a globally reputed Technical Institution creating Competent leaders and Skillful innovators in Science, Technology and Management.	To be a centre of excellence in Food Technology for dissemination of knowledge and skills through innovative teaching, quality research and outreach for the development of food processing sector and society.
INSTITUTE MISSION	**DEPARTMENT MISSION**
IM1: Providing a dynamic and creative learning environment for its students to acquire exemplary technical, analytical, professional skills.	**DM1: Higher Order Thinking**-To provide unique and multidisciplinary learning experience by imparting fundamental concepts, analytical and problem solving skills to produce competent and ethical Food Technologists.
IM2: Imbibing a spirit of innovation and research among its students and faculty for solving critical problems.	**DM2: Competency -** To endeavour for constant upgradation of technical expertise through continuous learning and to address problems in food safety and security through technological interventions.
IM3: Promoting Innovation, Employability and entrepreneurship skills through industry academia collaboration.	**DM3: Continuous Learning -** To integrate academic, collaborative research and consultancy initiatives with academic institutions in India and abroad, food processing industries, Research and Development organizations to explore novel techniques and innovative products to meet the industrial and societal needs.
IM4: Serving the society through technical intervention and creating socially responsible Professionals.	**DM4: Entrepreneurship -** To inculcate the spirit of leadership and entrepreneurial skills with ethical values to be a successful entrepreneur with social concern.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
PEO1	**Employability:** The Graduates exhibit professional competency and knowledge of modern tools and shall be suitably employed in food processing industries.
PEO2	**Higher Education:** The Graduates shall be capable to pursue higher studies/research in the field of engineering and management.
PEO3	**Entrepreneurship:** The Graduates shall be prepared for a successful career by meeting ever increasing demands required by Food Technology profession and enable them to become an entrepreneur.
PEO4	**Professional and Ethical values:** The Graduates cultivate professional and ethical attitude with effective communication skills, team work and multidisciplinary approach related to the issues in food processing sector.

PROGRAMME OUTCOMES (POs)	
PO1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
PO3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
PO4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
PO5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.
PO6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.
PO8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
PO10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO1	**Design Thinking and Problem solving:** Provide solutions for the problems and challenges in food processing industries by applying basic engineering and professional knowledge, critical thinking and problem solving skills.
PSO2	**Process and Products Development:** Design and develop innovative processing techniques and food products using modern tools and cutting edge technologies in food processing.

CURRICULUM

SEMESTER I							
S. No	**Course Code**	**Course Title**	**Course Category**	**L**	**T**	**P**	**Credits**
INDUCTION PROGRAMME (UHV-I)							
THEORY							
1	25UMAT11	Matrices and Calculus	BS	3	1	0	4
2	25UPHT15	Physical Science for Food Technology	BS	3	0	0	3
3	25UMET13	Fundamentals of Mechanical Engineering	ES	2	1	0	3
INTEGRATED COURSE							
4	25UFTI11	Food Chemistry	PC	3	0	2	4
5	25UHSI16	Professional Communication for Engineers	HS	1	0	4	3
PRACTICAL							
6	25UPHP13	Physical Science Laboratory	BS	0	0	2	1
7	25UGEP18	Design Thinking & Idea Lab	ES	0	0	2	1
8	25UGEP19	Engineering Graphics and Auto CAD	ES	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSE							
9	25UPCE11	Career Development Skills	EEC	0	0	2	0
MANDATORY COURSE							
10	25UMCC11	IKS – Concepts and applications in Engineering and Science	MCC	0	0	2	0
11	25UMCC12	Environmental Sciences and Sustainability	MCC	2	0	0	0
TOTAL CREDITS							**20**

SEMESTER II							
S. No	**Course Code**	**Course Title**	**Course 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	25UFTT23	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	1	0	4
INTEGRATED COURSE							
4	25UCSI25	Problem solving using Python	ES	2	0	4	4
5	25UFTI21	Food Microbiology	PC	3	0	2	4
PRACTICAL							
7	25UFTP27	Basic Electrical and Electronics lab	ES	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	25UCCC21	Certification Course I	CCC	0	0	4	0
MANDATORY COURSE							
11	25UMCC21	IKS in Humanities and Social Science	MCC	0	0	2	0
12	25UMCC23	Holistic Wellness	MCC	0	0	1	0
TOTAL CREDITS							**20**

SYLLABUS

SEMESTER-I

25UMAT11	ENGINEERING MATHEMATICS-I MATRICES AND CALCULUS	Category	L	T	P	Credit
		BS	3	1	0	4

Course Prerequisite

- Higher Secondary Level Mathematics

Course Objective

- To understand and gain the knowledge of matrix algebra, partial differentiation, double integration, triple integration and their application, curl, divergence. To familiar with vector differential operators, integral theorems (Green's, Stoke's, Gauss divergence).

Course Outcome

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

CO1	Find eigen values and eigenvectors, verify the Cayley-Hamilton theorem, and perform orthogonal diagonalization.	Apply (K3)
CO2	Compute partial derivatives, determine total derivatives, Jacobians, employ Taylor'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

UNIT I MATRICES (12)

Eigenvalues and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigen values and Eigenvectors- Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation -Nature of quadratic forms.

UNIT II 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 III INTEGRAL 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.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 BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
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 (9th Edition), John Wiley & Sons, New Delhi, 2011.

Online Courses/NPTEL/SWAYAM:

https://nptel.ac.in/courses/111106100

https://nptel.ac.in/courses/111104125

https://nptel.ac.in/courses/111105121

https://nptel.ac.in/courses/111107112

Assessment Methodology	Assessment Tools	Marks
Test	CAT1; CAT2; Model Exam	25
Problem based Assignment	Moodle / Google form	5
Simulation (Python/Matlab/Scilab) Based Project assignment	Demo and viva	5
Attendance		5
Total		**40**

25UPHT15	PHYSICAL SCIENCE FOR FOOD TECHNOLOGY	Category	L	T	P	Credit
		BS	3	0	0	3

Preamble/ Course Objective

- To understand basics of crystal physics.
- To enhance the fundamental knowledge of elasticity and its applications relevant to engineering streams.
- To familiarize students with thermal properties and applications
- To understand organic reaction mechanisms and reactive intermediates
- To learn analytical techniques for food analysis
- To study chemical kinetics and catalysis principles

Prerequisite

12^{th} Physics-Basic knowledge of atomic structure and bonding, and familiarity with fundamental physics concepts such as force, motion, and energy transfer.

Basic knowledge of atomic structure, bonding, redox and corrosion, functional groups, polymers, material properties, and simple math for calculations.

Course Outcome

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

CO1	Apply the basic knowledge of crystal structure in solids.	**Apply**
CO2	Understand the elastic nature of materials and determine the elastic moduli of different materials.	**Understand**
CO3	Analyze and predict organic reaction mechanisms (SN1, SN2, E1, E2)	**Analysis**
CO4	Apply food analysis using titration and instrumental methods	**Apply**
CO5	Calculate reaction rates and apply knowledge of catalytic processes	**Apply**
CO6	Analyze and predict organic reaction mechanisms (SN1, SN2, E1, E2)	**Analysis**

UNIT-I CRYSTAL PHYSICS

Single crystalline, polycrystalline and amorphous materials–single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices–inter-planar distances coordination number and packing factor for SC, BCC, FCC and HCP -crystal imperfections: point defects, line defects–Burger vectors, stacking faults–role of imperfections in plastic deformation-growth of single crystals: solution and melt growth techniques.

UNIT -II MECHANICAL PROPERTIES OF SOLIDS AND FLUIDS

Elasticity–Hooke's law-stress–strain-modulus of elasticity-stress-strain diagram-Poisson‟s ratio-rigidity modulus- twisting couple on a cylinder-moment of inertia - torsional pendulum method. Bendingofbeams-bendingmoment-cantileverdepression-theoryandexperiment-oungsmodulusdetermination–uniformandnon-uniformbending-I-shape girders. Viscosity-flow of motion-Reynolds number.

UNIT -III HEAT TRANSFER AND THERMAL APPLICATIONS

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints – bimetallic strips-thermal conduction, convection and radiation–heat conductions 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- IV GENERAL TREATMENT OF REACTION MECHANISM

Ionic and radical reactions; heterolytic and, homolytic bond cleavage; Reactive intermediates: carbocations (cabenium and carbonium ions), carbanions, carbon radicals, Nucleophilic substitution reactions: SN1, SN2, SNi mechanisms.; neighboring group participations. Elimination Reactions: E1, E2, and E1cB mechanisms. Saytzeff and Hofmann rules. Elimination vs substitution reaction. Electrophilic and Activated Nucleophilic substitution reactions of Benzene.

UNIT- V FOOD ANALYSIS

Analysis Basics: Definition and calculations of Standard solution, Normality, Molarity and Molality. Titration Methods: Acid-base titrations, Complexometric titration, Food acidity determination, Metal analysis and Redox titrations. Instrumental Methods: Spectrophotometry principles, UV-Visible spectroscopy and Flame photometry. Component Analysis: Moisture determination, Fat analysis (Soxhlet), Protein estimation (Kjeldahl) and Sugar analysis.

UNIT- VI CHEMICAL KINETICS

Chemical Kinetics Rates of chemical reactions; Order and molecularity of reactions; Rate law, rate constant, half-life; Differential and integrated rate expressions for zero and first order reactions; Catalysis: Homogeneous and heterogeneous, enzyme catalysis and its mechanism.

Text Books

1. P K. Palanisamy, Engineering Physics Vol I and II Scitech Publications (India) Pvt Ltd, 2018.
2. Bhattacharya,D.K.&Poonam,T."EngineeringPhysics".OxfordUniversityPress,2018.
3. Gaur,R.K.&Gupta,S.L.*"EngineeringPhysics".*DhanpatRaiPublishers,2018
4. Raghavan,V.*"PhysicalMetallurgy:PrinciplesandPractice"*.PHILearning,2019.
5. P.C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai and Sons, New Delhi 2004.
6. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, "Engineering Chemistry", 2nd edition. PHILearning PVT., LTD, New Delhi, 2008

Reference Book & Web Resources

1. Balasubramaniam,R.*"Callister'sMaterialsScienceandEngineering".*WileyIndiaPvt.Ltd., 2017
2. Resnick,R.,Halliday,D.,&Walker,J.*"PrinciplesofPhysics*",WileyIndiaPvt.,2018.
3. R.S. Khurmi, J.K. Gupta ,Thermal Engineering, S. Chand Publishing, ISBN: 978-8121926774
4. P.W. Atkins and J. De Paula, "Physical Chemistry", 9th edition, Oxford University Press, Oxford, 2010.
5. Jerry March, "Advanced Organic Chemistry: Reactions, Mechanisms and Structure", 6th edition, Wiley-Interscience, New York, 2007.
6. Daniel C. Harris, "Quantitative Chemical Analysis", 8th edition, W.H. Freeman and Company, New York, 2010.
7. https://www.khanacademy.org/science/organic-chemistry - Organic Chemistry tutorials and reaction mechanisms
8. https://www.nist.gov/pml/chemical-kinetics-database - NIST Chemical Kinetics Database

Weblink

1. **https://archive.nptel.ac.in/courses/115/105/115105129/**
2. **https://onlinecourses.nptel.ac.in/noc20_ph16/preview**
3. **https://nptel.ac.in/courses/113105081**
4. **https://archive.nptel.ac.in/courses/104/105/104105124/**
5. **https://archive.nptel.ac.in/courses/113/104/113104082**
6. **https://www.khanacademy.org/science/organic-chemistry - Organic Chemistry tutorials and reaction mechanisms**
7. **https://www.nist.gov/pml/chemical-kinetics-database - NIST Chemical Kinetics Database**

Assessment Methodology	Assessment Tools	Marks
Test	CAT1; CAT2; Model Exam	25
MCQ unit wise 10 questions	Moodle / Google form	5
Lab based assignment	Demo and viva	5
Attendance		5
Total		**40**

25UMET13	FUNDAMENTALS OF MECHANICAL ENGINEERING	Category	L	T	P	Credit
		ES	2	1	0	3

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	Understanding of the fundamentals essential for designing robot structure.	Understand (K2)
CO2	Knowledge of basic thermodynamic and Fluid mechanics concepts.	Remember (K1)
CO3	Understanding of the fundamentals for selecting robot material according to its working environment.	Understand (K2)
CO4	Knowledge of various mechanical elements used in mechanisms.	Remember (K1)
CO5	Knowledge of various manufacturing processes.	Remember (K1)

SYLLABUS

UNIT I INTRODUCTION TO THERMODYNAMICS & ENERGY CONVERSION DEVICES (9)

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 (9)

Fluid Properties and Fluid Statics, Types of Fluid Flow, Work and Energy of Moving Fluids, Hydraulic Pumps, Hydraulic Turbines.

UNIT III MECHANICS OF MATERIAL (9)

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 (9)

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	(9)

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

TOTAL PERIODS: 45

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/

Assessment Methodology	Assessment Tools	Marks
Test	CAT1; CAT2; Model Exam	25
MCQ unit wise 10 questions	Moodle / Google form	5
Assignment	Demo and viva	5
Attendance		5
Total		**40**

25UFTI11	FOOD CHEMISTRY	Category	L	T	P	Credit
		PC	3	0	2	4

Course Prerequisite

Course Objective

- To provide students with a fundamental principles of food chemistry and the role of major food components in food systems.

Course Outcome On the successful completion of the course, students will be able to		
CO1	Recall the chemical composition of different foods and the functions of key food components.	RememberK1)
CO2	Explain the relationship between a food molecule's structure and its function.	Understand(K2)
CO3	Apply principles of food chemistry to solve problems related to food spoilage, processing, and preservation.	Apply (K3)
CO4	Analyze the changes in food quality during various processing and storage conditions.	Analyze (K4)
CO5	Propose methods to improve the stability and nutritional quality of food products.	Evaluate (K4)

SYLLABUS

UNIT I: INTRODUCTION TO FOOD CHEMISTRY & WATER (9 hours)

Introduction: Definition and scope of Food Chemistry. Classification of foods. Importance of food chemistry in food processing and preservation. Water in Food: Structure of water molecule. Properties of water: dipole nature, hydrogen bonding, and its role as a solvent. Water activity and its significance in food quality and microbial growth. Sorption isotherms and their application. Methods for measuring water content.

UNIT II: CARBOHYDRATES (9 hours)

Classification: Monosaccharides, disaccharides, oligosaccharides, and polysaccharides. Monosaccharides: Structure and properties of glucose, fructose, and galactose. D and L isomerism. Disaccharides: Structure and properties of sucrose, lactose, and maltose. Polysaccharides: Starch, glycogen, cellulose, pectin, and gums. Their structure, properties, and functional roles in food (e.g., thickening, gelling). Carbohydrate reactions: Maillard browning and caramelization.

UNIT III: PROTEINS (9 hours)

Amino Acids: Structure, classification, and properties of amino acids. Essential and non-essential amino acids. Peptide bond formation. Protein Structure: Primary, secondary, tertiary, and quaternary structures. Denaturation of proteins: causes and effects. Functional Properties of Proteins: Solubility, water-holding capacity, gelation, foaming, and emulsification. Protein-based food ingredients (e.g., gluten, milk proteins).

Unit IV: LIPIDS (9 hours)

Classification: Fatty acids, triglycerides, phospholipids, and sterols. Saturated, monounsaturated, and polyunsaturated fatty acids. Properties of Lipids: Melting point, solubility, and polymorphism. Reactions of Lipids: Hydrolysis, oxidation (rancidity), and hydrogenation. Importance of antioxidants. Emulsions: Types of emulsions, emulsifiers, and

emulsion stability.

Unit V: MINOR COMPONENTS & FOOD ADDITIVES (9 hours)

Vitamins: Classification (fat-soluble and water-soluble). Structure and function of key vitamins (e.g., Vitamin C, Vitamin A). Stability of vitamins during processing. Minerals: Role of major and trace minerals in food and nutrition. Bioavailability. Enzymes in Food: Definition and classification of enzymes. Role of enzymes in food processing and spoilage. Enzyme browning. Food Additives: Introduction to common food additives: preservatives, antioxidants, colorants, and flavor enhancers.

TEXT BOOKS

1. Fennema, O. R. (2017). Fennema's Food Chemistry (5th ed.). CRC Press.
2. Coultate, T. P. (2016). Food: The Chemistry of Its Components (6th ed.). Royal Society of Chemistry.

REFERENCE BOOKS

1. Damodaran, S., Parkin, K. L., & Fennema, O. R. (2007). Fennema's Food Chemistry (4th ed.). CRC Press.
2. Belitz, H. D., Grosch, W., & Schieberle, P. (2009). Food Chemistry (4th ed.). Springer.

List of Experiments

1. Experiment to study the properties of carbohydrates- caramelization, Maillard reaction.
2. Experiment on enzymatic and acid hydrolysis of sucrose
3. Preparation of emulsions and study its stability
4. Determination of Foaming properties of proteins
5. Determination of Solubility, specific gravity and Refractive index of oils
6. Estimation of free fatty acid content of oil
7. Determination of peroxide value and Anisidine value of fats.
8. Experiment to study the effect of heat on proteins.
9. Determination of Iso-electric point of casein & experiment to study effect of rennin on milk proteins
10. Experiments to study the gelling properties of starch
11. Experimental study of gluten formation using wheat flour
12. Experimental study on enzymatic Browning in foods

Assessment Methodology	Assessment Tools	Marks
Test	CAT1; CAT2; Model Exam	10
Model Exam (Theory)		5
Assignment	Report and Presentation	5
Practical	Performance, Observation and Record	10
Model Practical	Performance and viva voce	15
Attendance		5
Total		**50**

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

Course Prerequisite:

- Basics of English Language

Course Objective:

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals

Course Outcome

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

CO1	Use appropriate words in a professional context.	Understand
CO2	Gain understanding of basic grammatic structures and use them in right context.	Understand
CO3	Speak fluently and accurately in formal and informal communicative contexts	Understand
CO4	Write definitions, descriptions, narrations and essays on various topics	Understand
CO5	Express their opinions effectively in both oral and written medium of communication	Analyze

SYLLABUS

UNIT I INTRODUCTION TO COMMUNICATION (9)

EFFECTIVE COMMUNICATION:(1)

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: (8)

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: Wh/ 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.

UNIT II NARRATION AND SUMMATION (9)

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

UNIT III DESCRIPTION OF A PROCESS / PRODUCT (9)

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

UNIT-IV VISUALIZATION AND CLASSIFICATION (9)

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

UNIT V EXPRESSION COMMUNICATION (9)

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

TOTAL PERIODS: 45

TEXTBOOKS

Technical Communication: Principles and Practice Meenakshi Raman & Sangeeta Sharma Oxford University Press 3rd Edition (or latest)
Communication Skills Sanjay Kumar & Pushp Lata, Oxford University Press, 2nd Edition (2015)

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

1.A Course Book on Technical English By Lakshmi Narayanan, Scitech Publications (India) Pvt. Ltd.(English For Technical Communication (With CD) By Aysha Viswamohan, McGraw-Hill Education, ISBN : 0070264244.)
2. Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House.
3. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

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		5
Total		**50**

25UPHP13	PHYSICAL SCIENCE LABORATORY	Category	L	T	P	Credit
		BS	0	0	2	1

Preamble/ 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
- To gain a practical knowledge of Engineering Chemistry in relevance to Industrial applications.
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper
- To demonstrate the synthesis of nanoparticles

Prerequisite

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

Course Outcome

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

CO1	Apply the elastic nature of materials and determine the elastic moduli of different materials.	**APPLY**
CO2	Analyse thermal properties of various material testing methods and use them in suitable applications	**APPLY**
CO3	Understand measurement technology, usage of new instruments and real time applications in engineering studies.	**APPLY**
CO4	Estimate water quality parameters such as total dissolved solids, total hardness, and chemical oxygen demand using volumetric analysis methods.	**APPLY**
CO5	Determine the concentration of metal ions such as copper in a given solution using volumetric or instrumental techniques.	**APPLY**
CO6	Synthesize metal nanoparticles using basic chemical methods and analyze their properties using suitable characterization techniques.	**APPLY**

Syllabus

1. Determination of Young's modulus of given material by non-uniform bending method.
2. Determination of viscosity of the given liquid using Poiseuille's method.
3. Determination of Thermal conductivity of a bad conductor –Lee's Disc method
4. Determination of the thickness of a given thin material– Air wedge method
5. Determination of the wavelength of Laser and particle size of given powder.
6. Determination of dissolved oxygen in water.
7. Determination of total hardness of water by EDTA method
8. Preparation of Cu nanoparticles by precipitation method.
9. Estimation of available chlorine in bleaching powder
10. Estimation of copper in copper sulphate solution

Text Book

1. Practical Physics – S.L. Gupta & V. Kumar
2. A Textbook of Practical Physics – M.N. Srinivasan
3. Engineering Physics Practical Manual – Dr. Arumugam M.
4. Engineering Physics Lab Manual – R.K. Shukla & Anchal Srivastava
5. Advanced Practical Physics for Students – B.L. Worsnop and H.T. Flint
6. P.C. Jain & Monica Jain – Engineering Chemistry
7. S.S. Dara & S.S. Umare – A Textbook of Engineering Chemistry
8. R. Gopalan, D. Venkappayya, S. Nagarajan – Engineering Chemistry
9. Shashi Chawla – Engineering Chemistry
10. K. Mukkanti – Practical Engineering Chemistry

Reference Book & Web Resources

1. Elements of Properties of Matter – *D.S. Mathur*
2. Engineering Physics – *R.K. Gaur & S.L. Gupta*
3. B.Sc. Practical Physics – *C.L. Arora*
4. Experimental Physics – *Worsnop and Flint*
5. P.C. Jain & Monica Jain – *Engineering Chemistry*
6. S.S. Dara & S.S. Umare – *A Textbook of Engineering Chemistry*
7. R. Gopalan, D. Venkappayya, S. Nagarajan – *Engineering Chemistry*
8. Shashi Chawla – *Engineering Chemistry*
9. K. Mukkanti – *Practical Engineering Chemistry*
10. Dr. Sudha Rani – *Laboratory Manual of Engineering Chemistry*

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
5. https://nptel.ac.in
6. https://vlab.co.in
7. https://www.khanacademy.org/science/chemistry
8. https://chem.libretexts.org
9. http://www.chemcollective.org

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	20
Record work	Record	10
Viva		5
Model exam	Performance and viva voce	15
Attendance		10
Total		**60**

25UGEP18	DESIGN THINKING AND IDEA LABORATORY	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.

Course Outcome

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

CO1	Understand the fundamentals of design thinking, including its origin, process models, and tools, and apply them to identify opportunities and develop a design brief.	Understand
CO2	Apply empathy tools and defining methods to understand user needs and formulate clear problem statements in design thinking.	Apply
CO3	Generate creative and innovative ideas using ideation techniques such as brainstorming, mind mapping, and lateral thinking.	Apply
CO4	Apply prototyping techniques to translate ideas into tangible models through iterative development of low-fidelity prototypes.	Apply
CO5	Interpret feedback from prototype testing and iteratively improve the design to better align with user needs.	Analyze

Syllabus

UNIT I FUNDAMENTALS OF DESIGN THINKING

Design Thinking Process: Types of the thinking process, Common methods to change the human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, the need of design thinking; An approach to design thinking**,** Design thinking Process model, Design thinking tools.

Case Studies: General, Engineering and Service applications
Activities: Identify Opportunity and Scope of the Project. Explore the possibilities and prepare a design brief

UNIT II: EMPATHIZE AND DEFINE

Design thinking phases, how to empathize, Role of empathy in design thinking, the purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools: Customer Journey Map, Personas.
Define- Methods of Define Phase: Storytelling, Critical items diagrams, Define success
Activities: Apply the methods of empathizing and Define Phases Finalize the problem statement

UNIT I IDEATION

Challenges in idea generation, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method**,** Create Thinking**,** Generating Design Ideas**,** Lateral Thinking**,** Analogies**,** Brainstorming**,** Mind mapping**,** National Group Technique**,** Synectic's**,** Development of work**,** Analytical Thinking**,** Group Activities. Ideation Tools: How Might We? (HMW), Storyboard, Brainstorming. What is design innovation? A mindset for innovation**,** and asking "What if?" asking "What wows?" and "What works?"
Activities- Apply the methods of Ideate Phase: Generate Lots of Ideas

UNIT I V PROTOTYPING

Definition - Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype.
Activities: Apply the Methods of the Prototype Phase: Create prototypes for selected ideas

UNIT V TING PROTOTYPES

Prototyping for digital products: What's unique for digital products, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users. Create a Pitch-Plan for scaling up-Road map for Implementation, Fine-tuning and Submission of the project report
Activities: Collect feedback; iterate and improve ideas
Present your solution using the Storytelling method

TEXTBOOKS:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.
2. IdrisMootee, Design Thinking for Strategic Innovation,2013, John Wiley & Sons Inc

REFERENCE BOOKS

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.
6. Karl T. Ulrich and Steven D. Eppinger, Product Design and Development, McGraw-Hill Education, 2015.
7. Charles Platt, Make: Electronics: Learning Through Discovery, Maker Media, 2011.

Assessment Methodology	Assessment Tools	Marks
Problem Identification & Research	Fieldwork, Surveys	10
Ideation & Solution Definition	Brainstorming sessions, Problem statement submission	10
Prototyping & Iteration	Prototype, Model	15
Report & Presentation	PPT Presentation	15
Attendance		10
Total		**60**

25UGEP19	ENGINEERING GRAPHICS & AUTO CAD	Category	L	T	P	Credit
		ES	0	0	2	1

Prerequisite

Students should have a fundamental understanding of engineering mathematics and basic geometric concepts, including lines, angles, shapes, and spatial visualization skills, typically covered in secondary school education.

Preamble/ Course Objective

- To develop knowledge of standard practices in engineering drawing, including lettering, line work, dimensioning, and projection techniques.
- To enable students to construct and interpret conic sections, spirals, involutes, helix curves, and projections of points, lines, planes, and solids.
- To understand the development and intersection of surfaces like cylinder-cylinder and cylinder-cone, essential for fabrication and design.
- To build skills in creating accurate isometric and orthographic projections for effective engineering communication.
- To introduce students to AutoCAD for creating 2D engineering drawings, enhancing their ability to use modern engineering tools.

Course Outcome

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

CO1	Understand and apply the principles of engineering drawing standards, including lettering, line types, dimensioning, and accurately construct conic sections, spirals, involutes, and helix curves.	K2
CO2	Interpret and generate projections of solid objects and their sectional views, aiding in better understanding of internal features in engineering components.	K3
CO3	Develop the lateral surfaces of solids essential for manufacturing and fabrication processes.	K3
CO4	Create and interpret isometric and orthographic projections of engineering objects to effectively communicate design intent.	K3
CO5	Utilize computer-aided drafting tools, particularly AutoCAD, to produce accurate 2D engineering drawings of simple geometries, enhancing proficiency in modern engineering software.	K3

Syllabus

UNIT-I

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning. Conic sections, Involutes, Spirals, Helix.

UNIT-II

Projection of Points, Lines and planes, Projection of Solids.

UNIT-III

Sections of solids and Development of surfaces

UNIT-IV

Isometric projections and Conversion of pictorial to Orthographic views

UNIT-V

Computer Aided Drafting: Introduction to Computer Graphics and Drafting, AutoCAD,2-D diagrams of simple geometries using Auto- CAD script.

Text Book

1. K.R.Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics ,Inzinc Publishers, 2007.

Reference Book

1. N.D.Bhatt, Engineering Drawing,49thedition,Chorotar Publishing House,2006.

2. K.Venugopal, Engineering Drawing and Graphics+AutoCAD,4th edition,New Age International Publication Ltd.,2004.
3. DavidIcook and Robert NMc Dougal, Engineering Graphics and Design with computer applications, Holt – Sounders Int. Edn.1985.
4. James D Bethuneandet.al., Modern Drafting,PrenticeHallInt.,1989.

Web Resources

1. https://nptel.ac.in/courses/112/103/112103019/
2. https://archive.org/details/engineeringdrawingndbhatt

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		10
Total		**60**

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

Prerequisite: Basic communication skills and foundational knowledge of workplace behaviour.

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

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.

CO1	Help students assess themselves, explore career options, and set actionable goals through structured planning.
CO3	Build awareness and practice of grooming, hygiene, positive attitudes, manners, and professional behavior.
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

UNIT 1 **10 Hrs**

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 2 **10 Hrs**

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 3 **10Hrs**

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 4 **10Hrs**

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 Hrs**

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

Assessment Methodology	**Assessment Tools**	**Marks**
Career Development Portfolio	Assignment	20
Personality Development Assignment	Assignment	20
Goal Setting and Action Plan Project	Project	15
Grooming and Etiquette Demonstration	Practical/Demo	15
Time and Stress Management Project	Project	20
Attendance and Class Participation	Continuous Assessment	10
Total		**100**

25UMCC11	IKS-CONCEPTS AND APPLICATIONS IN ENGINEERING AND SCIENCE	Category	L	T	P	Credit
		MCC	0	0	2	0

Course Prerequisite: Basic understanding of science and engineering fundamentals

Course Objective

This course introduces students to the rich heritage of Indian Knowledge Systems (IKS) and their contemporary applications in engineering and science. The objective is to:

- Familiarize students with traditional Indian knowledge systems and their scientific foundations
- Explore the integration of ancient wisdom with modern engineering practices
- Understand sustainable technologies and innovations rooted in Indian traditions
- Develop appreciation for indigenous knowledge in solving contemporary challenges
- Foster research mindset towards validating and modernizing traditional practices

Course Outcome

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

CO1	Understand the historical development and scientific basis of Indian Knowledge Systems
CO2	Analyze traditional Indian practices in mathematics, astronomy, metallurgy, and medicine
CO3	Apply IKS principles to contemporary engineering and scientific problems
CO4	Evaluate the sustainability aspects of traditional Indian technologies
CO5	Create innovative solutions by integrating traditional knowledge with modern science

UNIT I: Introduction to Indian Knowledge Systems (6 Hours) - Historical overview of Indian Knowledge Systems - Scientific methodology in ancient India - Major texts and scholars: Vedas, Upanishads, Charaka Samhita, Sushruta Samhita - Transmission and preservation of knowledge - Contemporary relevance and global recognition.

UNIT II: Mathematics and Astronomy in Ancient India (6 Hours) - Indian contributions to mathematics: Zero, decimal system, trigonometry - Aryabhata, Brahmagupta, Bhaskara's contributions - Astronomical observations and calendar systems - Navigation techniques and geographical knowledge - Applications in modern engineering calculations.

UNIT III: Metallurgy, Materials, and Architecture (6 Hours) - Ancient Indian metallurgy: Iron pillar of Delhi, Wootz steel - Traditional building materials and techniques - Architectural marvels: Structural engineering principles - Water harvesting and management systems - Sustainable construction practices.

UNIT IV: Medicine, Agriculture, and Life Sciences (6 Hours) - Ayurveda: Principles and scientific validation - Traditional agricultural practices and crop management - Biodiversity conservation methods - Food preservation techniques - Biotechnology applications in traditional practices.

UNIT V: Integration with Modern Science and Technology (6 Hours) - Validating traditional knowledge through modern scientific methods - Case studies of successful IKS-

modern science integration - Intellectual property and traditional knowledge protection - Research opportunities and career prospects - Future directions and challenges

Text Book

1. Subhash Kak, “The Nature of Physical Reality”, Mount Meru Publishing, 2016
2. B.V. Subbarayappa, “Indian Astronomy: A Source Book”, Nehru Centre, 2008
3. Kapila Vatsyayan, “Traditional Indian Art and Culture”, Cambridge University Press, 2015

Reference Book & Web Resources

1. P.P. Divakaran, “The Mathematics of India: Concepts, Methods, Connections”, Springer, 2018
2. S.N. Sen, “Ancient Indian History and Civilization”, New Age International, 2010
3. National Mission for Manuscripts - www.namami.gov.in
4. Digital Library of Traditional Ecological Knowledge - www.frlht.org
5. CSIR Traditional Knowledge Digital Library - www.tkdl.res.in

Assessment Methodology	**Assessment Tools**	**Marks**
Major IKS Integration Project	Project	20
Traditional Knowledge Practical Demonstration	Practical/Demo	20
Scientific Validation Assignment	Assignment	15
Heritage Site/Museum Field Report	Field Work	15
Innovation Proposal Presentation	Presentation	20
Attendance and Lab Participation	Continuous Assessment	10
Total		**100**

25UMCC12	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	Category	L	T	P	Credit
		MCC	2	0	0	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

Course Outcome

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

CO1	Understand fundamental principles of environmental science and ecosystem dynamics	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 systems	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

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

SEMESTER-II

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

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.

Prerequisite

Mathematics-I

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 – with constant coefficients, the operator D, Euler 's linear equation of higher order with variable coefficients - 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 Books

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

Assessment Methodology	Assessment Tools	Marks
Test	CAT1; CAT2; Model Exam	25
Mathematical modeling assignment	Analytical solution presentation	5
Transform applications project	Demo and viva	5
Attendance		5
Total		**40**

25UHST22	UNIVERSAL HUMAN VALUES-II	Category	L	T	P	Credit
		HS	2	0	0	2

Course Prerequisite: UHV-1

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 behavior, 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 fulfillment 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.re	Understand(K2)

Syllabus

UNIT I – INTRODUCTION TO VALUE EDUCATION: 9 Hours

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 Hours

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 Hours

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 Hours

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.

UNIT V – IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS: 9 Hours

Natural Acceptance of Human Values; Definitiveness of (Ethical) Human Conduct: - Exploring Ethical Human Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order; Competence in Professional Ethics:- Exploring Humanistic Models in Education; Holistic Technologies, Production Systems and Management Models-Typical Case Studies; Strategies for Transition towards Value-based Life and Profession.

Text Book and Teachers Manual

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.ISBN 978-93-87034-53.

Reference Book & Web Resources

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”.

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

25UFTT23	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	Category	L	T	P	Credit
		ES	3	1	0	4

Prerequisite

Physics

Course Objective

- Understand the fundamental concepts of electrical circuits and apply network laws to analyze them.
- Learn the working principles and applications of electrical machines and power systems.
- Gain basic knowledge of semiconductors, electronic devices, and analog circuits.
- Understand digital electronics and apply Boolean logic to design simple digital systems.
- Introduce the concepts of instrumentation and transducers used in measurement systems across industries.

Course Outcome

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

CO1	Analyze DC and AC electrical circuits using Ohm's law, Kirchhoff's laws, and basic circuit analysis techniques	Apply (K3)
CO2	Explain the working principles of transformers, motors, and the structure of power systems	Understand (K2)
CO3	Describe the functioning of basic semiconductor devices and analog electronic circuits.	Understand (K2)
CO4	Apply logic gates and Boolean algebra to design and analyze simple digital circuits	Apply (K3)
CO5	Identify appropriate sensors and measurement instruments for physical quantities used in industrial applications	Apply (K3)

SYLLABUS
UNIT I Fundamentals of Electrical Engineering (9) Ohm's Law, Kirchhoff's Laws - Mesh and Nodal Analysis - Introduction to AC circuits: RMS, Average value, Power Factor - Single-phase and Three-phase systems – Star and Delta connections-Power and Energy measurement using wattmeter
UNIT II Electrical Machines and Power Systems (9) Transformers: Construction, Principle, EMF equation - DC Machines: Working of DC generator and motor (brief) - Induction Motors: Construction and Principle - Basics of Power Generation, Transmission, and Distribution.
UNIT III Fundamentals of Electronics Engineering (9) Semiconductor Basics: Intrinsic & Extrinsic semiconductors - Diodes: PN junction diode, Zener diode and their applications - BJT and FET: Operation and characteristics (qualitative) - Rectifiers and Voltage Regulation
UNIT IV Digital Electronics (9) Number Systems: Binary, Decimal, Hexadecimal - Logic Gates: AND, OR, NOT, NAND, NOR, XOR - Boolean Algebra and Simplification - Basic Combinational Circuits: Half Adder, Full Adder, Multiplexer - Introduction to Microcontrollers (e.g., 8051 or Arduino basics)
UNIT V Instrumentation and Measurements (9) Measurement Systems: Functional Elements - Transducers: Types, Selection criteria - Measurement of Physical Parameters: Temperature, Pressure, Displacement, Flow Sensors in Industrial Applications - Basic concepts of Data Acquisition and PLCs
TOTAL PERIODS: 45

Text Books

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath – Tata McGraw Hill – 2010
2. Basic Electrical, Electronics and Instrumentation Engineering, R. Muthusubramanian, S. Salivahanan, K.A. Muraleedharan – Tata McGraw Hill – 2010
3. Applied Electronics, R. S. Sedha – S. Chand Publishing – 2008
4. Electronic Devices and Circuits, David A. Bell – Oxford University Press – 2010
5. Electronic Instrumentation, H. S. Kalsi – Tata McGraw Hill – 3rd Edition – 2010

Reference Book & Web Resources

1. Fundamentals of Electrical Engineering, Leonard S. Bobrow – Oxford University Press – 2nd Edition – 2011
2. Electrical and Electronic Technology**,** Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith – Pearson Education – 10th Edition – 2012
3. Digital Principles and Applications**,** Donald P. Leach, Albert Paul Malvino – Tata McGraw Hill – 7th Edition – 2011
4. Measurement Systems: Application and Design**,** Ernest O. Doebelin – McGraw Hill – 5th Edition – 2004
5. Transducers and Instrumentation**,** D.V.S. Murty – PHI Learning – 2nd Edition – 2008

Web Resources

1. NPTEL Course on Basic Electrical Technology

https://nptel.ac.in/courses/108/105/108105053
2. NPTEL Course on Basic Electronics
https://nptel.ac.in/courses/117/106/117106086
3. Tutorials Point – Basic Electrical and Electronics
https://www.tutorialspoint.com/basic_electrical_engineering/index.htm
4. All About Circuits – Electronics Textbook ; https://www.allaboutcircuits.com/textbook
5. Electronics-Tutorials Online Reference ; https://www.electronics-tutorials.ws/

Assessment Methodology	Assessment Tools	Marks
Test	CAT1; CAT2; Model Exam	25
MCQ unit wise 10 questions	Moodle / Google form	5
Assignment	Demo and viva	5
Attendance		5
Total		**40**

25UCSI25	PROBLEM SOLVING USING PYTHON	Category	L	T	P	Credit
		ES	2	0	4	4

Course Prerequisite:

- Programming in C

Course Objective:

- To impart the knowledge of Python basic structure, components, object storage, exception handling, and graphics toolkit using Tinker

Course Outcome

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

CO1	Understand Python's basic concepts, data types, variables, and control statements.	Understand
CO2	Understand the components of Python programming and storage statements.	Understand
CO3	Understand the functions, modules, packages, and interfaces in Python.	Understand
CO4	Understand the exception handling techniques and file operations.	Understand
CO5	Develop an application using GUI toolkits and widgets.	Apply

SYLLABUS

UNIT I INTRODUCTION (9)

History - Features -basic syntax - Data types - variables - Manipulating Numbers - Text Manipulations - Control Statements- Python Built-in Functions.

UNIT II COMPONENTS OF PYTHON PROGRAMMING (9)

Operator Basics - Numbers - String - List - Tuples - Dictionaries - Files - Object Storage - Type Conversion - Type Comparison - Statements – Assignments.

UNIT III FUNCTIONS AND PACKAGE (9)

Classes and Objects - creating a class, class methods, class inheritance. Functions Definition and Execution - Arguments - Return Values - Advanced Function Calling - Modules - Importing modules – Packages and Interfaces - Creating a module.

UNIT IV EXCEPTION HANDLING AND FILES (9)

Exception Handling- Building in Exceptions- Files, File operations, reading a file content, writing a file, modifying files pos, controlling file I/O, Manipulating file paths.

UNIT V GUI PROGRAMMING AND GRAPHICS (9)

GUI Programming toolkits – Introduction to Tkinter – Creating GUI widgets – Resizing – Configuring widget options – Creating Layouts – Radio buttons – Check boxes – Dialog boxes – Drawing using Turtle

TOTAL PERIODS: 45

TEXTBOOKS:

1. Martin C. Brown, "The Complete Reference - Python", Tata McGraw Hill Indian Edition, 2010. (UNIT 1-4)
2. Alan D. Moore Python GUI programming with Tkinter: Design and build functional and user-friendly GUI applications,2021. (Unit-5)

REFERENCES

1. Wesley J Chun, -Core Python Applications Programming, Prentice Hall, 2012.
2. Eric Matthes, "A Hands-On, Project-Based Introduction to Programming", 2nd Edition,2019.

ONLINE/ NPTEL COURSES:

1. Programming, Data Structures and Algorithms using Python- https://nptel.ac.in/courses/106106145
2. The Joy of Computing using Python-https://nptel.ac.in/courses/106106182
3. Python for Data Science- https://nptel.ac.in/courses/106106212

PRACTICE EXERCISES:

1. Identify and solve simple real-life/scientific/technical problems. (Electricity Billing, Retail shop billing, Sin series, etc).
2. Python programming using simple statements and expressions (exchange the values of two variables, circulatethe values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists and tuples.
5. Implementing real-time/technical applications using Sets and dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of a shape)

7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
9. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age, validity, student mark range validation)
10. Exploring Pygame tool. Developing a game activity using Pygame, like bouncing ball, car race, etc.

Assessment Methodology	Assessment Tools	Marks
Theory Test	CAT1; CAT2; Model Exam	15
Assignment	Online submission	10
Mini project implementation	Code demo and documentation	10
Model Practical		10
Attendance		5
Total		50

25UFTI21	FOOD MICROBIOLOGY	Category	L	T	P	Credit
		PC	3	0	2	4

Course Prerequisite

Biology at HSc level

Course Objective

- To provide students with a comprehensive understanding of microorganisms relevant to food, their role in spoilage, foodborne diseases, beneficial applications, and methods for controlling microbial growth to ensure food safety and quality.

Course Outcome

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

CO1	Recall the history, scope, classification, and characteristics of microorganisms important to food, and explain their growth requirements and microscopy techniques.	Remember (K1) / Understand (K2)
CO2	Identify sources of microbial contamination and describe the spoilage mechanisms and specific spoilage organisms in different food groups.	Understand (K2) / Apply (K3)
CO3	Differentiate between types of foodborne diseases, identify major pathogens, and explain hygiene, sanitation, and HACCP principles for food safety.	Analyze (K4)

CO4	Explain the role of beneficial microorganisms in fermentation, probiotics, prebiotics, and evaluate the use of starter cultures and GM microorganisms in food production.	Understand (K2) / Evaluate (K5)
CO5	Apply and assess physical, chemical, and biological methods for controlling microorganisms in food, including aseptic packaging.	Apply (K3) / Evaluate (K5)

SYLLABUS

UNIT I INTRODUCTION TO MICROBIOLOGY (9 hours)

Introduction to microbiology, history, and scope. Microbial classification and taxonomy. Characteristics of microorganisms relevant to food: bacteria, yeasts, molds, and viruses. Growth and reproduction of microbes. Factors influencing microbial growth: intrinsic and extrinsic factors (e.g., pH, water activity, temperature, oxygen availability, nutrients). Microscopic techniques and staining methods (Gram staining, acid-fast staining).

UNIT II MICROBIAL CONTAMINATION AND FOOD SPOILAGE (9 hours)

Sources of microbial contamination in food: soil, water, air, plants, animals, and human handlers. Microbial spoilage of different food groups: meat, fish, poultry, milk, dairy products, fruits, and vegetables. Indicators of spoilage. Specific spoilage organisms (SSOs). Microbial succession in food.

UNIT III FOODBORNE DISEASES AND FOOD SAFETY (9 hours)

Foodborne diseases: classification (infections, intoxications, and toxicoinfections). Major foodborne pathogens: *Salmonella*, *E. coli*, *Listeria*, *Staphylococcus aureus*, *Clostridium botulinum*. Symptoms and prevention of foodborne illnesses. Hygiene and sanitation in food handling and processing. HACCP (Hazard Analysis and Critical Control Points) principles and their application in food safety.

UNIT IV BENEFICIAL MICROORGANISMS IN FOOD (9 hours)

Role of microorganisms in food production: fermentation. Fermented foods: milk products (yogurt, cheese), vegetables (sauerkraut, pickles), bread, and alcoholic beverages. Probiotics and prebiotics. Starter cultures and their importance in controlled fermentation. Genetically modified microorganisms in food production.

UNIT V CONTROL OF MICROORGANISMS IN FOOD (9 hours)

Principles of microbial control. Physical methods: heat (pasteurization, sterilization), low temperatures (refrigeration, freezing), drying, irradiation, and high pressure processing. Chemical methods: use of food preservatives (e.g., nitrites, sulfites, organic acids). Biological methods: bacteriocins, bacteriophages. Aseptic packaging.

TEXT BOOKS

1. Montville, T. J., & Matthews, K. R. (2022). Food Microbiology: An Introduction. 5th ed. ASM Press.
2. Doyle, M. P., & Buchanan, R. L. (2020). Food Microbiology: Fundamentals and Frontiers. 4th ed. ASM Press.

REFERENCE BOOKS

1. Adams, M. R., & Moss, M. O. (2018). Food Microbiology. 4th ed. Royal Society of Chemistry.
2. Ray, B., & Bhunia, A. K. (2018). Fundamental Food Microbiology. 6th ed. CRC Press.
3. Forsythe, S. J. (2019). The Microbiology of Safe Food. 3rd ed. Wiley-Blackwell.

List of experiments:

1. Preparation and sterilization of culture media.
2. Microscopic observation and staining of microorganisms (simple, Gram, acid-fast staining).
3. Streak plate method for isolation of pure cultures.
4. Pour plate method for enumeration of microorganisms.
5. Spread plate method for enumeration of microorganisms.
6. Yeast and mold count from food samples.
7. Detection of coliforms by MPN method.
8. Detection of specific foodborne pathogens (Salmonella, S. aureus, etc.)
9. Antimicrobial activity assay (disc diffusion method).
10. Hanging drop method for demonstration of bacterial motility.
11. Effect of physical and chemical agents on microbial growth.

Assessment Methodology	Assessment Tools	Marks
Test	CAT1; CAT2	10
Model Exam (Theory)	Model Exam	5
Assignment	Report and Presentation	5
Practical	Performance, Observation and Record	10
Model Practical	Performance and viva voce	15
Attendance		5
Total		**50**

25UFTP27	BASIC ELECTRICAL AND ELECTRONICS LAB	Category	L	T	P	Credit
		ES	0	0	2	1

Course Objectives:

- Demonstrate the practical implementation of fundamental electrical laws and theorems.
- Enable students to measure and analyze the behavior of electric circuits under DC and AC conditions.

- Provide hands-on experience with electrical instruments and measurement techniques.
- Introduce the practical applications of magnetic circuits, electrical energy utilization, and safety practices.
- Develop skills in identifying, constructing, and testing basic wiring systems and protective devices.

Prerequisite : Physics

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

CO1	Apply basic circuit laws and perform electrical measurements on DC and AC circuits	K3
CO2	Analyze electrical parameters in magnetic and AC circuits using appropriate instruments and methods.	K2
CO3	Demonstrate knowledge of electrical wiring, lighting systems, protection devices, and safety practices.	K3

LIST OF EXPERIMENTS

1. Verification of Ohm's Law and Kirchhoff's Laws (KVL & KCL
2. Series and Parallel Resistance Circuits – Calculation and Measurement
3. Star-Delta and Delta-Star Conversion – Theoretical and Practical Validation
4. Mesh and Nodal Analysis using DC circuits with independent sources
5. Magnetic Field and Force Measurement on a Current-Carrying Conductor
6. Measurement of Self and Mutual Inductance using Coupled Coils
7. Measurement of RMS, Average, Form Factor and Peak Factor of AC waveforms using CRO
8. Phasor Analysis and Power Measurement in Single Phase AC Series Circuit (R-L or R-C or RLC)
9. Measurement of Power in Single Phase Load using Wattmeter and Voltmeter-Ammeter Method
10. Study and Demonstration of Electric Heating Methods (Resistance, Induction, Dielectric – any one)
11. Study of Electrical Lamps (Incandescent, Fluorescent, LED, etc.) and their Luminous Efficiency
12. Demonstration of Electrical Wiring Systems and Protective Devices (MCB, Fuse, Earthing Types)

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	20
Record work	Record	10
Viva		5
Model exam	Performance and viva voce	15
Attendance		10
Total		**60**

25UGEP28	FABRICATION LAB	Category	L	T	P	Credit
		ES	0	0	2	1

Prerequisite:

- Basic understanding of forces, energy, motion, and electricity.
- Exposure to basic fitting, carpentry, and sheet metal work.

Preamble/ Course Objective

1. To practice the usage of various tools towards assembly and dis-assembly of different items / equipment.
2. To make simple part / component using welding processes.
3. To train on the basic wiring practices of boards, machines, etc.
4. To provide a hands-on experience on the use of electronic components, equipment, sensors and actuators.
5. To expose to modern computer tools and advanced manufacturing / fabrication processes.

Course Outcome

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

CO1	Assemble and dis-assemble various items / equipment.	K3
CO2	Make simple parts using suitable welding processes.	K3
CO3	Setup wiring of distribution boards, machines, etc.	K3
CO4	Utilize the electronic components to fabricate a simple equipment, aided with sensors and actuators.	K3
CO5	Assemble and dis-assemble various items / equipment.	K3

Syllabus

LIST OF ACTIVITIES

(A). Dis-assembly & Assembly Practices

i) Tools and its handling techniques.

ii) Dis-assembly and assembly of home appliances – Grinder Mixer Grinder, Ceiling Fan, Table Fan & Washing Machine.

iii. Dis-assembly and assembly of Air-Conditioners & Refrigerators.

iv. Dis-assembly and assembly of a Bicycle, IC Engines.

(B). Welding Practices

i. Welding Procedure, Selection & Safety Measures.

ii. Power source of Arc Welding – Gas Metal Arc Welding & Gas Tungsten Arc Welding processes.

iii. Hands-on session of preparing base material & Joint groove for welding.

iv. Hands-on session of MAW, GMAW, GTAW, on Carbon Steel & Stainless Stell plates / pipes, for fabrication of a simple part.

(C). Electrical Wiring Practices

I. Electrical Installation tools, equipment & safety measures.

II. Hands-on session of basic electrical connections for Fuses, Miniature Circuit

Breakers and Distribution Box,

III. Hands-on session of electrical connections for Lightings, Fans, Calling Bells.

IV. Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.

(D). Electronics Components / Equipment Practices

i. Electronic components, equipment & safety measures.

ii. Dis-assembly and assembly of Computers.

iii. Hands-on session of Soldering Practices in a Printed Circuit Breaker.

iv. Hands-on session of Bridge Rectifier, Op-Amp and Tran impedance amplifier.

v. Hands-on session of integration of sensors and actuators with a Microcontroller.

vi. Demonstration of Programmable Logic Control Circuit.

(E). Contemporary Systems

i. Demonstration of Solid Modelling of components.

ii. Demonstration of Assembly Modelling of components.

iii .Fabrication of simple components / parts using 3D Printers.

iv. Demonstration of cutting of wood / metal in different complex shapes using Laser Cutting Machine.

Text Book

Reference Book & Web Resources

1. Stephen Christena, Learn to Weld: Beginning MIG Welding and Metal Fabrication Basics, Crestline Books, 2014.
2. H. Lipson, Fabricated - The New World of 3D Printing, Wiley, 1st edition, 2013.
3. Code of Practice for Electrical Wiring Installations (IS 732:2019)
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Oxford University Press, 7th ed. (Indian edition), 2017.

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Design and fabrication of models	Working prototype demo	5
Model contest	Review	5
Attendance		10
Total		**60**

25UPCE21	COMMUNICATION SKILLS	Category	L	T	P	Credit
		EEC	0	0	2	0

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: Career 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 1: 10 Hrs

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 2: **10Hrs**

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 3: 10 Hrs

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

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

UNIT 4: **10 Hrs**

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 5: **8 Hrs**

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

Active Sessions: Debate – Picture Connector

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

Assessment Methodology	**Assessment Tools**	**Marks**
Test 1 (Modules 1-2)	Internal Tests	15
Test 2 (Modules 3-5)	Internal Tests	15
Presentation Skills Demonstration	Practical Assessment	15
Public Speaking and Confidence Assessment	Practical Assessment	10
SWOT Analysis Report	Assignment	10
Active Listening and Conversation Skills Demo	Practical Assessment	10
Team Building Activity and Leadership Role	Project	10
Debate Participation and Performance	Practical Assessment	10

Assessment Methodology	Assessment Tools	Marks
Attendance and Class Participation	Continuous Assessment	5
Total		**100**

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

Preamble/ 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

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

UNIT I: Philosophical Foundations of Indian Knowledge Systems (6 Hours) - 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

UNIT II: Indian Literary and Artistic Traditions (6 Hours) - 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

UNIT III: Social Organization and Governance (6 Hours) - 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

UNIT IV: Educational Systems and Knowledge Transmission (6 Hours) - 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

UNIT V: Contemporary Relevance and Applications (6 Hours) - 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 challenges

Learning Activities

Research Projects: 1. **Philosophical Analysis Project** - Study of a specific philosophical school - Comparison with contemporary thought - Presentation of findings

2. **Literary Heritage Study**
   - Analysis of classical texts
   - Cultural significance evaluation
   - Creative interpretation through modern media
3. **Social Systems Research**
   - Historical analysis of governance models
   - Contemporary applications study
   - Policy recommendation development
4. **Case Study Analysis**
   - Traditional knowledge applications
   - Success stories and challenges
   - Future implementation strategies

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

Assessment Methodology	**Assessment Tools**	**Marks**
Philosophical Analysis Assignment	Assignment	25
Comparative Study Project (Ancient vs Modern)	Project	20
Literary/Artistic Tradition Presentation	Presentation	20
Heritage Site Visit and Report	Field Work	10
Contemporary Application Case Study	Assignment	15
Attendance and Class Participation	Continuous Assessment	10
Total		**100**

25UMCC23	**HOLISTIC WELLNESS**	**Category**	**L**	**T**	**P**	**Credit**
		MCC	**0**	**0**	**1**	**0**

Course Prerequisite

- Nil

Course Objective

- Foundational concepts of holistic wellness, emphasizing the integration of physical, mental, emotional, and Internal well-being. create a balanced lifestyle that promotes overall health and happiness through practical activities.
- Explore advanced techniques in mental, emotional, and spiritual well-being, with an emphasis on creating sustainable wellness habits.

Course Outcome

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

CO1	Understand the basic principles of holistic wellness. Apply strategies for maintaining physical health, including nutrition and exercise	Understand
CO2	Practice mindfulness techniques to enhance mental and emotional well-being.	Analyze
CO3	Develop a personal wellness plan incorporating various aspects of holistic health.	Apply

CO4	Apply advanced techniques in mindfulness, meditation, and stress management.	Evaluate
CO5	develop resilience and adaptability in maintaining wellness. Refine and sustain a personalized holistic wellness plan.	Create

UNIT I INTRODUCTION TO HOLISTIC AND PHYSICAL WELLNESS

Overview of holistic wellness: physical, mental, emotional, and internal health- The importance of balance in overall well-being. Importance of physical activity and exercise- Understanding nutrition and its role in health- Sleep hygiene and its impact on well-being.

Hands-on activity: Self-assessment of current wellness status.Designing a personalized fitness and nutrition plan.

UNIT II: MENTAL AND EMOTIONAL WELLNESS:

Stress management techniques- The role of Yoga, mindfulness and meditation in mental health- Emotional intelligence and its impact on relationships.

Hands-on activity: Practicing Yoga, mindfulness and emotional regulation exercises.

UNIT III: INTEGRATING WELLNESS PRACTICES:

Combining physical, mental, emotional, and Internal wellness practices into daily life - Developing a balanced wellness plan.

Hands-on activity: Creating a comprehensive personal wellness plan.

UNIT IV: EMOTIONAL RESILIENCEAND ADVANCED MINDFULNESS

Deepening mindfulness practices for enhanced mental clarity- Exploring different forms of meditation (e.g., guided, transcendental, movement-based). Building emotional resilience through positive psychology practices- Cognitive-behavioural strategies for managing stress and anxiety.

Hands-on activity: Developing and practicing a resilience toolkit. Daily meditation practice and journaling reflections.

UNIT V: INTERNAL GROWTH AND SUSTAINING WELLNESS PRACTICES:

Exploring the deeper aspects of internal wellness and self-actualization- Reflective practices for discovering life purpose and meaning. Strategies for maintaining wellness habits over the long term- Adapting wellness plans to life changes and challenges-

Hands-on activity: Revising and finalizing a long-term personal wellness plan. Creating a vision board or personal mission statement.

TEXTBOOKS:

1. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
2. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).
3. Patel, Kamlesh. Heartfulness Way: Heart-Based Meditations for Spiritual Transformation, Kamlesh Patel, 2018.

REFERENCE BOOKS

1. B.K.S Iyengar., Yoga: The Path to Holistic Health., Dorling Kindersley Limited, City of Publication (2001)
2.Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
3.James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
4.Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
5.KalderdonAdizesIchak., What Matters in Life: Lessons I Learned from Opening My Heart ., WS Press, Newtown, PA (2023)
6. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
7. Lipton, Bruce., The Biology of Belief 10th Anniversary Edition: Unleashing the Power of Consciousness, Matter & Miracles, Hay House, Carlsbad (2015).

WEB RESOURCES

1. Learning Suryanamskar
2. Yoga for well-being
3. Nutritional Educational contents
4. Introduction to Psychology
5. Guided Meditation
6. Simplified physical exercises instructions
7. Simplified Physical Exercises
8. Life skills and value education
9. James Allen Library

Assessment Methodology	**Assessment Tools**	**Marks**
Sports Skills Demonstration (Team/Individual Sports)	Practical Assessment	25
Yoga Asanas and Breathing Techniques Performance	Practical Assessment	25
Personal Fitness Plan Development and Implementation	Practical Assessment	25
Physical Activity and Academic Performance Analysis	Practical Assessment	25
Total		**100**