SCHEME OF INSTRUCTION AND SYLLABI OF B. TECH I AND II SEMESTERS

FOR

BIOTECHNOLOGY

(In line with AICTE Model Curriculum with effect from AY 2026-27)

(R–26 Regulation)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Affiliated to OU, Approved by AICTE, Accredited by NBA, NAAC (A++)

Kokapet Village, Gandipet Mandal, Hyderabad– 500 075. Telangana

E-Mail: principal@cbit.ac.in; Website: www.cbit.ac.in;

Phone Nos.: 040-24193276 / 277 / 279

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
DEPARTMENT OF BIOTECHNOLOGY

INSTITUTE VISION AND MISSION

VISION

To be centre of excellence in technical education and research

MISSION

To address the emerging needs through quality technical education and advanced research

DEPARTMENT VISION AND MISSION

VISION

To excel in education, research and entrepreneurship in various fields of Biotechnology for contribution to the evolving needs of the society

MISSION

1. To provide an excellent educational experience to the undergraduate students of Biotechnology through quality teaching and advanced curriculum with roots into the fundamentals, that enables students to become leaders in their chosen field of Biotechnology
2. To provide vibrant learning and research environment that enables students to focus on lifelong learning to transform into entrepreneurs, and renowned researchers
3. To instil the spirit of innovation and creativity in young minds through participation in International and National level conferences/hackathons combined with a deep awareness of ethical responsibilities to profession and society

PROGRAM EDUCATIONAL OBJECTIVES (PEOS):

The Biotechnology department is dedicated to graduating engineers who,

1. Will demonstrate successful careers in industry through scientific thinking, interpreting, analysing experimental results and pursue higher education and research in reputed national and international institutes.
2. Will demonstrate leadership and initiative to advance professional and organizational goals with a commitment to ethical standards of profession, teamwork, and respect for diverse cultural background
3. Will be involved in lifelong /self-learning to keep abreast with the constantly evolving technologies for establishing start-ups and becoming successful entrepreneurs.
4. Will be committed to creative practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.

PROGRAM 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. (WK1 to WK4)

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. (WK5)

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. (WK8).

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. (WK2 and WK6)

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. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

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. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOS):

Students should be able to

1. Apply the concepts of Biotechnology in the fields of health care, agriculture, biofuels, food industry and other relevant areas
2. Demonstrate adequate proficiency of good lab practices by adopting standard operating protocols and illustrate independent, safe and accurate handling of the biotechnology lab equipment

KNOWLEDGE AND ATTITUDE PROFILE (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R 26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

B. TECH BIOTECHNOLOGY

SEMESTER – I

S. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			SEE in Hours	Maximum Marks		
			L	T	P / D		CIE	SEE	
THEORY									
1	26MTC03/ 26BTC01	Mathematics-I / Basics of Biology-I	3	1	-	3	40	60	4
2	26CYC01	Applied Chemistry	3	-	-	3	40	60	3
3	26EEC01	Basic Electrical Engineering	3	-	-	3	40	60	3
4	26CSC01	Problem Solving and Programming Using C	3	-	-	3	40	60	3
5	26ADC01	Artificial Intelligence Foundations and Applications	2	-	-	3	40	60	2
	PRACTICAL								
6	26CYC02	Applied Chemistry Lab	-	-	3	3	50	50	1.5
7	26EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
8	26CSC02	Problem Solving and Programming Using C Lab	-	-	3	3	50	50	1.5
9	26MEC01	Robotics & Drones Lab	-	1	2	3	50	50	2
10	26MBC02	Community Engagement	-	-	2	-	50	-	1
TOTAL			**14**	**2**	**12**		**450**	**500**	**22**
Clock hours per week: 28									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R 26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

B. TECH BIOTECHNOLOGY

SEMESTER–II

S.No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC06/ 26BTC02	Mathematics-II / Basics of Biology-II	3	1	-	3	40	60	4
2	26PYC07	Physics	3	-	-	3	40	60	3
3	26BTC03	Process Principles and Reaction Engineering	3	-	-	3	40	60	3
4	26EGC01	Communicative English	2	-	-	3	40	60	2
	PRACTICALS								
5	26PYC08	Physics Lab	-	-	3	3	50	50	1.5
6	26MEC03	Engineering Graphics	-	1	3	3	50	50	2.5
7	26CSC38	Python Programming Workshop	-	-	3	3	50	50	1.5
8	26MEC04	Engineering Workshop & 3D Printing	-	-	3	3	50	50	1.5
9	26EGC02	Communication Skills Lab	-	-	2	3	50	50	1
TOTAL			**11**	**2**	**14**		**410**	**490**	**20**
Clock hours per week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R 26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

B. TECH BIOTECHNOLOGY

SEMESTER – I

S. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			SEE in Hours	Maximum Marks		
			L	T	P / D		CIE	SEE	
THEORY									
1	26MTC03/ 26BTC01	Mathematics-I / Basics of Biology-I	3	1	-	3	40	60	4
2	26CYC01	Applied Chemistry	3	-	-	3	40	60	3
3	26EEC01	Basic Electrical Engineering	3	-	-	3	40	60	3
4	26CSC01	Problem Solving and Programming Using C	3	-	-	3	40	60	3
5	26ADC01	Artificial Intelligence Foundations and Applications	2	-	-	3	40	60	2
	PRACTICAL								
6	26CYC02	Applied Chemistry Lab	-	-	3	3	50	50	1.5
7	26EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
8	26CSC02	Problem Solving and Programming Using C Lab	-	-	3	3	50	50	1.5
9	26MEC01	Robotics & Drones Lab	-	1	2	3	50	50	2
10	26MBC02	Community Engagement	-	-	2	-	50	-	1
TOTAL			**14**	**2**	**12**		**450**	**500**	**22**
Clock hours per week: 28									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

26MTC03

MATHEMATICS-I

(Biotech- BIPC Stream)

Instruction:	3 L+1T Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	4

COURSE OBJECTIVES:

1. To develop understanding of matrices, their types and algebraic operations.
2. To introduce trigonometric functions, elementary angles and their transformations.
3. To develop methods for solving cubic and bi-quadratic equations.
4. To explain the fundamental concepts of limits and continuity of functions.
5. To develop skills in differentiation of basic algebraic and trigonometric functions.

COURSE OUT COMES: Upon completing this course, students will be able to:

1. Perform matrix operations and compute the inverse of a matrix.
2. Evaluate trigonometric functions for standard angles and apply transformations.
3. Solve cubic and bi-quadratic equations using appropriate methods.
4. Evaluate limits and examine continuity of functions.
5. Differentiate algebraic and trigonometric functions using standard rules.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	1	1	2						2	1	
CO2	3	2	1	1	1						2	1	
CO3	3	3	2	1	1						2	1	
CO4	3	3	1	2	1						2	1	
CO5	3	3	1	1	1						2	1	

1 - Slightly, 2 - Moderately, 3 - Substantially

UNIT-I: Matrices

Introduction of matrix, order of matrix, types of matrices, (Square, Rectangular, Diagonal, Scalar, Unit, Null, Row, Column, Triangular Matrices) definitions with example. Scalar multiple of a matrix, Multiplication of Matrices, Transpose of a Matrix, Symmetric & Skew symmetric matrices, determinants, Adjoint & Inverse of a Matrix.

UNIT-II: Trigonometry

Introduction of Trigonometry, Trigonometric ratios of Compound angles, multiple angles & submultiple angles, sum and product of transformations, Introduction of Hyperbolic functions.

UNIT-III: Theory of Equations

Definition of polynomial, Remainder theorem (only statement) , fundamental theorem of algebra (only statement), Relation between roots and coefficients related problems, solution of an equation when two or more of its roots are connected by certain relations, synthetic division & related problems. Trial and error method and related problems.

UNIT-IV: Limits and continuity

Introduction of Intervals and neighborhoods, definition of limit and its related problems, left hand limit, right hand Limits and its related problems. Standard limits and its related problems, infinite limit, limits at infinity and its related problems, definition of Continuity and its related problems, Left & Right Continuity and its related problems.

UNIT-V: Differentiation

First principle of derivative (definition of derivative) & related Problems, Elementary properties (derivatives of sum & difference of two functions, derivative of product of two functions, reciprocal of a function, quotient of two functions, composite functions) and related problems, derivatives of trigonometric functions and related problems, derivatives of Hyperbolic functions, differentiation by substitution method, second order derivatives.

TEXT BOOKS:

1. Telugu academy Intermediate Mathematics books IA, IB &IIA.
2. Handbook -Mathematics (Key notes, Terms, Definitions, Formular)- Arihant Publications.

SUGGESTED READING:

1. Matrices By Shanti Narayan | PK Mittal S. Chand Publishing, 2010.
2. Schaum's Outline of Trigonometry, sixth edition, Frank Ayres & Robert E. Moyer.
3. Thomas' Calculus Early Transcendentals Thirteenth Edition.

26BTC01

BASICS OF BIOLOGY - I

(For MPC Stream of Biotech)

Instruction:	3 L+1T Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	4

COURSE OBJECTIVES: This course aims to

1. To give understanding of fundamentals of origin of life and various theories of evolution.
2. To give an insight into plant cells and its organelles
3. To provide knowledge on the classification of plants and their propagation mode.
4. To impart theoretical knowledge on various physiological aspects of plants
5. To give the students an understanding of knowledge on microbes and their economic importance.

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

1. Summarize the theories behind the origin of life and evolution studies.
2. Describe the structure and functions of plant cells and their organelles.
3. Classify major plant groups based on plant life cycles and reproductive modes.
4. Infer the basic physiological processes in plants and various methods of crop improvement.
5. Demonstrates characteristics of bacteria, fungi, and viruses and explains virus related diseases and economic importance of microbes.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2						2	2	2		2	2	
CO2	2						2	2	2		3	2	1
CO3	2						2	2	2		3	3	
CO4	2						2	2	2		3	3	1
CO5	2						2	2	2		3	3	1

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT I

History of Life and Evolution: History of Earth, Evolutionary theories of origin of life. Experimental verification of the chemical origin of life. Darwinism, Natural selection, Sexual selection, Artificial selection, Mendelism, Hugo De Vries mutation theory, Neo-Darwinism. Introduction and importance of classification - five kingdoms (Monera, Protista, Fungi, Plantae, and Animalia).

UNIT II

Cell Structure and Internal Organization of Plants: Cell as a basic unit of life, an overview of the plant cell, cell cycle, cell division, mitosis, and meiosis. Concept of growth, meristems (apical, intercalary, and lateral) their functions. Simple tissues (parenchyma, collenchyma, and sclerenchyma), complex tissues (xylem and phloem). Tissue systems (epidermal, ground and vascular)

UNIT III

Plant Systematic and Reproduction: Plant kingdom, salient features of classification. Alternation of generation of plants. General characteristics of Algae, Bryophytes, Pteridophyta, Gymnosperms, and life cycle of Angiosperms. Overview of modes of reproduction-Asexual: vegetative propagation, budding, sporulation, binary fission; Sexual reproduction: pollination, fertilization, development of embryo, endosperm, fruit, and seed formation. Apomixes, parthenocarpy, polyembryony type of reproduction.

UNIT IV

Plant Physiology and Concepts in Plant Biotechnology: Absorption of water soil water, water potential, diffusion, imbibition, osmosis, plasmolysis, absorption of water, ascent of sap, transportation. Crop improvement - Heterosis and mutation breeding. Plant tissue culture techniques and their applications. Plant growth regulators.

UNIT V

Introduction to Microbial World: General account of prokaryotes: structure & function of the bacterial cell. Concept of species and strains. Salient properties of Fungi and type study of Rhizopus. General characteristics of Virus. Study of Bacterial viruses - T4, plant viruses TMV, animal viruses HIV. Structure Reproduction in bacteria (asexual-binary fission and sexual-conjugation) and viruses (lytic and lysogenic). Economic importance of beneficial bacteria (agriculture, industry, medicine, and biotechnology).

TEXTBOOKS:

1. Ray F. Evert, Susan E. Eichhorn Biology of Plants W. H. Freeman 2012. Tata McGraw Hill Publishing Co. Pvt. Ltd 9th edition, (2010).
2. Campbell, N.A., Reece, J.B., Urry, Lisa, Cain, ML., Wasserman, S.A., Minorsky, P.V., Jackson, R.B.Biology: A Global 11th edition, Pearson Education Ltd. (2017)

SUGGESTED READING:

1. Willey, J. M., Sherwood, L., Woolverton, C. J., Prescott, L. M., & Willey, J. M New York: McGraw-Hill. 6th Edition (2011).

26CYC01

APPLIED CHEMISTRY

Common to B. Tech (Biotech & Chemical Engineering)

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	3

COURSE OBJECTIVES: This course aims to

1. Develop the concepts of structure and stereochemistry of organic compounds.
2. Describe electrochemical energy storage devices like batteries and fuel cells.
3. Explain the chemistry and biological importance of biomolecules.
4. Create awareness about wastewater treatment and environmental protection.
5. Discuss the applications of quantum dots and nanomaterials in engineering field.

COURSE OUTCOMES: At the end of the course, student will be able to

1. Illustrate stereo chemical concepts and reaction mechanisms of organic molecules.
2. Analyse the performance and efficiency of electrochemical energy systems.
3. Correlate the structure of biomolecules with their role in bioengineering systems.
4. Evaluate water quality parameters and select appropriate domestic and industrial treatment techniques.
5. Apply fundamental concepts of quantum confinement effect and nanomaterials in modern technology.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	2			2					2	2	2
CO2	3	2	2			2					2	2	2
CO3	3	2	3			2					2	3	2
CO4	3	2	3			3					2	3	3
CO5	3	2	2			2					2	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT – I: Introduction to Organic Chemistry

Structure and bonding in organic molecules (hybridzation), Electronic displacement in molecules – inductive, mesomeric, orientation and steric effects.

Stereochemistry: Definition, types of stereoisomerism-conformational isomerism- conformations of n-butane (Newman and Sawhorse representations), configurational isomerism- geometrical and optical isomerism-optical activity, symmetry and chirality. Enantiomers (lactic acid) and diastereomers (tartaric acid). Absolute configurations - Sequence rules for RS notation.

Types of organic reactions: Substitution Reactions- electrophilic substitution (nitration of benzene), nucleophilic substitution (SN^1 and SN^2) and free radical substitution (halogenation of Alkanes). Addition reactions- electrophilic addition (Markovnikov's rule), free radical addition (anti-Markovnikov's rule, peroxide effect) and nucleophilic addition reactions (addition of HCN to carbonyl compounds). Eliminations Reactions- E^1 and E^2 (dehydrohalogenation of alkyl halides), Saytzeff's rule.

UNIT-II: Energy Generation and Storage

Electrode potentials, Cell potentials, Reference electrodes – construction and working of standard hydrogen electrode (SHE) and saturated calomel electrode. Electrochemical series and its applications. Nernst equation and its applications - numericals. Determination of pH using glass electrode and quinhydrone electrode.

Electroanalytical techniques: Principle, method and applications of conductometry (acid-base titration), potentiometry (acid-base, redox titration).

Green energy and sustainability: Priciples of green chemistry. Production, storage and applications of green hydrogen.

UNIT-III: Biomolecules

Carbohydrates as an energy storage system: Classification of carbohydrates, structure of glucose, fructose, cellulose and starch. Determination of the open chain structure of glucose; Haworth (cyclic) structure of glucose, mutarotation.

Lipids: Fatty acids-saturated and unsaturated fatty acids. Oils- tests to check the purity of oils-acid value, saponification value and iodine Value. Applications of lipids in bioengineering.

Amino acids: Structural classification of amino acids based on R group, Zwitterion structures. Synthesis of amino acids by amination of α-halogen acids, Gabriel phthalimide synthesis and Strecker synthesis.

Nucleic acids: The structural features and functions of DNA and RNA.

UNIT–IV: Water Chemistry

Hardness of water: Types, units of hardness and disadvantages of hard water. Alkalinity of water and its estimation. Numerical problems on hardness of water and alkalinity. Boiler troubles – scales and sludge formation, causes, effects and prevention. Softening of water by ion exchange method. Desalination of water by reverse osmosis and electro dialysis method. Specifications of potable and industrial water. Disinfection of water by chlorination method, breakpoint chlorination. BOD and COD- definition, estimation (only brief procedure) and significance. Industrial wastewater treatment by using Zero Liquid Discharge (ZLD) method.

UNIT-V: Quantum dots and Nanomaterials

Nanomaterials: Introduction to nanomaterials and their classification as 0D, 1D, 2D and 3D materials. General applications of nanomaterials. Basic chemical method of preparation: sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (principles only).

Quantum dots: Definition and classification of quantum dots. Concept of quantum confinement. Size dependent optical properties (absorption and photoluminescence). Core and core shell quantum dots - surface capping and functionalization with emphasis on stability. Applications in LEDs, solar cells, bio-imaging and sensing. Raman Spectroscopy (Principle only).

Composite materials: Definition and classification of composites- Particle reinforced, fibre reinforced - glass fibre reinforced and carbon fibre reinforced composites and their applications.

TEXT BOOKS

1. P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Ltd., New Delhi, 17th edition (2025).
2. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, “Organic Chemistry”, Pearson, Delhi, 7th edition (2019).
3. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar,“Drugs”, Universities Press (India) Limited, Hyderabad (2016).

SUGGESTED READINGS

1. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, “Organic Chemistry”, Wiley, 12th edition (2017).
2. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2018

26EEC01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	3

COURSE OBJECTIVES: This course aims to

1. Understand the behavior of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. Comprehend the basic principle of operation of AC and DC machines
3. Infer about different types of cables, wires, safety rules, sensors and methods of Earthing,

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

1. Understand the concepts of Kirchhoff's laws and their application of various theorems to get solutions of simple DC circuits.
2. Predict the steady state response of RLC circuits with AC single phase/three phase supply.
3. Infer the basics of single phase transformer
4. Describe the construction, working principle of DC machine and 3-phase Induction motor.
5. Acquire knowledge of electrical wires, cables, earthing, and electrical safety precautions to be followed in electrical installations, including electric shock protection, energy calculations, and sensors.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	2					1	2		3	3	2
CO2	3	3	2					1	2		3	3	2
CO3	3	3	2	1				1	2		3	2	2
CO4	2	1						1	2		3	3	2
CO5	2		2					1	2		3	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT-I

DC Circuits:

Electrical Circuit Elements: R, L and C, voltage and current sources, Kirchhoff current (KCL) and voltage laws (KVL), Analysis of simple circuits with DC excitation: Nodal Analysis, Mesh Analysis, Superposition, Thevenin's and Norton's Theorems.

UNIT-II

AC Circuits:

Single Phase AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, series RL and RC.

Three phase balanced circuits: Introduction, Comparison of Single phase and Three Phase System, voltage and current relations in star and delta connections (Elementary treatment only)

UNIT-III

Single Phase Transformer: Construction, Working Principle, EMF Equation, Comparison of Ideal and Practical Transformer, Losses, OC and SC tests and Efficiency.

UNIT-IV

DC and AC Machines:

DC Generators: Construction, Principle of operation, EMF equation, Classification, Applications

DC Motors: Principle of operation, Classification, Torque Equation, Characteristics & Speed control of DC Shunt Motor, Applications.

Three Phase Induction Motors: Principle of operation, Applications

UNIT-V

Electrical Installations and Sensors:

Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, and first aid for electric shock.

Components of LT Switchgear: Fuse, MCB and Earthing (Elementary Treatment only), Elementary calculations for energy consumption.

Sensors: Introduction, Working Principle, Types-Temperature, Humidity, and Motion (Elementary treatment only).

TEXTBOOKS:

1. Allan R. Hambley, "Electrical Engineering: Principles and Applications", Pearson -7th Edition ,2022.
2. C.K. Alexander and M.N.O. Sadiku, "Fundamentals of Electric circuits" , 7th Edition, 2021.
3. B L Theraja , A K Theraja , A Text book of Electrical Technology volume 1 : Basic Electrical Engineering , 24th Edition , S Chand ,May 2023.
4. D. Patranabis, Sensors and Transducers, 2nd Edition, PHI Learning Private Limited (Eastern Economy Edition), New Delhi
5. Jacob Fraden," Handbook of Modern Sensors (Physics, Designs, and Applications)" Fifth Edition, 2016

SUGGESTED READINGS:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", 4th Edition , Tata McGraw Hill, April 2019.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 2nd Edition , 2022
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2nd Edition , June 2019
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013
5. Electrical Wiring and Installation by S.K. Bhattacharya (McGraw-Hill Education India)
6. Piezoelectric Sensors and Actuators: Fundamentals and Applications, Springer, 2018 Senturia S.

Online Resources:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Basic Electrical Circuits	Prof. Nagendra Krishnapura	IIT Madras
2	Electrical Machines	Prof. Anirban Sengupta	IIT Kanpur
3	Electric Circuits	Prof. S. C. Dutta Roy	IIT Delhi
4	Basic Electrical Technology	Prof. D. P. Kothari	IIT Delhi
5	Introduction to Electrical Engineering	Prof. S. K. Sharma	IIT Kanpur

26CSC01

PROBLEM SOLVING AND PROGRAMMING USING C

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	3

PREREQUISITES: Basic high school mathematics.

COURSE OBJECTIVES: This course aims to

1. Understanding the steps in problem solving and formulation of algorithms to problems.
2. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
3. Develop intuition to enable students to come up with creative approaches to problems.

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

1. List and outline the steps to develop algorithmic solutions and identify flowchart symbols.
2. Illustrate programming concepts such as variables, data types, conditionals, loops, print statements, and functions.
3. Develop algorithms using recursion and iteration techniques.
4. Analyze the use of arrays, pointers, initialization, and dynamic memory allocation.
5. Evaluate and develop large-scale programs using multiple files, header files, and make utilities.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	1		1						1	1	1	3
CO 2	3	1	1		1						1	2	1	3
CO 3	3	1	1		1						1	2	1	3
CO 4	3	1	1		1						1	2	2	3
CO 5	3	1	1		1						1	3	2	3

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Introduction: Introduction to Programming, Idea of Algorithm, Representation of Algorithm, Flowchart, from algorithms to programs, source code.

Basics of C: Background, Structure of a C Program, Datatypes, Tokens, Operators and Expressions-Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions, Input and Output Functions.

UNIT-II

Control Statements: Conditional Execution -Selection Statements, Conditional Operator, Switch statement**.** Iteration Execution - While Construct, For Construct, do-while Construct Goto Statement, Special Control Statements, Nested Loops.

Arrays: One-Dimensional Arrays-Declaration, Initialization, internal representation. Multidimensional Arrays.

UNIT–III

Strings: Strings: One-dimensional Character Arrays, Arrays of Strings: Two-dimensional Character Array.

Search and Sorting: Searching algorithms-linear, binary searching. Sorting algorithms- bubble sort, selection sort.

Functions: Concept, Uses, Prototype, Declaration, Parameter passing techniques, Passing Arrays to Functions, Storage Classes, Recursion.

UNIT-IV

Pointers: Declaring a Pointer, Initializing Pointers, Indirection Operator and Dereferencing, Arrays and Pointers, Pointers and Strings, Pointers to Pointers, Array of Pointers, Pointers to an Array, Two-dimensional

Arrays and Pointers, Pointers to Functions and Dynamic Memory Allocation.

UNIT–V

User-defined Datatypes: Structures- Declaring Structures and Structure Variables, Accessing the Members of a Structure, Initialization of Structures, Typedef, Nesting of Structures, Arrays and Structures. Union, Enumeration Types.

Files: Using Files in C, Declaration of File Pointer, Working with Text Files, Character Input and Output, Working with Binary Files, Sequential Versus Random File Access, File Record.

C Preprocessor Directives.

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh "Programming in C 2/e", 2nd Edition, Oxford University Press, 2012.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language", 2nd Edition (Paperback), Prentice Hall India, 2018.

SUGGESTED READING:

1. B.A.Forouzan and Hassan Afyouni "A Structured Programming Approach in C", 4th Edition, Cengage Learning, 2024.
2. E. Balaguruswamy, "Programming in ANSI C", 9th Edition, Tata McGraw-Hill, 2024.
3. Paul Deitel and Harvey Deitel, "C: How to Program", 9th Edition, Pearson, 2022.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://archive.nptel.ac.in/courses/106/105/106105171/

26ADC01

ARTIFICIAL INTELLIGENCE FOUNDATIONS AND APPLICATIONS

Instruction:	2L Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	2

PREREQUISITE: NIL

COURSE OBJECTIVES: This course aims to:

1. Provide a foundational understanding of Artificial Intelligence and its evolution
2. Introduce key AI subfields and their real-world applications across industries
3. Explain the impact of AI on society, including ethical and fairness considerations
4. Study emerging trends such as Generative AI and future directions

COURSE OUTCOMES: Upon completion of this course, students will be able to:

1. Understand the basic concepts and evolution of Artificial Intelligence
2. Illustrate major AI subfields and their functionalities
3. Develop and describe applications of AI in various domains
4. Elaborate ethical issues, bias, and societal impacts of AI systems
5. Demonstrate emerging trends such as Generative AI and their future implications

CO-PO Articulation Matrix:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2										2	
CO2	3	3										2	1
CO3	2	3				2						3	1
CO4	2	2				2	2	3				1	1
CO5	2	2				2	2	2				2	

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT - I

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Evolution of Artificial Intelligence: early developments and growth of AI. Definition and scope of AI. Core components of AI: Machine Learning, Pattern Recognition, Natural Language Processing, and Computer Vision. Concept of Artificial General Intelligence (AGI)

UNIT - II

AI SUBFIELDS AND TECHNOLOGIES

Introduction to AI subfields: **Computer Vision** - object detection, facial recognition, medical imaging, **Natural Language Processing** - text classification, translation, summarization, **Machine Learning** - classification, regression, clustering, recommendation systems, **Robotics**-types and components, and **Knowledge Engineering** - representation and reasoning.

UNIT - III

APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Applications of AI in various domains: **Healthcare** - diagnosis, drug discovery, **Finance** - risk management, trading, **Retail** - personalization, customer support, **Agriculture** -precision farming, **Education** - personalized learning, and **Transportation** -traffic management. Challenges in applying AI in real-world scenarios.

UNIT - IV

ETHICS, BIAS AND FAIRNESS IN AI

Ethics in AI systems. Types of bias and fairness issues. Transparency and explain ability. Accountability of AI systems. Privacy and data protection concerns. Security risks in AI systems. Inclusivity, sustainability, robustness, and reliability.

UNIT – V

GENERATIVE AI AND FUTURE DIRECTIONS

AI in research and interdisciplinary domains. Introduction to Generative AI and its evolution. Emerging trends and future directions of Artificial Intelligence. Social implications and impact of AI.

TEXT BOOKS:

1. AI for Everyone: A Beginner's Handbook for Artificial Intelligence, First Edition, Pearson India, 2023.SUGGESTED READING:
2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Fourth Edition, Pearson, 2021
3. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans, First Edition, Farrar, Straus and Giroux, 2019.

WEB RESOURCES:

1. Government of India, Press Information Bureau (PIB), YUVA AI for ALL Initiative Available: https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=2191334
2. FutureSkills Prime (MeitY & NASSCOM), AI Learning Platform. Available: https://futureskillsprime.in
3. India AI Mission (Government of India AI Initiative). Available: https://indiaai.gov.in

26CYC02

APPLIED CHEMISTRY LAB

Common to B.Tech (Bio-Tech & Chemical Engineering)

Instruction:	3 P Hours per week
Duration of SEE:	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	1.5

COURSE OBJECTIVES: This course aims to

1. Impart fundamental knowledge in handling the equipment/glassware and chemicals in chemistry laboratory.
2. Get familiarized with the volumetric principles for quantitative analysis.
3. Provide the knowledge in qualitative chemical analysis of organic compounds.
4. Understand & use the various instrumental methods to analyze the chemical compounds.
5. Interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

COURSE OUTCOMES: At the end of the course, student will be able to

1. Identify the basic chemical methods to analyze the substances quantitatively and qualitatively.
2. Develop analytical thinking and problem-solving skills in identifying unknown samples.
3. Estimate the amount of chemical substances by volumetric analysis.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	2	1		2					2	2	3
CO2	3	2	2	2		2					2	2	3
CO3	3	2	2	2		2					2	2	3
CO4	3	2	2	2		2					2	3	3
CO5	3	2	3	2		2					2	3	2

1 - Slightly; 2 - Moderately; 3 - Substantially

List of Laboratory Experiments

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Identification of organic functional groups (Carboxylic acids & Amines).
3. Estimation of temporary, permanent and total hardness of water using EDTA solution.
4. Determination of alkalinity in the given water sample.
5. Determination of concentration of given $KMnO_4$ solution by colorimetric method.
6. Determination of concentration of given $K_2Cr_2O_7$ solution by colorimetric method.
7. Estimation of amount of HCl conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids conductometrically using NaOH solution.
9. Identification of bio molecules (carbohydrates and proteins) in the given samples.

10. Preparation of Zinc Oxide Nanoparticles.
11. Preparation of nitrobenzene from benzene.
12. Synthesis of aspirin and paracetamol drugs.
13. Synthesis of phenol formaldehyde resin.

TEXT BOOKS

1. J. Mendham and Thomas, "Vogel's text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi, 6th ed. 2017.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati, R . Chand & Co. : New Delhi (2011).

SUGGESTED READINGS

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2020.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

26EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction:	2 P Hours per week
Duration of SEE:	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	1

COURSE OBJECTIVES: This course aims to

1. To acquire to verify the basic electrical circuit laws and theorems.
2. Explore the concept of single phase AC and Three phase AC concepts
3. To find the characteristics of Transformers, DC, AC Machines and switch gear components

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

1. Comprehend the circuit analysis techniques using various circuital laws and theorems.
2. Determine the different parameters related Single Phase AC and 3 Phase AC Circuits
3. Determine the turns ration/performance parameters of single-phase transformer
4. Infer the characteristics of the DC shunt motor subjected to different tests.
5. Illustrate different parts of Machines, Protection equipment and Sensors.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2		1	1							3	1	1
CO 2	3	2		1	1							3	1	2
CO 3	3	2	1	2	1							2	2	2
CO 4	3	2	1	2	1						1	2	1	3
CO 5	2	1	1		1	1					1	2	2	3

1 - Slightly, 2 - Moderately, 3 - Substantially

List of Laboratory Experiments/Demonstrations:

1. Verification of KCL and KVL.
2. Verification of Thevenin's Theorem.
3. Verification of Superposition Theorem.
4. Verification of Norton’s Theorem
5. Determination of parameters of a choke or coil by Wattmeter Method
6. Active and Reactive Power measurement of a single-phase system using 3-Ammeter method
7. Active and Reactive Power measurement of a single-phase system using 3-Voltmeter method
8. Measurement of 3-Phase Power in a Balanced system
9. Measurement of Energy Using a Single-Phase Energy Meter
10. Verification of Turns/voltage ratio of Single-Phase Transformer.
11. Open Circuit and Short Circuit tests on a Single-Phase Transformer.
12. Brake Test on DC Shunt Motor
13. Speed Control of DC Shunt Motor
14. Demonstration of Fuse & MCB
15. Demonstration of Sensors
16. Study of cut - out section of Electrical Machines

Note: At least 10 experiments need to be conducted

26CSC02

PROBLEM SOLVING AND PROGRAMMING USING C LAB

Instruction:	3 P Hours per week
Duration of SEE:	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	1.5

PREREQUISITES: Basic high school mathematics.

COURSE OBJECTIVES: This course aims to

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.

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

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Analyze programs using arrays, structures and pointers.
4. Evaluate problems in a modular approach using functions.
5. Develop file operations with simple text data.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1		1	1	1						1		1	2	-
CO 2	3	2	1	2								2	2	3
CO 3	3	2	1	2								2	2	3
CO 4	3	2	1	2								2	1	3
CO 5	3	1		1								1	2	3

1-Slightly, 2-Moderately, 3-Substantially

LABORATORY / PRACTICAL EXPERIMENTS:

1. Introducing to IDE Eg: Visual Editor, TurboC, DevC++, Visual Studio etc.,
2. Implement programs using arithmetic, relational, bitwise, conditional, logical, and ternary operators.
3. Implement programs using control statements (sequential, selection and iteration).
4. Implement programs using user defined functions and Recursion.
5. Implement Programs using one dimensional arrays.
6. Implement programs on two dimensional arrays with and without using functions.
7. Implement programs on String manipulation (with and without using string library functions).
8. Implement programs on sorting and searching using iteration and recursion. (Bubble Sort, Selection Sort, Linear Search, Binary Search)
9. Implement programs using pointers and dynamic memory allocation.
10. Implement programs using Structures.
11. Implement file handling programs (Modes, Operations, Access).

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e”, 2nd Edition Oxford University Press, 2012.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language”, 2nd Edition (Paperback), Prentice Hall India, 2018.

SUGGESTED READING:

1. B.A.Forouzan and Hassan Afyouni "A Structured Programming Approach in C", 4th Edition, Cengage Learning, 2024.
2. E. Balaguruswamy, "Programming in ANSI C", 9th Edition, Tata McGraw-Hill, 2024.
3. Paul Deitel and Harvey Deitel, "C: How to Program", 9th Edition, Pearson. 2022.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://archive.nptel.ac.in/courses/106/105/106105171/

26MEC01

ROBOTICS AND DRONES LAB

(Common to Mechanical, Civil, ECE, EVL, EEE, Chemical & Bio Tech)

Instruction:	1T+2 P Hours per week
Duration of SEE:	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	2

COURSE OBJECTIVES: The objectives of this course are to:

1. Develop a fundamental understanding of robotics, Arduino programming, and electronic circuit interfacing used in autonomous systems.
2. Gain practical knowledge of interfacing various sensors such as ultrasonic sensors, IR sensors, and LiDAR sensors with microcontrollers for data acquisition in robotic and drone applications.
3. Acquire proficiency in controlling different types of actuators including servo motors, stepper motors, DC motors, and BLDC motors for robotic and drone movement.
4. Understand the structure, components, and working principles of drones, and develop the ability to assemble basic quadcopter system.
5. Apply basic computer vision techniques using Python and OpenCV for image processing tasks relevant to drone-based applications.

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

1. Understand the fundamentals of robotics, Arduino programming, and electronic interfacing required for autonomous systems.
2. Interface and utilize sensors such as ultrasonic, IR, and LiDAR sensors to collect and process environmental data for robotic and drone applications.
3. Demonstrate the ability to control various actuators including servo motors, stepper motors, DC motors, and BLDC motors for implementing robotic movements.
4. Assemble and understand the operation of drone systems including mechanical, electrical, and control components required for drone flight.
5. Apply Python and OpenCV techniques for basic image processing tasks such as RGB extraction, shape creation, and region of interest (ROI) extraction (or) to develop simple autonomous systems.

CO-PO Articulation Matrix

PO/PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3	2	2	1	2	1	1	2	2	1	2	1	2
CO2	2	3	2	3	2	1	1	1	1	1	2	2	3
CO3	2	2	3	2	2	1	1	2	1	1	2	1	3
CO4	2	2	3	2	2	1	1	3	2	2	2	3	3
CO5	2	2	2	2	3	1	1	1	2	1	3	3	2

1 - Slightly; 2 - Moderately; 3 - Substantially

Lab Exercises:

1 a. Interface Arduino with LEDs to do traffic light simulation

b. Design and implement a system to interface an Arduino board with a seven-segment LED display to show decimal digits from 0 to 9. The Arduino should be programmed to sequentially display each number with a fixed time delay between transitions.

2 a. Interface Arduino with Electronic Devices such as Push Button to control piezo

buzzer.

b. Interface Arduino with Electronic Devices such as Potentiometer to control blinking time of LED

3 Interfacing Arduino with Ultrasonic Distance Sensor and Displaying Sensor Data on Serial Monitor.
4 Interfacing Arduino with IR Sensor and Reading Sensor Data on Serial Monitor.
5 Implement a system using Arduino to control the precise movement of a Servo Motor.
6 Control and operate a Stepper Motor using Arduino for precise and sequential motion.
7 Construct a two-wheel robot using DC motors controlled by Arduino. Program the robot to: (i) Move forward with controlled acceleration (ii) Move backward with controlled deceleration.
8 Controlling a BLDC motor of a drone using a Servo Tester.
9 Attach a propeller to a BLDC motor and measure the wind speed using an Anemometer.
10 Measure the distance between an obstacle and the drone using a TF-Mini LiDAR Range Sensor.
11 Assemble the mechanical and electrical subsystems of a quadcopter drone by integrating frame arms, BLDC motors, ESCs, power distribution system, and connectors. Verify electrical continuity and correct motor-ESC connections.
12 Integrate drone control components including flight controller, radio receiver, GPS module, battery, and propellers. Study of Drone Take-off, Flight, and Landing Basics.
13 Open CV for Image Processing in Drones: (i) Extraction of RGB values of a pixel (ii) Creation of coloured shapes and saving images (iii) Extraction of Region of Interest (ROI).
14 Open-Ended Autonomous System Project.

Note:

Students shall complete any 10 out of the 14 experiments. The Experiment No. 14 (Open-Ended Project) is mandatory and carries 10 marks in CIE.

TEXT BOOKS:

1. J. M. Hughes, *Arduino: A Technical Reference: A Handbook for Technicians, Engineers, and Makers*. Sebastopol, CA: O'Reilly Media, 2016.
2. S. Monk, *Programming Arduino: Getting Started with Sketches*. New York, NY: McGraw-Hill, 2022.
3. D. McGriffy, *Make: Drones: Teach an Arduino to Fly*. San Francisco, CA: Maker Media, 2016.

SUGGESTED READING:

1. https://www.geeksforgeeks.org/robotics-introduction/
2. https://dronebotworkshop.com/

26MBC02

COMMUNITY ENGAGEMENT

Instruction:	2P Hours per week
SEE	Nil
CIE	50 Marks
Credits:	1

COURSE OBJECTIVES: The main Objectives of this Course are to:

1. Develop an understanding of rural life, culture, and socio-economic conditions.
2. Expose students to rural livelihoods, local economic systems, and entrepreneurship opportunities.
3. Familiarize students with rural institutions, governance mechanisms, and development programmes in India.
4. Promote community engagement, social responsibility, and experiential learning through field-based activities.
5. Enable students to analyse community issues and contribute to sustainable rural development solutions.

COURSE OUTCOMES: After the completion of this Course, Student will be able to:

1. Understand rural society, culture, and development issues.
2. Demonstrate empathy and social responsibility towards communities.
3. Analyse rural livelihood systems and economic activities.
4. Evaluate the role of rural institutions and government programmes.
5. Participate in community-based activities and suggest improvements.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	1	2	2	2		3	1	2			2	1	2
CO2		1	2	2		2		2	1		1		1
CO3		1	1	2		3	1	3	1	2	1		1
CO4	2	2	3	2		2	1	2	2	1		2	2
CO5	1	2	2	1		2		1		1	1	1	2

1 - Slightly; 2 - Moderately; 3 - Substantially

Module I Appreciation of Rural Society

Rural lifestyle and social structure, Caste and gender relations, Rural values and traditions, Rural infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture and allied activities, Rural entrepreneurship, Non-farm livelihoods and artisans, Rural markets and credit systems, Farmer Producer Organizations (FPOs).

Module III Rural Institutions

Panchayati Raj system (Gram Sabha, Gram Panchayat), Self-Help Groups (SHGs), Role of NGOs in rural development

Module IV Rural Development Programmes

Overview of rural development in India, Key government schemes, Mahatma Gandhi National Rural Employment Guarantee (MGNREGA) Scheme, National Rural Livelihood Mission (NRLM), Pradhan Mantri Awas Yojana (PMAY), Swachh Bharat, Skill India, Ayushman Bharat.

TEXT BOOKS:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.
5. Helen Sheil, "Growing and Learning in Rural Communities" (Revised Edition), 2024.

SUGGESTED READINGS & JOURNALS:

1. Seth Appiah-Opoku , Usha Iyer-Raniga, "Contemporary Rural Development Programs", 2025
2. Journal of Rural development (published by NIRD & PR, Hyderabad).
3. Indian Journal of Social Work, (by TISS, Bombay).
4. Indian Journal of Extension Educations (by Indian Society of Extension Education).
5. Kurukshetra (Ministry of Rural Development, GOI).

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R 26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

B. TECH BIOTECHNOLOGY

SEMESTER–II

S.No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC06/ 26BTC02	Mathematics-II / Basics of Biology-II	3	1	-	3	40	60	4
2	26PYC07	Physics	3	-	-	3	40	60	3
3	26BTC03	Process Principles and Reaction Engineering	3	-	-	3	40	60	3
4	26EGC01	Communicative English	2	-	-	3	40	60	2
	PRACTICALS								
5	26PYC08	Physics Lab	-	-	3	3	50	50	1.5
6	26MEC03	Engineering Graphics	-	1	3	3	50	50	2.5
7	26CSC38	Python Programming Workshop	-	-	3	3	50	50	1.5
8	26MEC04	Engineering Workshop & 3D Printing	-	-	3	3	50	50	1.5
9	26EGC02	Communication Skills Lab	-	-	2	3	50	50	1
TOTAL			**11**	**2**	**14**		**410**	**490**	**20**
Clock hours per week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

26MTC06

MATHEMATICS-II
(BioTech- BIPC Stream)

Instruction:	3 L+1T Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	4

COURSE OBJECTIVES:

1. To explain various techniques of integration.
2. To develop Skills in solving first-order ordinary differential equations.
3. To develop understanding of basic operations in vector algebra.
4. To explain various methods of partial fractions.
5. To provide a basic understanding of complex numbers and their properties.

COURSE OUTCOMES: Upon completing this course, students will be able to:

1. Evaluate definite and indefinite integrals using standard techniques.
2. Solve first-order ordinary differential equations using suitable methods
3. Apply basic operations on scalars and vectors in problem-solving.
4. Apply appropriate methods to resolve partial fractions.
5. Solve problems involving complex numbers.

CO-PO Articulation Matrix:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	1	2	1						2	1	
CO2	3	2	1	1	1						2	2	
CO3	3	2	2	1	1						2	1	
CO4	3	3	2	1	1						2	1	
CO5	3	3	1	1	1						2	1	

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT- I: Integration

Definition of Integration, standard forms, properties of Integrals and its related problems, Integration by method of substitution, Integration by parts, integration of exponential, logarithmic & inverse trigonometric functions, definition and properties of definite Integrals, fundamental theorem of calculus(only statement) and its related problems.

UNIT- II: Differential Equations

Formation of Differential equations- Degree & order of an ordinary differential equation, solution of differential Equations, Variable Separable method, Homogeneous & Non-Homogeneous differential Equations and Linear differential Equations.

UNIT-III: Vector Algebra

Definition of vector and scalar, types of vectors (unit vector, equal vectors, collinear vectors, like and unlike vectors), definition of coplanar vectors, Addition of vectors, scalar multiplication, linear combination of vectors, component of vectors in three dimensions, dot product of two vectors, properties of dot product and related problems, angle between two non-zero vectors, cross product of two vectors, its properties and related problems, scalar triple product.

UNIT-IV: Partial Fractions

Rational fractions, Partial fractions of f(x)/g(x) when g(x) contains non-repeated linear factors, Partial fractions of f(x)/g(x) when g(x) contains repeated and non-repeated linear factors, Partial fractions of f(x)/g(x) when g(x) contains irreducible factors.

UNIT- V: Complex Numbers

Definition of Complex number, addition, difference, multiplication and division of complex numbers, representation of complex numbers in the form $a + ib$, conjugate of a complex Number, square root of complex number, modulus and amplitude of a complex number and its related problems.

Text Books:

1. Telugu academy Intermediate Mathematics books IA, IIA & IIB
2. Hand book -Mathematics (Key notes, Terms, Definitions, Formular)- Arihant Publications.

Suggested Reading:

1. Schaum's Outline of Vector Anaysis, Frank Ayres & Robert E. Moyer
2. Thomas' Calculus Early Transcendentals Thirteenth Edition.
3. Theory of Functions of a Complex Variable By Narayan Shanti & Mittal P.K.

26BTC02

BASICS OF BIOLOGY-II
(For MPC Stream of Biotech)

Instruction:	3 L+1T Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	4

COURSE OBJECTIVES: This course aims to

1. To impart theoretical knowledge on animal cells, tissues their types, and level of organization
2. To provide knowledge on basic concepts of Biology and the basis of animal kingdom classification.
3. To provide knowledge on various parasites, lifecycles, and diseases caused by them.
4. To impart knowledge on ecology, environment, and biotic interactions in nature
5. To give an insight into genes, chromosomes, blood grouping system, and gene expression

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

1. Identify the basic structure, and function of various animal cell organelles, level of organization, and types of tissues in animals.
2. Distinguish between invertebrates and vertebrates and apply the concepts of taxonomy, species, genus and scientific nomenclature in animal classification.
3. Identify the lifecycles, diseases, treatment, and preventive measures of human pathogens.
4. Outline population ecology, various biotic and abiotic environmental factors of ecosystem.
5. Define the concept of genes, alleles, chromosomes, blood grouping system, and gene expression.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2					2	2	2	2		2	2	1
CO2	2					2	2	2	2		2	2	
CO3	2					2	2	2	2		2	2	1
CO4	2					2	2	2	2		2	2	
CO5	2					2	2	2	2		2	2	1

1 - Slightly, 2 - Moderately, 3 - Substantially

UNIT-I

Animal Cell, Tissues, and Level of Organization: Structure of animal cell and its organelles. Differences between plant and animal cells. Level of organization, multicellularity, diploblastic and triploblastic conditions. Asymmetry, symmetry: radial symmetry and bilateral symmetry. Acoelomates, pseudo coelomates, and coelomates in brief. Animal tissues structure and functions. Different types of animal tissues and their functions. Epithelial, Connective, Muscular, and Nervous tissues in brief

UNIT-II

Animal Kingdom Classification: Classification of animal kingdom. Phylogeny of invertebrate and vertebrate phyla. Overview of major groups of animals, distinguishing features of invertebrates and vertebrates with representative examples. Taxonomy and Systematics, Concept of species and genus, Binomial and trinomial nomenclature.

UNIT-III

Parasitology: Parasitism and Parasitic Adaptation: Health and disease: introduction, life cycle, pathogenicity, treatment, and prevention; *Entamoeba histolytica*, *Plasmodium vivax*, *Ascaris lumbricoides*, and *Wuchereria bancrofti*. Brief account of pathogenicity, treatment, and prevention of typhoid, pneumonia, common cold, and ringworm.

UNIT-IV

Ecology and Environment: Levels of biological hierarchy, Organism and environment, habitat and niche. Abiotic environmental factors light, temperature, water and soil. Population and ecological adaptations, population attributes: growth, birth and death rate, sex ratio, age distributions, Population density. Population growth models, Biotic & environmental factors interactions: competition, mutualism, commensalism, parasitism, predation & amensalism.

UNIT-V

Genetics: Structure and functions of DNA, Chromosome; Concept of gene and alleles, multiple alleles, ABO blood groups. Sex chromosomes, Sex-linked inheritance. Central Dogma, Characteristics of genetic code, Gene expression and regulation: transcription, translation, and regulation in prokaryotes (lac operon) and eukaryotes.

TEXT BOOKS

1. Campbell, N.A., Reece, J.B., Urry, Lisa, Cain, ML., Wasserman, S.A., Minorsky, P.V., Jackson, R.B. Biology: A Global 11th edition, Pearson Education Ltd. (2017)
2. Beginning Science: Biology. B.S. Beckett. Oxford University Press.1st edition, 1983.

SUGGESTED READING:

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. & J.I., Spicer Invertebrates: A New Edition, Blackwell Science (2002)
2. K Vaidhyanath, K Pratap Reddy and K Sathya Prasad, to Applied Biology and BS Publications, India, 2004.

26PYC07

PHYSICS
(Biotech& Chemical)

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	3

COURSE OBJECTIVES: The objectives of the course is to make the student

1. Learn the basic concepts of wave nature of light
2. Know about the properties of magnetic and dielectric materials.
3. Understand the physical properties of crystalline materials.
4. Familiarize with fundamental ideas of quantum mechanics.

COURSE OUTCOMES: At the end of the course, the student will be able to

1. Analyse the wave nature of the light by correlating theoretical concepts with experimental results.
2. Categorize lasers and optical fibres for real time applications.
3. Classify different types of crystals and their imperfections.
4. Identify magnetic and dielectric materials for engineering applications.
5. Interpret the dual nature of matter and its quantum effects.

CO-PO Articulation Matrix:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	1	1	1	1	2	1	1	2	1	2		
CO2	3	1	2	1	2	2	1	2	2	2	2	1	1
CO3	2	2	1	1	1	1	1	1	1	2	1	1	1
CO4	2	2	2	2	2	2	2	1	1	2	1	1	1
CO5	2	2	2	2	2	1	2	2	1	2	1		

1 - Slightly, 2 - Moderately, 3 - Substantially

UNIT-I

Wave Optics: Interference of light by splitting of wavefront and amplitude – Fresnel's biprism – Interference in thin films (reflected light) – Newton's rings – Fraunhofer diffraction at single slit – Double slit – Diffraction grating – Introduction to polarisation – Malus's law – Double refraction – Nicol's prism – Optical activity – Laurant's half shade polarimeter.

UNIT-II

Lasers: Characteristics of lasers – Spontaneous and Stimulated Emissions – Einstein's coefficients – Population inversion – Ruby laser – He-Ne laser – Applications of lasers in engineering and medicine.

Fiber Optics: Introduction – Construction – Principle – Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded-index fibers – Pulse dispersion – Fiber losses – Fiber optic communication system – Applications.

UNIT-III

Crystallography: Space lattice – Unit cell – Crystal systems – Bravais lattices – Number of atoms per unit cell – Coordination number – Atomic radius – Packing fraction (for sc, bcc, fcc) – Lattice planes – Miller indices – Bragg's law – Experimental determination of lattice constant of a cubic crystal by powder X-ray diffraction method – Structure of NaCl.

Crystal Imperfections: Classification of defects – Point defects – Concentration of Schottky and Frenkel defects.

UNIT-IV

Dielectric Materials: Introduction – Dielectric polarization – Types of dielectric polarization (qualitative): electronic, ionic, orientational and space-charge polarizations – Frequency and temperature dependence of dielectric polarization – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

Magnetic Materials: Origin of magnetism – Magnetic moment – Bohr magneton – Classification of magnetic materials: dia, para, ferro, anti-ferro and ferrimagnetic materials – Weiss molecular field theory – Domain theory –Hysteresis curve – Soft and hard magnetic materials.

UNIT-V

Quantum Mechanics: Introduction – de-Broglie hypothesis – Wave-particle duality –Born's interpretation of the wave function – Verification of matter waves by Davisson-Germer's experiment – Uncertainty principle – Schrodinger wave equation (time-dependent and time-independent) – Particle in an infinite square well potential.

TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.
5. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury *Concepts of modern physics* , 7th edn, McGraw Hill publications, 2017.

26BTC03

PROCESS PRINCIPLES AND REACTION ENGINEERING

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	3

COURSE OBJECTIVES: This course aims to

1. The course aims to impart knowledge of the basic chemical engineering principles and techniques used in analysing a biochemical process.
2. The course aims to provide the students with an understanding of how to represent experimental data in graphical form.
3. This course also aims to enable the students to evaluate material balances in different units.
4. The course aims at enabling the students to learn calculations regarding enthalpy and heat of reactions
5. The course aims to impart knowledge of homogenous reactions and enhance skills to formulate and analyse different types of reaction kinetics used in biochemical engineering.

COURSE OUTCOMES: After completion of this course, student will be able to

1. Grasp the fundamentals of physical variables, dimensions, units, equations with dimensional homogeneity, and measurement conventions, fostering their ability to apply these principles in practical engineering scenarios.
2. Analyse and present experimental data using graphs, including understanding errors, significant figures, statistics, and logarithmic coordinate graphs, while following proper data plotting procedures.
3. Confidently compute material balances for biotech processes, applying principles to real cases along with recycle, by-pass, and purge streams.
4. Solve enthalpy-related challenges in non-reactive and reactive scenarios, and apply energy balance concepts to practical cases within biotechnology processes
5. To predict growth kinetics and analyse reaction kinetics for biological systems.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	2	2		2	2			2			3	3
CO 2	2	2	2		2	2			3			2	3
CO 3	2	2	2		2	2			2			2	1
CO 4	2	2	2		2	2			2			2	1
CO 5	2	2	2		2	2			2			2	3

1 - Slightly, 2 - Moderately, 3 - Substantially

UNIT-I

Introduction to Engineering calculations: Physical variables, Dimensions, and Units: Substantial and Natural variables, Equations with and without Dimensional Homogeneity, Units and conversions; SI and MKS system of Units; Measurement conventions, Density, Specific gravity, and Specific volume. Concentration units for pure components, Moles, Chemical composition, Temperature, Pressure, Standard conditions, and Ideal gases; Ideal gas law, Definition of Stoichiometry.

UNIT-II

Presentation and Analysis of Data: Presentation and Analysis of Data, Errors in Data and Calculations, Significant Figures, Types of Error, Statistical Analysis, Presentation of Experimental Data, Data Analysis, Graph Paper with Logarithmic Coordinates, General Procedures for Plotting Data, Numerical wherever relevant.

UNIT-III

Material balances: Law of conservation of mass, Types of material balance problem, Simplification of the general mass balance equation, Procedure for material balance calculations, material balance worked examples; Continuous filtration, batch mixing, Continuous fermentation, Xanthan gum production. Material balances with recycle, By-pass, and Purge streams.

UNIT-IV

Energy Balances: Basic Energy concepts, General energy balance equations, Enthalpy calculation procedures, Enthalpy Change in Non-Reactive Processes, Procedure for Energy-Balance Calculations without reaction, Enthalpy Change Due to Reaction, Heat of Reaction for Processes with Biomass Production, Fermentation energy balance equation worked examples (Ethanol fermentation and Citric acid production.

UNIT-V

Homogenous reactions: Basic reaction theory, Reaction; thermodynamics, Yield, Rate, Kinetics, Effect of temperature on reaction rate. Calculation of Reaction rates from experimental data; Average rate –Equal Area method. Mid-point slope method. General reaction kinetics for biological systems; Zero order and first-order kinetics, Michaelis - Menten Kinetics. Cell Growth Kinetics; Batch growth, balanced growth, Effect of Substrate concentration. Growth kinetics with Plasmid Instability, Plasmid instability in batch culture.

TEXT BOOKS:

1. Pauline M. Doran, Bioprocess Engineering Principles — 2nd Edition (2013), Academic Press / Elsevier.
2. Hougen, Watson and Ragatz, Chemical Process Principles — 2nd Edition (1959), Wiley (latest available edition).

SUGGESTED READINGS:

1. David M. Himmelblau, James B. Riggs, Basic Principles and Calculations in Chemical Engineering — 9th Edition (2018), Pearson.
2. James E. Bailey, David F. Ollis, Biochemical Engineering Fundamentals — 2nd Edition (1986), McGraw-Hill.
3. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering — 1st Edition (1997), CRC Press (latest available edition).
4. Octave Levenspiel, Chemical Reaction Engineering — 3rd Edition (1999), Wiley.

26EGC01

COMMUNICATIVE ENGLISH

(BE/B.Tech - Common to all Branches)

Instruction:	2 L Hours per week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits:	2

Prerequisite: Basic knowledge of English grammar and vocabulary and communicative abilities.

COURSE OBJECTIVES: The course is taught with the objectives of enabling the students to:

1. Improve their understanding of communication skills to apply in real life situations.
2. Equip themselves with Reading Comprehension strategies and texts and textuality
3. Enhance their writing skills through paragraphs, précis and essays by using cohesive devices for structural coherence.
4. Build tone and tonality for professional use through meaningful sentences.
5. Demonstrate knowledge of drafting formal reports to define, describe and classify the processes by following a proper structure.

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

1. Create the awareness of communication skills in life and use in real life situations.
2. Apply effective reading techniques through critical reading exercises to reading comprehension and to support lifelong learning.
3. Develop; independently write well structured coherent paragraphs through précis writing.
4. Construct sentences clearly and comprehensively to write effective business letters and draft emails for a better professional communication.
5. Distinguish formal and informal reports and draft formal reports.

CO PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1					1	2	2	2	3	3	3		
CO2					1	2	2	1	1	2	2		
CO3		1				2	2	1	1	2	1		
CO4		1				1	2	2	2	2	2		
CO5		1		1	1	2	2	2	2	2	2		

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT-I: Dynamics of Communication

Introduction to communication; Process of communication; Types of communication: verbal and non-verbal; Barriers to communication; Intrapersonal, Interpersonal communication; Johari Window. Listening, Speaking, Reading, Writing, Communication, Study skills & Literary Appreciation.

Vocabulary & Grammar: The concept of Word Formation - Root words, Use of prefixes and suffixes to form derivatives, Standard abbreviations. Construction of Sentences

Reading Task I: Rene Descartes' "*I think therefore, I am*"

UNIT-II: Introduction to Reading

The Reading process, purpose, Analysis of different kinds of texts; Reading Comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Practice with Critical Reading passages

Vocabulary and Grammar: Use of Synonyms and Antonyms, Tenses.

Reading Task II: Bertrand Russell's"*Knowledge and Wisdom*" (Essay)

UNIT-III: Introduction to Writing Skills

Paragraph Writing. – Structure and features of a paragraph;Précis writing

Vocabulary & Grammar: Use of Discourse Markers, Cohesion and Coherence in writing

Reading Task III: Rudyard Kipling's "*If"*

UNIT-IV: Professional Writing Skills

Professional Communication:Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails.

Vocabulary and Grammar: Phrasal verbs, Subject-verb agreement in sentences

Reading Task IV: Chetan Bhagath's "*The Cut-off*"

UNIT-V: Professional Writing Skills: Engineering Specific Input.

Report writing – Importance, structure, elements & styles of formal reports; Writing a formal report.

Vocabulary and Grammar: Words often Confused, Common Errors.

Reading Task IV: *Nightfall in the City of Hyderabad* by Sarojini Naidu

TEXT BOOKS:

1. Sanjay Kumar &PushpLata, "English Language and Communication Skills for Engineers", Oxford University Press,2018.
2. "Language and Life: A Skills Approach", Board of Editors, 2018th Edition, Orient Black Swan, 2018.

SUGGESTED READINGS:

1. Ashraf, M Rizvi, "Effective Technical Communication", Tata McGraw-Hill, 2006.
2. Michael Swan,"Practical English Usage", Oxford University Press, 4th Edition,2016.
3. Meenakshi Raman and Sangeetha Sharma, "Technical Communication: Principles and Practice" 3rd Edition, Oxford University Press, 2015.
4. Communicative English and Employability Skills, Dr. B. Vijaya, Orient Blackswan, 2026

26PYC08

PHYSICS LAB
(Biotech & Chemical)

Instruction:	3 P Hours per week
Duration of SEE:	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	1.5

COURSE OBJECTIVES: The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the physical properties of magnetic and dielectric materials
4. Familiarize with motion of electrons in electric and magnetic fields

COURSE OUTCOMES: At the end of the course, the student will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate the wave nature of light experimentally
3. Utilize physical properties of magnetic and dielectric materials for various applications
4. Make use of lasers and optical fibers for engineering applications
5. Explain motion of electrons in electric and magnetic fields

CO-PO Articulation Matrix:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	2	3	1	2	3	3	2	1	2		1
CO2	3	2	1	2	2	2	2	2	1	1	3		
CO3	3	2	3	2	3	2	2	3	2	1	2	1	
CO4	3	3	2	2	2	2	3	2	1	1	3	1	1
CO5	3	1	2	3	2	1	2	2	2	1	2		1

1 - Slightly; 2 - Moderately; 3 - Substantially

LIST OF EXPERIMENTS:

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Fresnel's Biprism	:	Determination of wavelength of given monochromatic source
3.	Newton's Rings	:	Determination of wavelength of given monochromatic source
4.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
5.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
6.	Malus's Law	:	Verification of Malus's law
7.	Double Refraction	:	Determination of refractive indices of O-ray and E-ray of given calcite crystal
8.	Polarimeter	:	Determination of specific rotation of glucose
9.	Laser	:	Determination of wavelength of given semiconductor laser

10.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
11.	Dielectric constant	:	Determination of dielectric constant of given PZT sample
12.	M & H Values	:	Determination of magnetic moment M of a bar magnet and absolute value H of horizontal component of earth's magnetic field
13.	B-H curve	:	Determination of hysteresis loss of given specimen
14.	Planck's constant	:	Determination of Planck's constant using photo cell
15.	e/m of an Electron	:	Determination of specific charge of an electron by J.J. Thomson method

NOTE: A minimum of TWELVE experiments should be done.

26MEC03

ENGINEERING GRAPHICS

(Common to Mechanical, Civil, ECE, EVL, EEE, Chemical & Bio Tech)

Instruction:	1 T+3 D Hours per week
Duration of SEE:	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	2.5

COURSE OBJECTIVES: This course aims to

1. Get exposure to a cad package and its utility.
2. Understand orthographic projections.
3. Visualize different solids and their sections in orthographic projection
4. Prepare the student to communicate effectively by using isometric projection.
5. Prepare the student to use the techniques, skills, and modern tools necessary for practice.

COURSE OUTCOMES: upon completion of this course, student will be able to

1. Become conversant with appropriate use of CAD software for drafting and able to draw conic sections.
2. Understand orthographic projections of points and straight lines.
3. Draw the projections of planes and solids.
4. Draw the sectional views and develop the surfaces of solids.
5. Create an isometric projections and views.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	2	1	3	1	1	1	1	1	2	1	2	3
CO 2	3	2	2		2	1	1		1		1	1	1	3
CO 3	3	2	3	1	2	1	1	1	1	1	1	2	1	3
CO 4	3	2	3	1	2	1	1	1	1	1	1	2	2	3
CO 5	3	2	3		2	1	1		2	1	1	2	1	3

LIST OF EXERCISES:

1. Introduction to Auto CAD package: Settings, draw, modify tools, dimensioning, documentation and practice exercises.
2. Construction of Conic Sections by General method.
3. Orthographic projection: Principles, conventions, Projection of points.
4. Projection of straight lines in simple position, inclined to one plane & both the reference planes (without traces and mid-point).
5. Projection of perpendicular planes.
6. Projection of solids in simple position.
7. Projection of solids with axis Inclined to one plane.
8. Sections of Prisms and Pyramids in simple position.
9. Development of the surfaces of a right regular prism and a cone in simple positions.
10. Isometric projections of regular solids.
11. Conversion of isometric views to orthographic views and vice-versa.

TEXT BOOKS:

1. N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishers, 2012.
2. K.Venugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt.Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, "Engineering Drawing", 2/e, McGraw-Hill Education (India) Pvt. Ltd.

SUGGESTED READING:

1. Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011.

26CSC38

PYTHON PROGRAMMING WORKSHOP

(For Civil, Mechanical, EEE, ECE, ECE-EVL (VLSI), Chemical, Biotech)

Instruction	3 P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1.5

PREREQUISITE: Basic Computer Skills, Interest in Problem Solving, Basic Mathematical Skills.

COURSE OBJECTIVES: This course aims to

1. Master the fundamentals of writing Python scripts.
2. Learn Python elements such as variables, flow controls structures, functions and modules.
3. Discover how to work with lists and sequence data, and files.

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

1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to design and build the solutions.
3. Develop the solutions with modular approach using functions to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of Standard Template Libraries and modules to build file handling / Searching / sorting applications.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2			1	1						2	1	2	2
CO 2	3	3	3	1	1	1					2	2	1	3
CO 3	3	3	3	1	2	1					2	2	1	3
CO 4	3	3	3	1	1	1					2	1	2	3
CO 5	3	3	3	1	2	1					2	2	2	3

1-Slightly, 2-Moderately, 3-Substantially

LABORATORY / PRACTICAL EXPERIMENTS:

1. Explore various Python Program Development Environments. eg: Vscode, IDLE, PyCharm, anaconda etc.,
2. Design Flowcharts using raptor / draw.io tools.
3. Simple scripts to demonstrate the use of various data types and operators.
4. Demonstrate the use of control structures.
5. Experiments using Comprehensions with List, Dictionary, Set.
6. Implementation using Functions, Lambda functions and parameter passing.
7. Experimentation with Arrays using array and numpy modules.
8. Experiments using Searching and Sorting techniques.
9. Simple scripts to demonstrate the use of built-in modules.(Ex: math, random).
10. Demonstration of File Handling.

TEXT BOOKS:

1. Jeeva Jose, "Taming Python by Programming", 2nd Edition, 2019, Khanna Book Publications.
2. Reema Thareja, "Python Programming", 1st Edition, 2017, Oxford Press.

SUGGESTED READING:

1. Zed A. Shaw, "Learn Python3 the Hard Way", 1st Edition, 2018, Pearson Education Inc.
2. R.S. Salaria, "Programming in Python", 1st Edition, 2024, Khanna Publishing House.
3. Yashavant Kanetkar and Aditya Kanetkar, "Let Us Python", 1st Edition, 2019, Edition, BPB Publications.

ONLINE RESOURCES:

1. https://onlinecourses.swayam2.ac.in/cec24_cs01/preview.
2. https://www.coursera.org/specializations/python.
3. https://www.python.org.
4. https://www.visual-paradigm.com/tutorials/decision-table-in-action.jsp.

26MEC04

ENGINEERING WORKSHOP & 3D PRINTING

(Common to Mechanical, Civil, ECE, EVL, EEE, Chemical & Bio Tech)

Instruction:	3 P Hours per week
Duration of SEE:	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	1.5

Prerequisite: Nil

COURSE OBJECTIVES: This course aims to:

1. Give a feel of Engineering Practices and develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive and team work attitude to get things right the first time.
3. Provide basic knowledge of steel, plastic, composite, and other materials for suitable applications.
4. Study of principle and hands on practice on techniques of fabrication, manufacturing, and allied skills.
5. Advance important, hard and pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

COURSE OUTCOMES: Upon completion of this course, students will be able to

1. Students will be able to fabricate a square tray and perform a lap joint on mild steel using proper marking, , welding, and finishing techniques.
2. Apply house-wiring techniques to construct and verify single-point, series, parallel, and staircase circuits.
3. Apply pipe fitting techniques to thread, assemble, and verify GI pipe systems as per given diagrams.
4. Perform 3d modeling using solid works software and pre-processing operations on STL files for 3D printing, also understand reverse engineering process.
5. Conceptualize and produce simple device/mechanism of their choice.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	1	2	1	1			1				1	1	3
CO2	1		1								1	1	3
CO3	1		1			1					1	1	3
CO4	1		1			1					1	2	2
CO5	2	2	2	1	3	1	1	1	2		2	2	3

1 - Slightly; 2 - Moderately; 3 - Substantially

LAB EXPERIMENTS

Group 1: Workshop Practice

1. To make a square tray from the given sheet metal
2. Fabricate a funnel from the given sheet metal and join it using soldering.
3. Wiring of Single Light Point and Socket with Switches, and Series–Parallel Connection of Two Light Points with Verification.
4. Stair case wiring of one light point controlled from two different places independently using two 2way switches.
5. To make external threads for GI/uPVC pipes using die and connect the GI/uPVC pipes as per the given diagram using taps, couplings, and bends.
6. Assemble GI/uPVC pipes as per the diagram using fittings, install a shower, tap, and valves, and demonstrate operation with a water connection.

Group 2: Additive Manufacturing /3D Printing

1. Introduction to Additive manufacturing and modeling Software
2. To create a 3D CAD model (Door Bracket and Door handle) using modeling software.
3. To perform preprocessing operations and print a door bracket model using an extruder type 3D printer.
4. To create a 3D CAD model using Reverse engineering.
5. To demonstrate Engraving, Drilling and Cutting operations on printed circuit boards using CNC PCB Mate.
6. To design an innovative component using the CAD software/print the selected innovative component using a 3D printer.

TEXT BOOKS:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Sabrie Soloman , "3D Printing & Design ", 1st edition,khanna Publishing House,2020

SUGGESTED READING:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology.
2. Oliver Bothmann, 3D Printers: A Beginner's Guide, January 1, 2015.

26EGC02

COMMUNICATION SKILLS LAB

(BE/B.Tech - Common to all Branches)

Instruction:	2 P Hours per week
Duration of SEE:	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	1

Prerequisite: Basic Knowledge of English Communication.

COURSE OBJECTIVES: This course will introduce the students

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation through computer-aided multi-media instruction.
2. To the significance and application of word stress and intonation.
3. To sufficient practice in listening to English spoken by educated English speakers in different socio-cultural and professional settings.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behaviour while developing their ability to use language appropriately, to discuss in groups and make presentations.

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

1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Produce speech with clarity and confidence using correct word stress, and intonation.
3. Achieve improved ability to listen, understand, analyse, and respond to English spoken in various settings.
4. Determine the context and speak appropriately in various situations.
5. Design effective posters collaboratively through creative decisions, give presentations, and efficiently participate in Group discussions.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1								1	1		1		
CO2						1		1	2		1	1	
CO3						1	1	1	2		1	1	
CO4	1	1	1	1	1	1	2	2	3		1	1	1
CO5		1	1	1	1	2	2	2	3	1	2	1	1

1 - Slightly; 2 - Moderately; 3 - Substantially

Exercises

Computer-Aided Language Learning Lab

1. **Introduction to English Phonetics**: Introduction to English Phonetics and organs of speech.
2. **Sound System of English**: Speech sounds- Vowels and Consonants - Basic phonetic transcription practice.
3. **Syllable Division and Word stress**: Introduction to syllables- structure of syllables - Rules of word stress.

4. **Intonation**: Types of Intonation, Practice in Articulation – MTI – Common Errors in pronunciation.
5. **Listening Skills**: understanding Listening- types of listening- Practice in Listening comprehension texts.

Interactive Communication Skills Lab

1. **Role Play -** Practicing the nuances of situational language, simulating the real-world conversations in a designed environment.
2. **Group Discussions -** Understanding the Dynamics and techniques of a Group Discussion, and Non-Verbal Communication.
3. **Debate -** Learning speaking dynamics in a formal discourse, discussion and oral addresses.
4. **Poster Presentation –** Working on a Theme, Poster preparation and presentation.
5. **Public Speaking –** Speaking with confidence and clarity in different contexts on various issues.

TEXT BOOKS:

1. T Balasubramanian, "A Textbook of English Phonetics for Indian Students", Macmillan, 2nd Edition, 2017.
2. J Sethi et al., "A Practical Course in English Pronunciation (with CD)", Prentice Hall India, 2005.
3. Priyadarshi Patnaik, "Group Discussions and Interview Skills", Cambridge University Press Pvt. Ltd., 2nd Edition, 2023.
4. Aruna Koneru, "Professional Speaking Skills", Oxford University Press, 2018.

SUGGESTED READING:

1. "English Language Communication Skills – Lab Manual cum Workbook", Cengage Learning India Pvt. Ltd., 2022.
2. KN Shoba& J. Lourdes Javani Rayen."Communicative English – A workbook", Cambridge University Press, 2019.
3. Sanjay Kumar& Pushp. Lata. "Communication Skills: A Workbook. Oxford University Press", 2019.
4. Veerendra Mishra et al. "English Language Skills: A Practical Approach", Cambridge University Press, 2020.

SUGGESTED SOFTWARE:

1. K-VAN Multi-Media Language Lab
2. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
3. Digital All
4. Orell Digital Language Lab (Licensed Version).