MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
(Deemed to be University)
MADANAPALLE
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Estd 1998

DEPARTMENT OF BIOINFORMATICS
Course Structure
&
Detailed Syllabi

For the students admitted to

B. Tech. Regular Four Year Degree Programme during the Academic Year 2026-27

and

B. Tech. Lateral Entry Scheme during the Academic Year 2027-28

DEPARTMENT OF BIOINFORMATICS

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

(Deemed to be University)

MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: BIOINFORMATICS

Total Credits	160 Credits for 2026 (Regular) & 120 Credits for 2027 (Lateral Entry) Admitted Batch onwards

I. Induction Program and Holistic Development Activities

Sl.No	Title	Duration
1	Induction Program (Mandatory)	Three weeks' duration at the start of First Year

R25 - Curriculum Structure

I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	AEC	25BAENGTC01	Professional Communication	2	0	0	2	2
2	HSMC	25BAHUMTC01	Human Values and Professional Ethics	2	0	0	2	2
3	BSC	25BAMATTC13	Calculus and Differential Equations	3	0	0	3	3
4	BSC	25BAPHYTC03	Modern Physics for Quantum Technologies	3	0	0	3	3
5	ESC	25BACADTC01	Python Programming for Problem Solving	3	0	0	3	3
6	PCC	25BAEEETC02	Basic Electrical and Electronics Engineering	3	0	0	3	3
7	AEC	25BAENGLC01	Professional Communication Laboratory	0	0	2	2	1
8	BSC	25BAPHYLC01	Physics Laboratory	0	0	2	2	1
9	ESC	25BACADLC01	Python Programming for Problem Solving Laboratory	0	0	2	2	1
10	ESC	25BACOMLC01	Engineering Skills Laboratory	0	0	2	2	1
Total				**16**	**0**	**8**	**24**	**20**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	25BAMATTC14	Linear Algebra for Bioinformatics	3	0	0	3	3
2	BSC	25BACHETC03	SMART Chemistry	3	0	0	3	3
3	ESC	25BACIVTC02	Introduction to Environment and Sustainability	2	0	0	2	2
4	ESC	25BABIMTC01	Introduction to Bioinformatics	3	0	0	3	3
5	ESC	25BACADTC02	C and Data Structures	3	0	0	3	3
6	ESC	25BAMECEC01	Engineering Graphics	2	0	2	4	3
7	BSC	25BACHELC03	Chemistry Laboratory	0	0	2	2	1
8	ESC	25BACSELC02	IT Essentials Laboratory	0	0	2	2	1
9	ESC	25BACADLC02	C and Data Structures Laboratory	0	0	2	2	1
Total				**16**	**0**	**8**	**24**	**20**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

- ***Proficiency modules***

  - Basic Computer Proficiency
  - Interpersonal skills
  - Computer Graphics
  - Web programming
  - Mobile Apps
  - Vocabulary enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Universal Human Values (UHV – I)
2. Physical and Health
3. Culture
4. Literature and Media
5. Social Service
6. Self-Development
7. Nature and Environment
8. Innovation

I Year I Semester

B. Tech I Year I Semester

25BAENGTC01 PROFESSIONAL COMMUNICATION

L	T	P	C
2	0	0	2

Pre Requisites: Universal Human Values (UHV-I) (desirable).

Course Description :

This course aims to develop essential English communication skills required for academic, social, and professional contexts. Students will learn to convey information effectively. The program enhances reading for comprehension, promotes reading for pleasure, and trains students to write various texts including emails, reports, business letters, presentations, and posters, enabling clear and confident communication in diverse settings.

Course Objectives:

This course aims to:

1. Enable students greet, introduce themselves and others, and describe their daily routines, surroundings, and familiar places.
2. Develop the ability to narrate past events or incidents coherently and to express plans and predictions for the future.
3. Foster functional communication skills such as enquiring, requesting, giving directions, instructions, and reporting information accurately.
4. Cultivate reading proficiency by engaging with stories, enhancing comprehension, vocabulary, and critical appreciation.
5. Equip students with skills in professional writing through emails, reports, letters, posters, and visual presentations.

UNIT I EVERYDAY ENGLISH 6 hours

Basics of essential grammar; Functions of communication such as greetings, introductions, leave-taking, polite expressions; describing daily routines and habits using the simple present tense; Describing things related to family, friends, classroom, home, campus, common places, gadgets and other objects.

UNIT II NARRATION AND PLANNING 6 hours

Using past tense forms for narration; sequencing events using connectors; vocabulary related to experiences, festivals, travel, and memorable events; expressing future time; predicting events and making career plans/prospects

UNIT III FUNCTIONAL COMMUNICATION IN DAILY LIFE 6 hours

Making enquiries using wh-questions, polite questions, and indirect requests; requesting and offering help with expressions for permission, obligation, and necessity; giving directions using common roadmap vocabulary; providing and following formal/informal instructions in everyday and academic contexts; reporting information through direct and indirect speech; impersonal passive voice.

UNIT IV READING FOR COMPREHENSION AND PLEASURE 6 hours

Developing extensive reading skills through prescribed short stories: *The Victory* by Rabindranath Tagore and *The Ransom of the Red Chief* by O Henry; applying techniques of reading such as skimming, scanning, and reading for gist and detail; building vocabulary through the texts; engaging in discussions on characters, settings, and themes from the reading; practicing reading comprehension for specific details through formal email samples.

UNIT V PROFESSIONAL AND BUSINESS COMMUNICATION 6 hours

Learning principles of professional communication such as clarity, conciseness, courtesy, correctness, and formats; Email etiquette; Drafting emails/letters critically appreciating the novel/short story read in Unit 4; preparing short reports; drafting business letters such as inquiries, complaints, replies; designing posters with focus on layout, persuasive language, and visuals; delivering short presentations using visual aids.

Course Outcomes:

Students will be able to:
CO1: Greet and introduce themselves and others, describe their routines, places, and things around them.
CO2: Narrate an event or incident, planning and predicting the future
CO3: Enquire, request, give directions/instructions, report and convey information
CO4: Read for pleasure and read for comprehension
CO5: Write formal/informal emails, short reports, presentations, business letters, and make posters.

Text Books:

1. Functional English for Communication by Ujjwala Kakarla, Tanu Gupta, Leena Pundir (SAGE, 2019)
2. Communication Skills by Sanjay Kumar & Pushp Lata (Oxford University Press, 3rd Edition, 2024)
3. Extensive Reading in the Second Language Classroom" by Richard R. Day and Julian Bamford (Cambridge University Press, 2022).

Reference Books:

1. Functional English Grammar (Cambridge University Press, 2024)
2. Essentials of Business Communication by Mary Ellen Guffey & Dana Loewy (Cengage Learning, 10th Edition, 2016)
3. English for Business Communication by Mable Chan (Routledge, 2025)
4. Handbook of Communication Skills edited by Owen Hargie (Routledge)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination

Dept. of Bioinformatics

B.Tech I Year I Semester

25BAHUMTC01 HUMAN VALUES AND PROFESSIONAL ETHICS

L	T	P	C
2	0	0	2

Pre-requisite None. Universal Human Values (UHV-I) (desirable).

Course Description :

1. This course presents a universal approach to value education by developing the right understanding of reality (i.e., a worldview of the reality "as it is") through the process of self-exploration.
2. The whole course is presented in the form of a dialogue whereby a set of proposals about various aspects of reality are presented, and the students are encouraged to self-explore the proposals by verifying them based on their natural acceptance within oneself and validating experientially in living.
3. The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information.
4. While introducing the holistic worldview and its implications, a critical appraisal of the prevailing notions is also made to enable the students to discern the difference on their own right.
5. Thus, this course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Course Objectives :

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a right understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values (UHV) and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. To aid the students in realising their full human potential and act accordingly.
5. To assist the students to live with a feeling of relationship, harmony and co-existence.

UNIT I INTRODUCTION TO VALUE EDUCATION 6 hours

Lecture 1: Holistic Development and the Role of Education (Right Understanding, Relationship and Physical Facility)
Lecture 2: Understanding Value Education
Lecture 3: Self-Exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Lecture 5: Happiness and Prosperity – Current Scenario

UNIT II HARMONY IN THE HUMAN BEING 6 hours

Lecture 6: Understanding Human being as the Co-existence of the self and the body
Lecture 7: The body as an Instrument of the self
Lecture 8: Understanding Harmony in the self
Lecture 9: Harmony of the self with the body
Lecture 10: Programme to ensure self-regulation and Health

UNIT III HARMONY IN THE FAMILY AND SOCIETY 6 hours

Lecture 11: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 12: 'Trust' – the Foundational Value in Relationship
Lecture 13: 'Respect' – as the Right Evaluation
Lecture 14: Other Feelings, Justice in Human-to-Human Relationship
Lecture 15: Understanding Harmony in the Society

UNIT IV HARMONY IN THE NATURE/EXISTENCE 6 hours

Lecture 16: Understanding Harmony in Nature
Lecture 17: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Lecture 18: Realizing Existence as Co-existence at All Levels
Lecture 19: The Holistic Perception of Harmony in Existence

UNIT V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS 6 hours

Lecture 20: Natural Acceptance of Human Values
Lecture 21: Definitiveness of (Ethical) Human Conduct
Lecture 22: Competence in Professional Ethics
Lecture 23: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 24: Strategies for Transition towards Value-based Life and Profession

Course Outcomes:

After completing this Unit, students will be able to
CO1: Understand the basic human aspiration and Natural Acceptance.
CO2: Aware of themselves and self-regulation.
CO3: Recognize human-human relationship (Justice) and identify human goals in society.
CO4: Appreciate the harmony in nature and existence.
CO5: Develop as socially and ecologically responsible engineers in handling problems with sustainable solutions (user-friendly and eco-friendly).

Text Book(s)

1. R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 3rd Revised Edition, UHV Publications, Sarva Shubha Nyas, Kanpur, 2023. ISBN: 978-81-957703-7-3 (Printed Copy) ISBN: 978-81-957703-6-6 (e-book)
2. R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for a Foundation Course in Human Values and Professional Ethics,* 3rd Revised Edition, UHV Publications, Sarva Shubha Nyas, Kanpur, 2023.

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), Annie Leonard, Free Press, 2010.
4. The Story of My Experiments with Truth, Mohandas Karamchand Gandhi, Fingerprint! Publishing
5. Small is Beautiful - E. F Schumacher, Random House, 2011.
6. Slow is Beautiful - Cecile Andrews, New Society Publishers, 2006.
7. Economy of Permanence - J C Kumarappa
8. Vivekananda - Romain Rolland

Online Resources:

1. https://fdp-si.aicte-india.org/index.php
2. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
3. https://uhv.org.in/
4. https://www.youtube.com/@UniversalHumanValues/playlists
5. https://www.youtube.com/@mitsmadanapalle3058/playlists

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech I Year I Semester

25BAMATTC13 CALCULUS AND DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

Pre Requisites: Basics of Geometry and Algebra

Course Description:

This course introduces the fundamental concepts of derivatives, integration, differential calculus, multivariable calculus, and ordinary differential equations. The course covers limits, continuity, mean value theorems, series expansions, partial differentiation, extreme values of multivariable functions and methods for solving first and second-order differential equations. These mathematical tools provide a foundation for modeling biological processes.

Course Objectives:

1. To acquire the knowledge on derivatives and integrations
2. To introduces the fundamental principles of differential calculus.
3. To familiarize the knowledge of partial derivatives and extreme values in multivariable functions.
4. To formulate and solve first order ordinary differential equations.
5. To solve second order differential equations of various kinds

UNIT I DERIVATIVES AND INTEGRATION 9 hours

Limit, Continuity, derivatives, derivatives as rate of change. Integration, Standard forms, Evaluation of definite integrals, length and area.

UNIT II DIFFERENTIAL CALCULUS 9 hours

Maxima and minima for function of single variable, Rolle's theorem, mean value theorems, Taylor's and Maclaurin's series.

UNIT III MULTIVARIABLE DIFFERENTIAL CALCULUS 9 hours

Functions of several variables, Partial derivatives, Chain rule, Directional derivatives, Extreme values and Saddle points.

UNIT IV FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 hours

Order and degree, formation of differential equations, solution of first order linear differential equation (variable separable method, homogeneous, exact, linear equations). Applications: Growth and Decay

UNIT V SECOND ORDER ORDINARY DIFFERENTIAL EQUATIO 9 hours

Second order linear differential equations, Homogeneous equation with constant coefficients, non-homogeneous equations (RHS is $e^{ax}, x^n, sinax, cosax$).

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Solve problems involving the differentiation and integration of functions.

CO2: Employ the mean value theorems and series expansions for mathematical modeling in bioinformatics.

CO3: Evaluate rates of change using partial derivatives to investigate relationships among multiple biological variables.

CO4: Apply analytical techniques to solve first-order ordinary differential equations.

CO5: Solve second-order differential equations arising in computational biology applications.

Text Books:

1. George B. Thomas, Maurice D. Weir, Joel R. Hass, Thomas' Calculus, Pearson Education 12th Edition, 2014.
2. Simmons G.F., Differential Equations with Applications and Historical Notes, Tata McGraw Hill Edition 2003, Eighteenth reprint 2010.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2006.
2. John Bird, Higher Engineering Mathematics, 2nd Edition, Routledge (Taylor & Francis Group), London, New York, 2018.
3. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd. 4th Edition, 2014.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42th Edition, 2012.
6. Michael D. Greenberg, Advanced Engineering Mathematics, Prentice Hall, 2nd Edition, 1998.
7. Howard Anton, Irl Bivens, Stephen Davis, Calculus Early Transcendentals, 10th Edition, John Wiley & Sons, Inc. 2012.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

25BAPHYTC03 MODERN PHYSICS FOR QUANTUM TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisites: Plus two physics fundamental knowledge

Course Description:

This course offers an accessible and engaging introduction to the fundamental concepts of modern physics and their applications in quantum computing. specifically designed for computer science and engineering students. It explores key quantum concepts such as superposition, entanglement, and quantum gates, and explains how these ideas form the foundation of quantum information processing. Students will also explore the hardware side of quantum computing, including optics and photonics-based systems, linear optical components, semiconductor technologies, magnetism, and superconducting qubits used in modern quantum processors. The course combines theoretical understanding with practical insights into the tools, frameworks, and emerging technologies driving real-world quantum computation.

Course Objectives:

1. Understand and apply principles of interference, diffraction, and polarization in advanced optical systems for quantum technologies.
2. Interpret Schrödinger's equation to simple quantum systems and apply quantum tunneling phenomena.
3. Explain quantum superposition, entanglement, and quantum gates for computation.
4. Understand semiconductor physics, quantum Hall effect, and quantum dots in computing hardware.
5. Apply magnetism and superconductivity for superconducting qubits and quantum circuits.

UNIT I WAVE OPTICS 9 hours

Principles of interference, Young's double slit experiment, Newton's rings experiment, Michaelson interferometer, Quantum interference, Principles of Diffraction, Single Slit, double slit, diffraction grating (Qualitative). Polarization and Types, methods of Polarization, Nicol Prism, Beam splitters (Intensity & polarization), phase shifters (Half wave and Quarter wave).

UNIT II QUANTUM MECHANICS 9 hours

De Broglie's hypothesis, Uncertainty principle, Postulates of quantum mechanics - Wave function, Operators, Quantum states and measurement, Hilbert space, Schrodinger wave equations: Time dependent and independent, Applications of Schrodinger wave equation: free particle, particle in a box, and tunnelling.

UNIT III FOUNDATIONS OF QUANTUM COMPUTING 9 hours

Qubit, single and multi-qubit systems, Bloch sphere visualization, Quantum vs classical computers, Principles of superposition, Quantum Parallelism. Measurement of Quantum states and observation, Quantum Entanglement: introduction, EPR pairs and importance in quantum information, Unitary transformations, Elementary quantum gates.

UNIT IV FREE ELECTRON THEORY & SEMICONDUCTORS 9 hours

Quantum free electron theory, origin of energy bands, band structure, classification of materials, density of states, Fermi energy level.

Semiconductor types, intrinsic and extrinsic, Drift and Diffusion Current, Hall effect, 0-, 1-, 2-dimensional quantum materials, Quantum dots, Quantum Dots as Qubits, Quantum Hall Effect (QHE) and Sensors.

UNIT V MAGNETISM AND SUPERCONDUCTIVITY FOR QUANTUM TECHNOLOGIES 9 hours

Magnetism: Atomic origin and classification of magnetic materials, hysteresis, magnons. Superconductors: Type I & II, BCS theory, Josephson junctions, superconducting qubits, Quantum circuits, SQUIDs, superconductors in quantum computers.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Apply optical interference, diffraction, and polarization principles in designing quantum optical systems.

CO2: Solve simple quantum systems using Schrödinger's equation and interpret tunnelling phenomena.

CO3: Represent and manipulate qubit states, superposition, and entanglement using basic quantum gates.

CO4: Understanding semiconductor properties and quantum effects for their role in quantum hardware.

CO5: Apply the magnetic and superconducting principles relevant to superconducting qubits and Quantum circuits.

Text Books:

1. Engineering Physics –Dr. M.N. Avadhanulu, Dr. P.G. Kshirsagar & TVS Arun Murthy, 11th editions 2018, S. Chand and Company.
2. Quantum Mechanics, Concepts and Applications (An Indian Adaptation) - **Nouredine Zettili,** 2ed: by Wiley.
3. Quantum Computing: A Beginner's Introduction, - Parag K. Lala, 1st Edition, 2019 McGraw-Hill Education.
4. Quantum Computing for Everyone – Bernhardt, 2020, The MIT Press
5. Engineering Physics - H.K. Malik & A.K. Singh, 2nd Edition, 2018, McGraw Hill Education (India) Private Limited.

Reference Books:

1. Concepts of Modern Physics, - Arthur Beiser, 7th Edition, 2017, TATA Mc Graw Hill
2. Engineering Physics –K. Thyagarajan, 2018, McGraw Hill Publisher
3. Physics Vol I & II, - Halliday/Resnick/Krane 5th Edition, 2007, John Wiley.
4. Quantum Computation and Quantum Information - Nielsen & Chuang, 10th Anniversary Edition, 2010, CAMBRIDGE UNIVERSITY PRESS
5. Solid State Electronic Devices- B.G. Streetman, Sanjay Kumar Banerjee, 7th ed. 2018, Pearson,
6. Superconductivity: Basics and Applications to Magnets - P. N. Barnes, 2015, Springer

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

25BACADTC01 PYTHON PROGRAMMING FOR PROBLEM SOLVING

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course introduces the fundamentals of programming using Python. It focuses on algorithmic thinking, Python syntax, control structures, functions, built-in data structures, file handling, modules, and packages. The course enables students to develop problem-solving skills and implement efficient Python programs for real-world applications.

Course Objectives:

This course enables students to

1. Understand the fundamentals of algorithms, Python programming environment, data types, operators, and expressions.
2. Develop Python programs using decision-making, iterative, and control statements.
3. Apply string processing techniques and implement modular programs using functions.
4. Utilize Python data structures such as lists, tuples, sets, and dictionaries for data organization and manipulation.
5. Implement file handling operations and develop reusable programs using modules and packages.

UNIT I PYTHON PROGRAMMING FUNDAMENTALS 9 hours

Problem Solving Concepts: Algorithms, Characteristics of Algorithms, Building Blocks of Algorithms, Flow of Program Execution.

Introduction to Python: History of Python, Features of Python Programming, Python Interpreter, Running Python Programs, Python Scripts, Variables, Keywords, Identifiers, Input and Output Statements, Indentation, Comments.

Data Types and Operators: Numeric Data Types, Strings, Boolean Data Type, Type Conversion, Arithmetic Operators, Relational Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and Operator Precedence.

UNIT II PYTHON PROGRAM FLOW AND CONTROL STATEMENTS 9 hours

Decision Making Statements: Introduction to Control Structures, if Statement, if-else Statement, if-elif-else Statement, Nested Conditional Statements.

Iterative Statements: range() Function, for Loop, while Loop, Nested Loops.

Loop Control Statements: break Statement, continue Statement, pass Statement.

UNIT III STRINGS AND FUNCTIONS 9 hours

String Processing: Introduction to Strings, String Operations, String Indexing and Slicing, String Traversal, String Handling Functions, String Methods, String Immutability.

Functions: Introduction to Functions, Defining Functions, Calling Functions, Passing Arguments, Function Parameters, Return Values, Built-in Functions, User-defined Functions, Recursive Functions, Scope of Variables,Global and Local Variables.

UNIT IV PYTHON COLLECTIONS AND DATA STRUCTURES 9 hours

Lists: Introduction to Lists, List Creation, Indexing and Slicing, List Operations, List Traversal, List Methods.

Tuples and Sets: Introduction to Tuples, Tuple Operations and Methods, Introduction to Sets, Set Operations, Set Methods.

Dictionaries and Comprehensions: Introduction to Dictionaries, Creating Dictionaries, Accessing and Updating Dictionary Elements, Dictionary Operations, Dictionary Methods, Sequences, List and Dictionary Comprehensions.

UNIT V FILE HANDLING, MODULES AND PACKAGES 9 hours

File Handling: Introduction to Files, Types of Files, File Handling Modes, Opening and Closing Files, Reading Data from Files, Writing Data into Files, Appending Data to Files, Exception Handling in File Operations.

Modules and Packages: Need for Modular Programming, Creating Modules, Import Statement, From Import Statement, Namespace, Standard Python Modules, User-defined Modules, Creating and Using Packages.

Course Outcomes:

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

1. CO1: Explain Python programming fundamentals, data types, operators, expressions, and basic problem-solving techniques.
2. CO2: Develop Python programs using conditional statements, loops, and control statements.
3. CO3: Implement string manipulation techniques and design modular programs using functions and recursion.
4. CO4: Apply Python data structures including lists, tuples, sets, and dictionaries to solve computational problems.
5. CO5: Develop Python applications using file handling concepts, modules, and packages.

Text Books

1. Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press, 2017.
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media, 2015.

Reference Books

1. Mark Lutz, Learning Python, 5th Edition, O'Reilly Media, 2013.
2. Wesley J. Chun, Core Python Applications Programming, 3rd Edition, Pearson Education, 2012.
3. John V. Guttag, Introduction to Computation and Programming Using Python, 2nd Edition, MIT Press, 2016.
4. Paul Barry, Head First Python, 2nd Edition, O'Reilly Media, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B.Tech I Year I Semester

25BAEEETC02 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

		L	T	P	C
Pre Requisites:	None	**3**	**0**	**0**	**3**

Course Description:

This course introduces the fundamentals of DC and AC circuits, electrical measurements, and sensors. This course covers the construction, principles, and applications of electrical machines along with essential safety practices. Students can learn about semiconductor devices, their applications in circuits, and basics of digital electronics. The course builds a strong foundation in electrical and electronic engineering concepts for beginners.

Course Objectives:

1. Introduce the basics of DC and AC circuits and power systems.
2. Explain the principles of electrical measurements and sensors.
3. Describe the construction and operation of common electrical machines.
4. Familiarize students with semiconductor devices and their applications.
5. Cover fundamentals of digital electronics and logic circuit design.

UNIT I INTRODUCTION TO DC AND AC CIRCUITS 9 hours

DC Circuits: Basic circuit elements and sources; Ohm's law; Kirchhoff's laws; Series and Parallel connection of circuit elements; Mesh current analysis; Node voltage analysis.
AC Circuits: Alternating voltages and currents, RMS, average, maximum values, Single Phase RL, RC, RLC series circuits, Power in AC circuits, Power Factor, Three-phase balanced systems, Star and delta Connections.

UNIT II MEASURING INSTRUMENTS AND SENSORS 9 hours

Operating Principle – Moving Coil and Moving Iron Instruments, Power Measurement, Energy Meter.Classification and characteristics of Sensors and Transducers; Types: proximity sensors, limit switches, piezoelectric, hall effect, photo sensors, Strain gauge, LVDT, piezo electric crystals, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

UNIT III ELECTRICAL MACHINES AND ELECTRICAL SAFETY 9 hours

Construction, working principle, and applications of DC Machines, Transformers, Three-phase Induction motors, Alternators, Stepper motor, and BLDC motor.
Electrical Safety and Precautions; Fuses and its types; Earthing and its types.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9 hours

Introduction to Semiconductor materials, Characteristics: PN junction diodes, Zener diodes, BJTs; Applications: Rectifiers, Voltage regulator, and Public addressing system.

UNIT V DIGITAL ELECTRONICS 9 hours

Binary arithmetic; Number base conversion; Boolean algebra: simplification of Boolean functions using K-maps; Logic gates; Introduction of basic combinational circuits: Half adder, Full adder; Introduction to sequential circuits; Flip Flops.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Analyse simple DC and AC circuits using fundamental laws.
CO2: Operate measuring instruments and classify sensors used in systems.
CO3: Explain the working and applications of electrical machines and safety devices.
CO4: Apply semiconductor devices in basic power electronic circuits.
CO5: Design simple digital logic circuits using combinational and sequential elements.

Text Books:

1. Kothari DP and Nagrath IJ, "Basic Electrical and Electronics Engineering", McGraw Hill Education, Second Editions, 2020.
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
3. Bhattacharya SK, "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition,2017
4. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. Rajendra Prasad 'Fundamentals of Electrical Engineering', Third Edition, Prentice Hall of India, 2014.
2. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
3. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
4. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

25BAENGLC01 PROFESSIONAL COMMUNICATION LABORATORY

L	T	P	C
0	0	2	1

Course Description:

This course enhances proficiency in English communication with emphasis on fluency, accurate pronunciation, and confidence. It develops speaking, listening, reading, and writing skills through structured activities. Learners will also develop competence in composing formal correspondence, reports, presentations and designing effective posters.

Course Objectives:

This course aims to:

1. Enable students to confidently greet others, introduce themselves and others in professional and cross-cultural contexts, and describe their everyday routines, roles, environments, and familiar locations with clarity.
2. Build the skill to narrate past experiences, achievements or memorable events clearly and to articulate professional goals, plans and predictions for the future.
3. Enhance practical communication skills such as making enquiries, requesting, giving directions or offering clarifications, and drafting accurate reports in academic and workplace settings.
4. Strengthening reading and listening skills by engaging with stories to improve comprehension, vocabulary, and critical appreciation.
5. Prepare students to compose formal emails, reports, letters, and to make posters, and deliver presentations using effective English expressions, structures, and style.

Lab Activities

Activities shall include listening tasks and a revisit of grammar, vocabulary, pronunciation, and intonation (wherever required)

1. Introduction to sounds of English, stress and intonation for apt pronunciation
2. Greetings; Introducing oneself and others; conversations
3. Describing a person, place, object, etc.
4. Narrating a personal incident/events
5. Planning/predicting a future event/prospects
6. Skit on enquiring and requesting
7. Roleplays on giving formal/informal instructions and reporting what has been done so far in the lab / general scenario
8. Listening to select video/audio and discussing a favorite part of the story/ documentary in groups.
9. Reading comprehension and reading business emails
10. Writing email, letters/reports
11. Presentations and making posters (online and offline)

Course Outcomes:

Students will be able to:

CO1: Speak English fluently with a good pronunciation in an Indian accent, and confidently handle greetings, introductions, and provide descriptions of their routines, locations, and surrounding objects.

CO2: Narrate stories, incidents, or personal experiences, as well as engage in planning and predicting future possibilities using appropriate English structures.

CO3: Demonstrate effective English communication by asking questions, making polite requests, giving instructions, and presenting reports or information clearly.

CO4: Apply listening and reading skills for comprehension, interpretation, and language development in both academic and professional contexts.

CO5: Compose grammatically correct and well-structured formal emails, reports, presentations, and business letters, and design posters with clear English expressions.

Text Books:

1. Communicative English – A Workbook by Shobha K.N. & Rayen J. Lourdes (Cambridge University Press, 2019)

Reference Books:

1. Communication Skills: A Workbook by Sanjay Kumar & Pushp Lata (Oxford University Press, 2019)
2. ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities (Board of Editors, Orient Black Swan Pvt. Ltd., 2016)
3. English Language Skills: A Practical Approach by Veerendra Mishra et al. (Cambridge University Press, 2020)

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BAPHYLC01 PHYSICS LABORATORY

L	T	P	C
0	0	2	1

Pre-requisites: Plus two physics knowledge

Course Description:

This course offers a comprehensive exploration of fundamental physics principles through a series of well-designed experiments, emphasizing both conceptual understanding and hands-on measurement techniques.

Course Objectives:

1. To experimentally analyze and quantify optical phenomena such as interference, diffraction, and polarization, using techniques like Newton's rings, single slit, and diffraction grating.
2. To determine and understand essential material and electronic properties, including energy gap in semiconductors and the mechanical strength of materials using specialized methods.
3. To measure and interpret magnetic and electromagnetic characteristics by studying B-H curves, magnetic fields, and resonance phenomena in electrical circuits.
4. To estimate fundamental physical constants such as Planck's constant and the charge-to-mass ratio of an electron using classical experimental setups.
5. To develop skills in conducting precise experimental investigations, analyzing data, and deriving key physical quantities relevant to modern physics and engineering applications.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. To determine the slit width (d) using the diffraction pattern produced by a single slit.
4. To determine the Brewster's angle and refractive index of a glass.
5. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.
6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
7. Determination of wavelength of Laser light using diffraction grating.
8. Determination of energy gap of a semiconductor using p-n junction diode.
9. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
10. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
11. Estimation of Planck's constant using photoelectric effect.
12. Determination of numerical aperture and acceptance angle of an optical fiber.
13. To study the frequency response of series LCR circuit-resonance frequency, band width and quality factor.
14. To find the charge to mass ratio of an electron using Thomson's method.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

Course Outcomes:

Students will be able to:

CO1: Know the various phenomena of light practically and gain knowledge about various optical technique methods.

CO2: Verify the theoretical concepts of optics, magnetism, waves and oscillations by hands on experiment.

CO3: Apply the scientific process in the conducting of experiments and report the experimental findings.

CO4: Understand mechanical phenomena by instruments and apply them in real time applications.

CO5: Acquire and interpret experimental data to examine the physical laws.

Text / Reference Books:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.
2. Engineering Physics Laboratory Manual, Jayaraman, 2013, Pearson Education.
3. A Course of Experiments with He-Ne Lasers, R.S. Sirohi, New Age International (P) limited, Publishers, 1985.

Web Resources: www.vlab.co.in
https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BACADLC01 PYTHON PROGRAMMING FOR PROBLEM SOLVING LABORATORY

L	T	P	C
0	0	2	1

Pre-requisite: NIL

Course Objectives:

1. Understand Python fundamentals, algorithms, data types, operators, and expressions.
2. Develop Python programs using decision-making, looping, and control statements.
3. Apply string handling concepts and implement modular programs using functions.
4. Utilize Python data structures such as lists, tuples, sets, and dictionaries for problem-solving.
5. Implement file handling, modules, and packages to develop reusable applications.

Programs:

1. Develop a Python program to create a personal expense calculator that accepts a user's monthly income and expenses such as food, transport, education, and other expenses. Calculate the total expenditure and remaining savings. Display the monthly expense summary.
2. An electricity department wants to automate the billing process. Write a Python program that accepts customer details and number of units consumed. Calculate and display the total electricity bill amount based on the given charges.
3. A weather monitoring application requires conversion of temperature values. Develop a Python program to accept temperature in Celsius and convert it into Fahrenheit and Kelvin.
4. An online examination system evaluates student performance automatically. Write a Python program to accept student marks, calculate percentage, determine pass/fail status, and assign grades based on the percentage obtained.
5. A banking organization wants to simulate basic ATM operations. Develop a Python program to perform balance enquiry, deposit, and withdrawal operations repeatedly using menu-driven options until the user chooses to exit.
6. An organization maintains employee attendance records. Write a Python program to calculate attendance percentage by accepting the number of working days and attended days. Display eligibility status based on attendance percentage.
7. An online application requires a password verification system for secure user registration. Write a Python program using functions to check password strength based on length, uppercase letters, lowercase letters, digits, and special characters.
8. A university stores student information digitally. Develop a Python program to perform string operations such as extracting student initials, converting names into required formats, and displaying formatted student details.
9. Design a Python-based calculator application using user-defined functions to perform arithmetic operations. Implement a recursive function to calculate the factorial of a given number.
10. A university wants to analyze student marks in a course. Develop a Python program using list operations to store marks of students and perform the following operations:
    a. Add new student marks to the list.
    b. Remove incorrect entries.
    c. Find highest and lowest marks.
    d. Calculate average marks.
    e. Sort the marks in ascending and descending order.
    f. Display the final marks list.
11. An organization maintains fixed employee information. Develop a Python program using tuples to:

a. Store employee details.

b. Access employee information.
c. Perform tuple operations.

12. A social media platform wants to analyze user connections. Develop a Python program using sets to:
a. Find common friends.
b. Find unique friends.
c. Suggest new connections.

13. A supermarket wants to manage product information. Create a Python program using dictionaries to:
a. Store product ID, name, and price.
b. Search products.
c. Update product information.
d. Display inventory details.

14. An organization wants to maintain employee payroll records permanently. Develop a Python program using file handling concepts to store employee details, retrieve employee records, and display salary information.

15. A college examination cell wants to maintain student results electronically. Write a Python program to store student marks into a file, read the stored information, calculate results, and generate a student performance report.

16. A banking system requires reusable program components. Develop a Python application by creating user-defined modules for account creation, deposit, withdrawal, and balance enquiry. Store transaction details using files.

Course Outcomes:

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

CO1: Develop Python programs using basic syntax, data types, operators, and input/output operations.

CO2: Implement programming solutions using conditional statements, loops, and control statements.

CO3: Apply strings and functions to design modular Python programs.

CO4: Analyze and solve problems using Python data structures and their operations.

CO5: Create application-based Python programs using file handling, modules, and packages.

Text Books:

1. Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press, 2017.
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media, 2015.

Reference Books:

1. Mark Lutz, Learning Python, 5th Edition, O'Reilly Media, 2013.

2. Wesley J. Chun, Core Python Applications Programming, 3rd Edition, Pearson Education, 2012.

3. John V. Guttag, Introduction to Computation and Programming Using Python, 2nd Edition, MIT Press, 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

25BACOMLC01 ENGINEERING SKILLS LABORATORY

L	T	P	C
0	0	2	1

Pre-Requisites Nil

Course Description:

This course provides hands-on experience in using basic electrical/electronic instruments and circuit design. and to develop practical skills in microcontroller programming and device interfacing for real-time applications. And provides hands-on training in fundamental manufacturing and fabrication processes used in mechanical engineering. Students will develop practical skills through activities such as sheet metal product development, plastic fabrication, 3D printing, woodwork using carpentry tools, laser engraving, and metal welding. The course also introduces the operation and applications of various mechanical power tools, CNC lathe, and milling machines, enabling learners to gain exposure to modern and traditional manufacturing techniques.

Course Objectives:

By the end of this course, the student will be able to:

1. To provide hands-on experience in using basic electrical/electronic instruments and circuit design.
2. To develop practical skills in microcontroller programming and device interfacing for real-time applications.
3. Provide hands-on experience in basic fabrication processes using sheet metal, plastics, wood, and welding to develop simple utility products.
4. Familiarize students with modern manufacturing technologies such as 3D printing, CNC machining, and laser engraving for product realization.
5. Enable students to understand, identify, and safely operate various mechanical engineering tools and equipment for engineering applications.

PART – A

Study Experiments:

1. Familiarization with Instrumentation and Tools
2. Understanding the microcontroller architecture and Programming

Choose any six from the following list of experiments:

1. Clock Pulse Generation and Signal Analysis using Digital Storage Oscilloscope (DSO).
2. Measurement of Electrical Power, Power Factor, and Energy using Portable Meters.
3. Study, Design and Testing of Full-Wave Bridge Rectifier Circuit.
4. Study, Design and Implementation of a SMPS.
5. Study, Design and Testing of Multiplexer using Logic Gates.
6. Interfacing of 7-Segment Display, Buzzer, Sensor with microcontroller.
7. Speed and Angle Control of Servo Motor using Microcontroller.
8. PCB Soldering Techniques and Testing Using a Multimeter.

Content Beyond the Syllabus (Virtual Laboratory)

9. Familiarisation of ICs.
10. Application of basic logic gates in fire and burglar alarms.
11. Wiring of a simple circuit for controlling

    (1) a lamp/fan point,
    (2) a staircase or corridor winding,
    (3) an electrical appliance (16A socket).

PART – B

List of Experiments:

1. Utility product development using sheet metal.
2. Plastic product fabrication.
3. 3D printing of simple components.
4. Wood product fabrication using carpentry tools.
5. LASER engraving.
6. Metal welding and fabrication.
7. Study of different mechanical engineering power tools.
8. Study of CNC Lathe and Milling machining processes.

Content beyond Syllabus

9. Plumbing
10. Computer Controlled Cutting of wooden object
11. 3D Machining

Course Outcomes:

At the end of the course, the student will be able to

CO1: Demonstrate soldering, measurement, and testing techniques using basic electrical/electronic instruments.

CO2: Design and implement simple circuits and microcontroller-based applications for power and control systems

CO3: Demonstrate the ability to fabricate simple components using sheet metal, wood, and welding processes.

CO4: Analyze and compare traditional and modern manufacturing techniques such as 3D printing, CNC machining, and laser engraving.

CO5: Select and operate appropriate hand tools, power tools, and machine tools for given product development tasks with safety considerations.

Text Books:

1. R. S. Sedha, A Textbook of Applied Electronics, S. Chand & Company Ltd.
2. Muhammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education.

3. V. Ramesh Babu, Engineering Workshop practice for JNTU, VRB Publishers Pvt. Ltd. 2023.
4. A. K. Sarathe, Engineering Workshop Practice, 1st edition, Khanna Book Publishers, 2022
5. Lab manual provided by the departments.

Reference Books:

1. Boylestad & Nashelsky, Electronic Devices and Circuit Theory, Pearson Education.
2. David A. Bell, Electronic Instrumentation and Measurements, Oxford University Press.
3. The Art of Electronics by Paul Horowitz and Winfield Hill, Cambridge University Press.
4. Sanjay Gupta & Santosh Gupta, SMPS: Switch Mode Power Supply, Technical Publications.
5. Boylestad & Nashelsky, Electronic Devices and Circuit Theory, Pearson Education.
6. P.Kannaiah, K.L.Narayana, Workshop Manual, 2nd Edition, SciTech Publishers, 2009.
7. K.C. John, Mechanical Workshop Practice, 2nd edition, Kindle Edition, 2010.
8. https://fab-coep.vlabs.ac.in/

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

I Year II Semester

B. Tech I Year II Semester

25BAMATTC14 LINEAR ALGEBRA FOR BIOINFORMATICS

L	T	P	C
3	0	0	3

Pre Requisites: Basic knowledge of algebra and arithmetic operations, coordinate geometry and graph plotting, elementary functions and equations.

Course Description:

Matrices and Linear Algebra provide the mathematical foundation for bioinformatics applications such as sequence analysis, gene expression data processing, machine learning, and biological network modeling.

Course Objectives:

1. To introduce vector and matrix operations used in biological and computational data analysis.
2. To develop skills in solving systems of linear equations and understanding matrix properties.
3. To explain eigenvalues, eigenvectors, and matrix diagonalization for modeling biological systems.
4. To provide knowledge of vector spaces, subspaces, bases, and dimensions in data representation.
5. To apply linear transformations and projections in bioinformatics and computational biology problems.

UNIT I VECTORS AND MATRICES 9 hours

Vectors and Vector Operations, Linear Combinations, Row and Column Vectors, The Dot Product, Vector Length, The Angle Between Vectors, Matrix Addition and Scalar Multiplication, Matrix Multiplication, Types of Matrices, Determinants.

UNIT II SYSTEM OF LINEAR EQUATIONS AND RANK OF A MATRIX 9 hours

Systems of Linear Equations, Row Echelon Form, Gaussian Elimination, Solving Linear Systems, Elementary Matrices and Matrix Inverses, Characterization of Invertible Matrices, Rank of Matrices.

UNIT III EIGENVALUES, EIGENVECTORS AND DIAGONALIZATION 9 hours

Eigenvalues and Eigenvectors, Computation of Eigenvalues and Eigenvectors, Properties, The Algebraic Multiplicity, Diagonalization, Matrix Powers.

UNIT IV VECTOR SPACES AND SUBSPACE 9 hours

Vector addition and scalar multiplication, Subspaces, The Span of a Set of Vectors, Linear Dependence and Independence, Bases and the Dimension of Subspaces, The Fundamental Matrix Subspaces, Eigenspaces and Geometric Multiplicity.

UNIT V LINEAR TRANSFORMATIONS AND PROJECTIONS 9 hours

Linear Transformations, Linear Transformations as Matrices, A Catalog of Linear Transformations, Projections, Rotations in Two and Three Dimensions, Composition of Linear Transformations.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Apply vector and matrix operations to represent and analyze biological datasets.

CO2: Solve systems of linear equations and determine matrix rank using appropriate methods.

CO3: Compute eigenvalues and eigenvectors and use diagonalization techniques in scientific computations.

CO4: Analyze vector spaces, subspaces, linear independence, and bases concepts in data modeling.

CO5: Utilize linear transformations and projections to solve problems in bioinformatics and related domains.

Text Books:

1. Nathaniel Johnston, Introduction to Linear and Matrix Algebra, 1st ed, Springer Nature Switzerland AG, 2021.

Reference Books:

1. Datta Kanti Bhushan, Matrix and Linear Algebra Aided with MATLAB, 3rd ed, PHI, 2016.

2. Hans Schneider, George Philip Barker, Matrices and Linear Algebra, 2nd ed, Dover Publications Inc., 1989.

3. Fuzhen Zhang, Problems in Linear Algebra and Matrix Theory, 1st ed, World Scientific, 2022.

4. James DeFranza Dr, Daniel Gagliardi, Introduction to Linear Algebra with Applications, 1st ed, McGraw Hill, 2018.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

25BACHETC03 SMART CHEMISTRY

L	T	P	C
3	0	0	3

Pre Requisites: Intermediate Chemistry

Course Description:
SMART Chemistry explores the intersection of modern chemistry, materials science, and computation. The course covers quantum chemistry, group theory, spectroscopy, nanomaterials, molecular logic gates, and bio-inspired computing, emphasizing their applications in molecular electronics and AI-driven chemical systems. Students gain a foundational understanding of advanced chemical principles and futuristic computing paradigms.

Course Objectives:

1. **To develop** an understanding of the principles of quantum chemistry, materials science, group theory, and spectroscopy relevant to computing and molecular technologies.
2. **To enable** students to apply concepts of materials for computing, molecular logic gates, and bio-inspired systems to solve problems in next-generation computing and electronics.
3. **To cultivate** analytical skills for interpreting chemical, spectroscopic, and computational data, and relating them to emerging scientific and technological applications.

UNIT I QUANTUM CHEMISTRY 9 hours

Fundamentals of Quantum mechanics:- Wave-particle duality, Uncertainty principle, Postulates of quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo-diatomic molecules – energy level diagrams of N_2, and O_2, calculation of bond order, π-molecular orbitals of butadiene.

UNIT II GROUP THEORY & SPECTROSCOPY 9 hours

Introduction to group theory, definitions of group, subgroup, Class, Properties of a group, Symmetry elements and symmetry operations, Symmetry point groups, Matrix representation of groups, C_{2V} & C_{2h} point groups. Integration with Quantum Chemistry: Symmetry-informed AI models for molecular structure prediction.
Introduction to spectroscopy, UV-Visible spectroscopy – electronic transitions in MOs, Beer-Lambert's Law - Instrumentation – Applications.

UNIT III MATERIALS FOR COMPUTING 9 hours

Semiconductors – Introduction, basic concept, role of doping agents, applications
Super conductors-Introduction, basic concept, applications.
Conducting polymers – Introduction, mechanism of conduction & applications
Memristors: Concept, working principle, and applications
Nano materials: Introduction, classification, properties and applications (including computing) of Fullerenes, carbon nano tubes and Graphene.

UNIT IV MOLECULAR LOGIC GATES 9 hours

Introduction to Boolean logic, Basic logic gates: AND, OR, NOT, Truth tables and binary language, Transition from silicon to molecules: molecular electronics (VS) molecular logic, Simple chemical input–output systems (e.g., pH, metal ions), Fluorescent and colorimetric logic gates.
Basic examples: (AND gate using acid–base, OR gate using metal ions, NOT gate using quenching), Applications of Molecular Logic, Future of Molecular computing (Limitations and challenges of molecular logic, Comparison with traditional electronics.

Future of Molecular Computing: AI/ML-driven design of molecular circuits, hybrid silicon-molecular architectures.

UNIT V BIO-INSPIRED COMPUTING 9 hours

Introduction to biomolecules, structure & functions of carbohydrates, amino acids, protein, DNA, RNA, neurons, synapses, neuro-muscular junctions (NMJ).
Genes, codons, DNA computing, protein computing, biohybrid robots-Xenobots, Belousov–Zhabotinsky (BZ) reaction and applications.
Introduction to post-CMOS computing, Link to brain-inspired AI (neuromorphic computing)
AI in Bio-computing: ML for genome analysis, protein folding (AlphaFold).

Course Outcomes:

At the end of the course, the students would be able to

CO1: Explain the fundamental postulates of quantum mechanics and the significance of the wave function
CO2: Explain the concepts, properties, and applications of semiconductors, superconductors, conducting polymers, and memristors. Analyze semiconductors, superconductors, polymers, memristors, and nanomaterials for computing, with emphasis on AI-enabled materials discovery.
CO3: Explain Boolean logic, basic logic gates, and the transition from silicon to molecular electronics
CO4: Explain the structure and functions of biomolecules and their roles in biological computing systems
CO5: Explain the basic concepts of group theory, symmetry operations, and point groups, integrating AI/ML approaches for chemical and spectroscopic data interpretation.

Text Books:

1. Quantum Chemistry – Ira N. Levine, 8th Ed., Pearson Education, 2020.

2. Nanostructures and Nanomaterials: Synthesis, Properties and Applications – Guozhong Cao & Ying Wang, 2nd Ed., World Scientific, 2011.
Group Theory and Chemistry – David M. Bishop, Dover Publications, 1993.

3. Artificial Intelligence in Chemistry: Machine Learning and Deep Learning in Chemical and Materials Science – Edited by Hugh Cartwright, Royal Society of Chemistry, 2020.

4 Symmetry and Spectroscopy: An Introduction to Vibrational and Electronic Spectroscopy – Daniel C. Harris & Michael D. Bertolucci, Illustrated Reprint (Dover Publications), November 1, 1989.

5 Recent Developments in Biologically Inspired Computing – L. N. de Castro & F. J. Von Zuben, Idea Group Publishing, 2004.

6 Molecular Logic-based Computation – A. Prasanna de Silva, Royal Society of Chemistry, 2012

Reference Books:

1. Molecular Electronics: An Introduction to Theory and Experiment – Juan Carlos Cuevas & Elke Scheer, 2nd Ed., World Scientific, 2017.
2. Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies – Dario Floreano & Claudio Mattiussi, MIT Press, 2008.
3. Principles of Instrumental Analysis – Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, 7th Ed., Cengage Learning, 2018.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B.Tech I Year II Semester

25BACIVTC02 INTRODUCTION TO ENVIRONMENT AND SUSTAINABILITY

		L	T	P	C
Pre-Requisites:	None	**2**	**0**	**0**	**2**

Course Description:

This course provides foundational knowledge of environmental systems, biodiversity, and sustainability. It addresses major environmental challenges like pollution and climate change, and introduces students to key policies, global sustainability frameworks, and sustainable engineering practices.

Course Objectives:

1. Understand the interdependence between environmental system and human well-being.
2. Analyze key environmental issues including pollution, climate change, and resource degradation.
3. Interpret environmental laws, standards, and global sustainability agreements.
4. Evaluate sustainability frameworks and the role of engineering in achieving development goals.
5. Apply sustainable engineering principles to address real-world environmental challenges.

UNIT I ENVIRONMENTAL SYSTEMS 6 hours

Definition, scope, and importance of environment - Components of ecosystem: biotic and abiotic - Energy flow in ecosystems (food chains, food webs) - Biogeochemical cycles: Water, Carbon, Nitrogen - Biodiversity: definition, values, and threats - Overview of natural resources: renewable vs. non-renewable

UNIT II ENVIRONMENTAL CHALLENGES 6 hours

Pollution: definition, types (Air, Water, Soil, Noise) - Causes, effects, and basic control measures - Urbanization – Land degradation - Solid and E-waste management –- Climate change, global warming, greenhouse effect - Ozone depletion and carbon footprint

UNIT III ENVIRONMENTAL POLICIES 6 hours

Overview of ISO 14001:2015 - Roles of CPCB, SPCBs, and NGT - Key environmental acts (Air, Water, Forest, Wildlife) - International agreements: Montreal, Kyoto, Paris Agreement - Basics of Environmental Impact Assessment (EIA) - Introduction to carbon credit and energy auditing

UNIT IV SUSTAINABILITY GOALS 6 hours

Foundations of Sustainability- Definition, Concept, needs and challenges- principles of sustainability - Evolution of Global Sustainability Frameworks - Agenda 21, millennium development goals, and protocols - Sustainable Development Goals - targets, indicators – Role of engineering and technology in achieving SDGs

UNIT V SUSTAINABLE ENGINEERING APPROACHES 6 hours

Introduction to Sustainability in Engineering - Guiding principles and Frameworks for sustainable engineering – Sustainability approaches - Triple bottom Line, Cradle to Cradle concept - Life cycle assessment - Zero waste and R concept - Circular economy - ISO 14000 Series

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Recommend ecofriendly solution to protect ecosystem.
CO2: Identify appropriate pollution control methods for specific situations.
CO3: Demonstrate the use of renewable energy for sustainable development.
CO4: Apply techniques to reduce environmental impact from climate change.
CO5: Utilize environmental laws and policies to promote sustainable practices.

Text Books:

1. R. L. Rag and Lekshmi Dinachandran Remesh. Introduction to Sustainable Engineering. 2nd Edition,PHI Learning Pvt. Ltd., 2016.
2. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Scienceand Conservation. S. Chand Publishing, New Delhi.
3. **Masters, Gilbert M. & Ela, Wendell P.** – *Introduction to Environmental Engineering and Science*, Pearson Education, 3rd Edition, 2013
4. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development,Cengage learning
5. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies,Prentice Hall
6. Richard T. Wright, Dorothy F. Boorse (2017) Environmental Science: Toward A Sustainable Future,Pearson, 13th Edition

Reference Books:

1. R.C. Sohal & S.K. Agrawal – *Environmental Studies*, University Science Press, 2018.
2. Erach Bharucha – *Textbook of Environmental Studies for Undergraduate Courses*, University Grants Commission, 2nd Edition, 2013.
3. Peavy, H.S., Rowe, D.R. & Tchobanoglous, G. – *Environmental Engineering*, McGraw Hill Education, 2017.
4. R.K. Trivedi & P.K. Goel – *An Introduction to Air Pollution*, B.S. Publications, 2015.
5. Harris, Frances (2012) Global Environmental Issues, 2nd Edition. Wiley-Blackwel
6. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.
7. Leelakrishnan, P. (2022). *Environmental law in India* (Vol. 1). LexisNexis.
8. Ghosh, S. (Ed.). (2019). *Indian environmental law: Key concepts and principles*. Orient BlackSwan.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

25BABIMTC01 INTRODUCTION TO BIOINFORMATICS

L	T	P	C
3	0	0	3

Pre Requisites: Intermediate Level

Course Description:

Bioinformatics is an interdisciplinary field that integrates biology, computer science, mathematics and statistics to store, retrieve, analyse and interpret biological data. A B.Tech graduate in Bioinformatics must possess a sound understanding of both biological concepts and computational approaches. This course establishes that foundation by introducing the molecular basis of life through fundamental concepts of biochemistry, molecular biology and genetics.

The course begins with an introductory overview of biomolecules, gene organization and the flow of genetic information, providing students with the biological background necessary for understanding computational analyses. It then introduces the principles and scope of bioinformatics, biological databases, sequence file formats, sequence alignment, similarity searching and modern sequencing technologies. By the end of the course, students will have developed a strong conceptual foundation for advanced subjects such as genomics, transcriptomics, proteomics, metagenomics, structural bioinformatics, computational biology and Next Generation Sequencing (NGS).

Course Objectives:

1. To provide an introductory understanding of the structure and function of biomolecules that constitute biological systems.
2. To introduce the fundamental concepts of molecular biology, genetics and the central dogma governing the flow of genetic information.
3. To explain the principles, scope, interdisciplinary nature and applications of Bioinformatics in modern biological sciences.
4. To familiarize students with major biological databases, web-based bioinformatics resources, sequence file formats and modern sequencing technologies.
5. To develop fundamental knowledge of sequence alignment and similarity searching using standard bioinformatics tools.

UNIT I BIOCHEMISTRY – THE MOLECULAR BASIS OF LIFE 9 hours

The cell as the basic unit of life – a brief orientation to prokaryotic and eukaryotic cell organization.
Biomolecules overview – carbohydrates and lipids: their basic building blocks and biological roles (structural and energy-related), covered at a survey level rather than in exhaustive classification.
Amino acids and proteins – the concept of amino acids as protein building blocks, and a conceptual overview of the four levels of protein structure (primary to quaternary).
Nucleic acids – the basic chemistry of nucleotides and the structural organization of DNA and RNA.
Enzymes – a brief conceptual introduction to enzymes as biological catalysts and the idea of specificity.

UNIT II MOLECULAR BIOLOGY AND GENETICS 9 hours

Genes and heredity – genes as units of inheritance; genotype and phenotype (introductory concepts).
Central Dogma of molecular biology – flow of genetic information from DNA to RNA to protein. DNA replication – the concept of semi-conservative replication, at a conceptual level.
Transcription – the basic idea of RNA polymerase and promoters; a brief, terminology-level introduction to eukaryotic mRNA processing (capping, splicing, polyadenylation).

The genetic code and translation – codons, ribosome structure, tRNA, and the stages of translation, covered conceptually rather than mechanistically.
Gene structure – a brief overview of exons, introns and the idea of regulatory elements (only fundamentals).
Mutations and sequence variation – point mutations, frameshift mutations, and silent/missense/nonsense changes, at an awareness level.

UNIT III FUNDAMENTALS OF BIOINFORMATICS 9 hours

Bioinformatics – definition, principles, history, scope and interdisciplinary nature; applications in genomics, transcriptomics, proteomics, metagenomics, drug discovery, precision medicine and biotechnology.
Genome organization – genes, genomes and chromosomes; types of biological sequence data including genomic DNA, complementary DNA (cDNA) and transcriptomic sequences.
DNA sequencing technologies – introductory overview of Sanger sequencing and Next Generation Sequencing (NGS); applications of NGS in genomics, transcriptomics and clinical diagnostics.
Web-based bioinformatics resources – overview of NCBI, EMBL-EBI, DDBJ and ExPASy.

UNIT IV BIOLOGICAL DATABASES AND SEQUENCE FILE FORMATS 9 hours

Concept of primary and secondary (derived) databases; organization, content and purpose of biological databases.
Nucleotide sequence databases – GenBank, EMBL, DDBJ; protein sequence databases – UniProt (Swiss-Prot and TrEMBL).
Structure database – Protein Data Bank (PDB); literature database – PubMed.
Sequence file formats – FASTA and GenBank flat-file format; retrieving, reading and interpreting sequence records.

UNIT V SEQUENCE ALIGNMENT AND SIMILARITY SEARCHING 9 hours

Concept of sequence similarity, identity and homology; pairwise sequence alignment – global and local alignment, gap penalties, and a basic introduction to scoring matrices (PAM and BLOSUM).
Similarity searching using BLAST – BLASTN, BLASTP and BLASTX; interpreting BLAST output (score, E-value, percent identity).
Multiple sequence alignment – concept and importance; tools such as Clustal Omega and MAFFT

Course Outcomes:

At the end of the course, the students will be able to:

CO1: Describe, at an introductory level, the structure and function of the major biomolecules (carbohydrates, lipids, proteins and nucleic acids) that form the chemical basis of biological data.
CO2: Explain the fundamental concepts of genetics and molecular biology, including gene organization, the central dogma, DNA replication, transcription, translation and mutations.
CO3: Explain the principles, scope and interdisciplinary applications of Bioinformatics, including genomics, transcriptomics, proteomics, metagenomics and modern DNA sequencing technologies, and identify major bioinformatics resource centres.
CO4: Retrieve and interpret sequence records from major biological databases and identify standard sequence file formats.
CO5: Perform and interpret pairwise and multiple sequence alignments and similarity searches using tools such as BLAST, Clustal Omega and MAFFT.

Text Books:

1. **Lehninger Principles of Biochemistry**, David L. Nelson, Michael M. Cox & Aaron A. Hoskins, 8th Edition, W.H. Freeman, 2021.
2. **Molecular Biology of the Gene**, James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine & Richard Losick, 9th Edition, Affiliated East-West press, 2025.
3. **Introduction to Bioinformatics**, Arthur M. Lesk, 5**th Edition**, Oxford University Press, 2019.
4. **Bioinformatics and Functional Genomics**, Jonathan Pevsner, 3rd Edition, Wiley-Blackwell, 2015.

Reference Books:

1. **Molecular Biology of the Cell**, Bruce Alberts, Rebecca Heald, Alexander Johnson, David Morgan, Martin Raff, Keith Roberts & Peter Walter, 7th Edition, W.W. Norton & Company, 2022.
2. **Biochemistry**, Jeremy M. Berg, Gregory J. Gatto Jr., Justin Hines, John L. Tymoczko & Lubert Stryer, 10th Edition, W.H. Freeman, 2023.
3. **Essential Bioinformatics**, Jin Xiong, Cambridge University Press, 2006.
4. **Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins**, A.D. Baxevanis & Gary D. Bader & David S. Wishart, 4th edition, Wiley-Blackwell, 2020.
5. **Practical Bioinformatics**, Mark Agostino, 2nd edition, Garland Science, 2026.
6. **Bioinformatics: Sequence and Genome Analysis**, David W. Mount, 2nd Edition, Cold Spring Harbor Laboratory Press, 2005.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

25BACADTC02 C AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite Programming for Problem Solving

Course Description:

This course introduces C programming concepts and fundamental data structures for effective problem-solving. It covers C programming constructs, arrays, functions, structures, pointers, dynamic memory allocation, linked lists, stacks, queues, searching, and sorting techniques. The course enables students to develop structured programs and apply appropriate data structures for efficient data organization and processing.

Course Objectives:

This course enables students to

1. Understand C programming constructs, arrays, functions, and structured programming concepts.
2. Apply pointers, structures, and dynamic memory allocation techniques for efficient programming.
3. Understand fundamental data structures and their organization methods.
4. Implement linked lists, stacks, and queues to solve computational problems.
5. Apply searching and sorting techniques for effective data processing.

UNIT I C PROGRAMMING ESSENTIALS 9 hours

C Fundamentals: Structure of C Program, Data Types, Variables, Constants, Input and Output Statements, Control Statements, Looping Statements.

UNIT II ARRAYS, FUNCTIONS AND STRUCTURES

Arrays and Strings: One-dimensional Arrays, Two-dimensional Arrays, Array Operations, String Declaration, String Handling Functions.

Functions: Function Declaration, Function Definition, Function Call, Parameter Passing, Recursion

Structures: Structure Definition, Structure Variables, Array of Structures, Introduction to Unions

UNIT III POINTERS AND DATA STRUCTURES 9 hours

Pointers: Introduction to Pointers, Pointer Declaration, Pointer Arithmetic, Pointers with Arrays, Pointers with Structures

Data Structures: Need for Data Structures, Types of Data Structures, Abstract Data Types (ADT).

Dynamic Memory Allocation: malloc(), calloc(), free().

UNIT IV LISTS, STACKS AND QUEUES 9 hours

Lists: Introduction, List Operations, Implementation using Singly Linked List

Stacks: Introduction, Stack Operations, Implementation using Arrays, Applications of Stack.

Queues: Introduction, Queue Operations, Linear Queue, Circular Queue, Applications of Queue.

UNIT V SEARCHING AND SORTING 9 hours

Searching Techniques: Linear Search, Binary Search.

Sorting Techniques: Bubble Sort, Selection Sort, Insertion Sort.

Course Outcomes:
After completing this Unit, students will be able to
CO1: Develop C programs using programming constructs, arrays, and functions.

CO2: Implement solutions using structures, pointers, and dynamic memory management concepts.

CO3: Apply fundamental data structure concepts for organizing and managing data.

CO4: Develop applications using linked lists, stacks, and queues.

CO5: Analyze and implement searching and sorting algorithms for problem-solving.

Text Book(s)

1. Seymour Lipschutz, Data Structures with C, Schaum's Outline Series, McGraw Hill Education, 2017.
2. Reema Thareja, Data Structures Using C, 2nd Edition, Oxford University Press, 2014.

Reference Books

1. Yashavant Kanetkar, Let Us C, 18th Edition, BPB Publications, 2021.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2002.
3. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, 2019.

Mode of Evaluation: Assignments, Mid Term Tests, Semester End Examination.

B. Tech I Year II Semester

25BAMECEC01 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

Pre-requisite: None

Course Description:
This course introduces the fundamentals of Engineering Graphics and its applications, with hands-on practice using AutoCAD and Autodesk Fusion 360. It covers orthographic projection of points, lines, planes, and solids, including sectional views and surface developments. Students will learn to interpret and convert between isometric and orthographic views, as well as perform simple 2D drawings and 3D modelling. The course emphasizes visualization skills and technical drawing practices essential for engineering design and communication.

Course Objectives:
This course is designed to:

1. Provide fundamental knowledge of engineering graphics and its applications in design and communication.
2. Develop skills in orthographic projections of points, lines, planes, and solids.
3. Enable students to visualize and represent sections and development of engineering solids.
4. Familiarize students with isometric and orthographic views and their interconversion.
5. Introduce computer-aided design (AutoCAD and Autodesk Fusion 360) for 2D drafting and simple 3D modelling.

UNIT I INTRODUCTION **12 hours**

Introduction to Engineering Graphics and its Applications. Introduction to AutoCAD commands. Types of Lines, Dimensioning and Geometrical Constructions, Simple 2D drawings using AutoCAD.

UNIT II PROJECTIONS OF POINTS & LINES **12 hours**

Projection of points: Orthographic projections, notation system, positions and projection of points in four quadrants.
Projection of lines: Positions and projection of lines (inclined to one plane, HP/VP).

UNIT III PROJECTIONS OF PLANES & SOLIDS **12 hours**

Projection of planes: Positions and projection of planes (inclined to two planes, HP and VP).
Projection of solids: Projections of regular solids. (resting on HP and axis inclined to HP only).

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **12 hours**

Section of solids: Sectional view of regular solids (cutting plane inclined to HP) and its true shapes.
Development of Surfaces: Development of surfaces of regular solids (Prism and Pyramid only).

UNIT V ISOMETRIC, ORTHOGRAPHIC VIEWS AND SIMPLE 3D MODELLING **12 hours**

Conversion of isometric views into orthographic views and vice-versa.
3D Modelling: Introduction to 3D modelling. Simple 3D modelling using Autodesk Fusion 360. (Software practice only. Not for examination)

Course Outcomes:

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

CO1: Interpret and apply AutoCAD commands to create simple 2D engineering drawings.
CO2: Construct orthographic projections of points, lines, and planes in different quadrants.
CO3: Generate projections of solids, sectional views, and true shapes.
CO4: Develop surface diagrams of prisms and pyramids and apply them to practical applications.
CO5: Convert between isometric and orthographic views and create simple 3D CAD models using Fusion 360.

Text Books:

1. K.L. Narayana & P. Kannaiah, *Engineering Graphics*, 4th Edition, Scitech Publications, 2021.
2. K. Venugopal & V. Prabhu Raja, *Engineering Drawing + AutoCAD*, 7th Edition, New Age International, 2022.
3. Dhananjay A. Jolhe, *Engineering Drawing with an Introduction to AutoCAD*, 5th Edition, McGraw Hill Education, 2023.

Reference Books:

1. N.D. Bhatt & V.M. Panchal, *Engineering Drawing: Plane and Solid Geometry*, 56th Edition, Charotar Publishing House, 2023.
2. Shah, P.J., *Engineering Drawing*, 3rd Edition, Pearson Education, 2021.
3. Agrawal B. & Agrawal C.M., *Engineering Graphics*, 2nd Edition, Tata McGraw Hill, 2020.

Online Learning Resources:

1. National Programme on Technology Enhanced Learning (NPTEL), Engineering Graphics – IIT Kharagpur. Available at: https://nptel.ac.in/courses/11210560
2. Autodesk Education, AutoCAD & Fusion 360 Learning Resources. Available at: https://www.autodesk.com/education/edu-software/overview
3. Coursera, Engineering Drawing and Visualization – Georgia Tech. Available at: https://www.coursera.org/learn/engineering-drawing

Mode of Evaluation: Continuous Assessment, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

25BACHELC03 CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

Pre Requisites: **NIL**

Course Description:

This laboratory course provides practical training in classical volumetric and instrumental analytical techniques, alongside modern experimental approaches including nanomaterials synthesis, conducting and biodegradable polymers, spectroscopy, and molecular logic gates. Emphasis is placed on sustainable methodologies, quantitative data analysis, and applications of bio-inspired computing in chemical systems.

Course Objectives:

- To verify the fundamental concepts with experiments

List of Experiments:

From the following 17 experiments, students are required to perform any 10 using volumetric and/or instrumental methods of analysis. Wherever applicable, modeling software may also be used.

1. Preparation of a nanomaterial.
2. Demonstration of a two-input molecular AND logic gate based on two chemical inputs using spectroscopy
3. Demonstration of a three-input molecular AND logic gate based on three chemical inputs
4. using spectroscopy
5. Determination of λmax for molecules using UV-VISIBLE spectroscopy
6. Synthesis of polyaniline conducting polymer
7. Demonstration of a two-input molecular OR logic gate based on two chemical inputs
8. Estimation of ferrous ion by colorimetry
9. Demonstration of a two-input molecular AND logic gate based on two chemical inputs using titrimetry
10. Green synthesis of PVA/Starch biopolymer (biodegradable materials for sustainable tech)
11. Synthesis of PVA biopolymer
12. Estimation of Ascorbic acid
13. Demonstration of a two-input molecular NOT logic gate based on two chemical inputs
14. Verification of Beer-Lambert's Law

15. Determine reaction order and rate constant using MS-excel regression model
16. Conductometric titration of strong acid vs strong base
17. Conductometric titration of weak acid vs strong base
18. Determination of amino-acid sequence and ID of a protein from a DNA/protein input.

Course Outcomes:

CO1: Apply volumetric, colorimetric, conductometric, and spectroscopic techniques to determine physicochemical properties and composition of chemical systems.

CO2: Demonstrate the principles of molecular logic gates and their applications in bio-inspired computing through chemical and spectroscopic experiments.

CO3: Design and synthesize nanomaterials, conducting polymers, and biodegradable polymers, highlighting sustainable and green chemistry approaches.

CO4: Analyze kinetic parameters and quantitative data using modern computational tools such as regression models and molecular modeling software.

CO5: Integrate experimental chemistry with interdisciplinary applications in materials science, biopolymers, and biomolecular identification for real-world problem solving.

Reference Books:

1. Vogel's Textbook of Quantitative Chemical Analysis – J. Mendham, R.C. Denney, J.D. Barnes & M.J.K. Thomas, 6th Ed., Pearson Education, 2000.
2. Instrumental Methods of Chemical Analysis – B.K. Sharma, 23rd Ed., Goel Publishing House, 2007.
3. Molecular and Supramolecular Information Processing: From Molecular Switches to Logic Systems – Evgeny Katz (Ed.), Wiley-VCH, 2012.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

25BACSELC02 IT ESSENTIALS LABORATORY

L	T	P	C
0	0	2	1

Pre-requisite: NIL

Course Description:

This course equips students with foundational computing skills, including computer hardware assembly, safe internet usage, professional document creation, cloud collaboration, and responsible use of AI tools for productivity and creativity.

Course Objectives:

1. Understand computer components, assembly, and OS installation.
2. Create documents, spreadsheets, and presentations using productivity tools.
3. Utilize cloud tools for storage, scheduling, and data collection.
4. Explore AI tools for prompts, creative tasks, and translation.
5. Build foundational computing skills with safe internet practices and responsible AI use.

List of Experiments:

1. **PC Hardware:**

Task 1: Hardware Identification

- Identify common computer peripherals (input, output, storage) and list Central Processing Unit (CPU) components with their functions.

2. **Internet & Email:**

Task 1: Networking Concepts and Safe Practices

- LAN, MAN, WAN, Wi-Fi, and the Internet.
- Web browsers, web navigation, search engines, web surfing best practices, netiquette, and cyber hygiene (Passwords, Updates, Phishing Awareness, Safe Downloads, Backups).
- Bookmark webpages and configure or showcase a pop-up blocker in a modern browser.

Task 2: Email Operations

- Create an email account, compose and send an email, and demonstrate unsubscribing from unwanted mailing lists using standard unsubscribe mechanisms or settings.

3. **Office Productivity Tools (MS-Office/Libre Office):**

Word Processor

Task 1: Event Certificate Creation

- Design a professional event certificate:
  - Font formatting (typeface, size, style), Drop Cap for emphasis, Text effects and character spacing adjustments, Borders and color schemes, Header and footer for branding/institutional details, Insert → Date and Time field for event date and Export final certificate to PDF.

Task 2: Newsletter Development

- Create a newsletter:
  - Automatic Table of Contents, Multi-column (newspaper) layouts, Images from local files and LibreOffice Clipart Gallery, Drawing tools and Fontwork for decorative headings, Textboxes for flexible content placement, Paragraph styles for consistent formatting, Built-in Mail Merge Wizard with spreadsheet data.

Spread Sheet

Task 1: Scheduler Creation

- Build a scheduler
    - Gridlines and cell formatting (dates, times, custom formats).
    - AutoFill for repeated patterns, Text formatting for emphasis.

Task 2: GPA Calculator & Visualization

- Create a GPA calculator:
    - Mathematical functions (sum, average, etc.)
    - Charts to visualize data, Hyperlinks for navigation between sheets or to online resources.

Task 3: LOOKUP/VLOOKUP

- Boolean and logical operators, Conditional formatting.

Presentation

Task 1: Interactive Presentation

- Develop an interactive presentation:
    - Insert Hyperlinks, Images, Audio, Video, and Clip Art.
    - Insert tables, and charts.
    - Custom animations, slide transitions, and action buttons.

Task 2: Student Project Presentation using CANVA .

4. **Cloud Storage and Calendar:**

Task 1: Data Management and Scheduling

- Store, organize, share, and retrieve files using a cloud storage service (e.g., Google Drive), including restoring items from Trash when applicable.

- Schedule activities using a calendar application (e.g., Google Calendar), including creating events, setting recurring schedules, inviting guests, attaching Drive files, and configuring notifications.

Task 2: Event Form Creation (Microsoft/Google/Any online platform)

5. **AI Tools & Ethical Usage:**

Task 1: Prompt Engineering and Response Evaluation

- Formulate clear, precise prompts or questions for an AI-based tool (e.g., ChatGPT, Gemini).

Task 2: AI-Assisted Creative Writing

- Provide an introductory sentence, paragraph, or descriptive scene to an AI text-generation tool.
- Allow the AI to continue the narrative, ensuring coherence in tone, style, and plot progression.
- Assess the creativity, originality, and narrative flow of the generated content.

Task 3: AI-Powered Language Translation and Plagiarism Check

- Input a sentence or passage in a source language into an AI translation tool.
- Translate it into a target language and review the results for grammar, fluency, and contextual meaning.
- Plagiarism Check for the AI-generated translation to human or reference translations.

Course Outcomes:

After completion of the course, Students will be able to,

CO1: Identify computer hardware, networking basics, and safe internet/email use.

CO2: Create documents, spreadsheets, and presentations using productivity tools.

CO3: Use advanced spreadsheet functions for data analysis and visualization.

CO4: Manage files, schedules, and forms with cloud applications.

CO5: Assess AI tool outputs for accuracy, creativity, and ethical use.

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003.
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech,2013, 3rd edition.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition.
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft).
5. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme– CISCO Press, Pearson Education, 3rd edition.
6. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and Semester End Examination

B. Tech I Year II Semester

25BACADLC02 C AND DATA STRUCTURES LABORATORY

L	T	P	C
0	0	2	1

Pre-requisite Programming for Problem Solving Laboratory

Course Description:

This laboratory course provides hands-on experience in C programming and fundamental data structures. It focuses on developing programs using control structures, arrays, strings, functions, structures, pointers, dynamic memory allocation, linked lists, stacks, queues, searching, and sorting techniques. The course enables students to apply programming concepts for solving real-world computational problems.

Course Objectives:

The objectives of this laboratory course are to enable students to:

1. Develop C programs using control structures, arrays, and string handling concepts.
2. Implement modular programming concepts using functions, structures, and pointers.
3. Apply dynamic memory allocation and fundamental data structure concepts for efficient data management.
4. Implement linear data structures such as linked lists, stacks, and queues.
5. Apply searching and sorting techniques to solve computational problems.

List of Experiments:

1. Develop a C program for a smart traffic system that determines actions based on traffic signal conditions and vehicle status using decision-making statements.
2. Develop a C program to analyze a given number by checking whether it is prime, palindrome, or Armstrong number using iterative statements.
3. Develop a C program to calculate electricity charges based on units consumed using different tariff conditions and generate the final bill.
4. A weather monitoring system stores daily temperature readings. Write a C program using arrays to find the highest temperature, lowest temperature, and average temperature.
5. Develop a C program for a text processing application to perform string operations such as:
   - Find length of a string
   - Copy one string to another
   - Compare two strings
   - Concatenate two strings
6. Develop a menu-driven C program using functions to perform mathematical operations and calculate factorial using recursion.

7. Develop a C program using structures to maintain book details such as book ID, title, author name, and availability status.
8. An IoT system collects sensor readings. Develop a C program using pointers to access and process sensor data stored in an array.
9. Develop a C program to allocate memory dynamically for storing and processing a collection of values during program execution.
10. Implement a singly linked list to manage songs in a music playlist. Perform:
    - Insert a song
    - Delete a song
    - Display playlist
11. A text editor stores previous actions for undo functionality. Implement stack operations to:
    - Insert new actions
    - Remove recent actions
    - Display history
12. A printer processes multiple printing requests. Implement a queue system to:
    - Add printing requests
    - Process requests
    - Display pending jobs
13. A digital contact directory stores contact numbers randomly. Develop a C program to search for a specific contact number using the linear search technique.
14. A library maintains book IDs in sorted order. Develop a C program to search for a required book ID efficiently using the binary search technique.
15. A gaming platform needs to arrange player scores based on ranking. Develop a C program to sort player scores using bubble sort, selection sort, and insertion sort techniques.

Course Outcomes:

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

CO1: Develop C programs using decision-making statements, loops, arrays, and strings.

CO2: Design modular applications using functions, structures, pointers, and dynamic memory concepts.

CO3: Implement linked list operations for dynamic data organization.

CO4: Develop applications using stack and queue data structures.

CO5: Analyze and implement searching and sorting algorithms for efficient problem-solving.

Text Books:

1. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Education, 2019.
2. Reema Thareja, Data Structures Using C, 2nd Edition, Oxford University Press, 2014.

References Books:

1. Yashavant Kanetkar, Let Us C, 18th Edition, BPB Publications, 2021.
2. Seymour Lipschutz, *Data Structures with C*, Schaum's Outline Series, McGraw Hill Education, 2017.
3. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C*, 2nd Edition, Pearson Education, 2002.

Mode of Evaluation: Continuous Internal Evaluation and Semester End Examination.