CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Computer Science and Engineering)

SEMESTER – I

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.	26MTC01	Calculus and Numerical Methods	3	-	-	3	40	60	3
2.	26PYC01	Optics and Quantum Technologies	3	-	-	3	40	60	3
3.	26CSC01	Problem Solving and Programming using C	3	-	-	3	40	60	3
4.	26EGC01	Communicative English	2	-	-	3	40	60	2
5.	26ECC40	Basic Electronics and Sensors	3	-	-	3	40	60	3
PRACTICAL									
6.	26PYC03	Optics and Quantum Technologies Lab	-	-	3	3	50	50	1.5
7.	26EGC02	Communication Skills Lab	-	-	2	3	50	50	1
8.	26CSC02	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
9.	26MEC02	Computer Aided Engineering Drawing	-	-	3	3	50	50	1.5
10.	26ECC41	Basic Electronics and Sensors Lab	-	-	2	3	50	50	1
TOTAL			**14**	**-**	**13**	**-**	**450**	**550**	**20.5**
Clock Hours Per Week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Dissertation** **SEE-Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Computer Science and Engineering)

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.	26MTC04	Linear Algebra	3	-	-	3	40	60	3
2.	26CYC03	Biomaterials and Quantum Chemistry	3	-	-	3	40	60	3
3.	26EEC01	Basic Electrical Engineering	3	-	-	3	40	60	3
4.	26CSC03	Data Structures using C	4	-	-	3	40	60	4
5.	26CSC05	Python Programming	2	-	-	3	40	60	2
PRACTICAL									
6.	26CYC04	Biomaterials and Quantum Chemistry Lab	-	-	2	3	50	50	1
7.	26MBC02	Community Engagement	-	-	2	-	50	-	1
8.	26CSC04	Data Structures using C Lab	-	-	3	3	50	50	1.5
9.	26CSC06	Python Programming Lab	-	-	2	3	50	50	1
10.	26EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
TOTAL			**15**	**-**	**11**	**-**	**450**	**500**	**20.5**
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Dissertation** **SEE-Semester End Examination**

Semester I
and
Semester II
Syllabus

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Computer Science and Engineering)

SEMESTER – I

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.	26MTC01	Calculus and Numerical Methods	3	-	-	3	40	60	3
2.	26PYC01	Optics and Quantum Technologies	3	-	-	3	40	60	3
3.	26CSC01	Problem Solving and Programming using C	3	-	-	3	40	60	3
4.	26EGC01	Communicative English	2	-	-	3	40	60	2
5.	26ECC40	Basic Electronics and Sensors	3	-	-	3	40	60	3
PRACTICAL									
6.	26PYC03	Optics and Quantum Technologies Lab	-	-	3	3	50	50	1.5
7.	26EGC02	Communication Skills Lab	-	-	2	3	50	50	1
8.	26CSC02	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
9.	26MEC02	Computer Aided Engineering Drawing	-	-	3	3	50	50	1.5
10.	26ECC41	Basic Electronics and Sensors Lab	-	-	2	3	50	50	1
TOTAL			**14**	**-**	**13**	**-**	**450**	**550**	**20.5**
Clock Hours Per Week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Dissertation** **SEE-Semester End Examination**

26MTC01

CALCULUS AND NUMERICAL METHODS

(CSE, CSE (AI&ML), CSE (IOT & Cyber Security including Block Chain Technology), IT, AI&DS)

Instruction	3 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Explain mean value theorems and their geometrical interpretations.
2. Develop understanding of partial derivatives and methods for finding extreme values of functions of two variables.
3. Develop skills in solving differential equations using appropriate methods.
4. Present numerical methods for solving algebraic and transcendental equations.
5. Explain interpolation techniques and numerical differentiation for analyzing data.

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

1. Interpret and analyze mean value theorems and their geometrical significance, including curvature.
2. Determine and analyze extreme values of functions of two variables using partial derivatives.
3. Solve differential equations using standard techniques.
4. Apply numerical methods to solve algebraic and transcendental equations.
5. Apply interpolation and numerical differentiation techniques to estimate and analyze given 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	3	3	1	2	1	-	-	-	-	-	2	2	1	1
CO 2	3	2	1	1	2	-	-	-	-	-	2	2	1	1
CO 3	3	3	2	2	1	-	-	-	-	-	2	2	1	1
CO 4	3	3	2	2	3	-	-	-	-	-	2	3	2	1
CO 5	3	3	2	2	3	-	-	-	-	-	2	3	2	1

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Differential Calculus: Rolle's Theorem, Lagrange's Mean value theorem, Cauchy's Mean value theorem (without proofs) and their geometrical interpretations. Curvature, Radius of curvature, Centre of curvature, Evolute and Involute (Cartesian curves).

UNIT-II

Partial Differentiation and Its Applications: Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobian, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT-III

Differential Equations: Differential Equation of Order one: Exact Differential Equations, Differential Equations Reducible to Exact Equations, Linear Equations, Bernoulli's Equations.

Higher order Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution.

UNIT-IV

Numerical Methods: Numerical solution of algebraic and transcendental equations by Bisection method, Regula-falsi method and Newton-Raphson's method, Numerical Solution of first order

Differential Equations by Taylor's series method, Euler's method, Modified Euler's method and Runge-Kutta fourth order method.

UNIT-V

Interpolation and Numerical Differentiation: Forward, Backward differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation for unequal intervals, Numerical differentiation at the tabulated points using Newton's forward and backward differences, interpolating Polynomials.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2011.

SUGGESTED READING:

1. R.K.Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publications, 2016.
2. Ramana B.V, "Higher Engineering Mathematics", 11th Reprint, Tata McGraw Hill New Delhi, 2010.
3. M.K. Jain, S.R.K Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering and Computation", New age International Publications, 2008

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111105160
2. https://onlinecourses.nptel.ac.in/noc26_ma20/preview

26PYC01

OPTICS AND QUANTUM TECHNOLOGIES

(CSE, IT, CSE (AI&ML), CSE (IoT & Cyber Security including Block Chain Technology), AI&DS)

Instruction	3 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Understand the fundamentals of wave nature of light.
2. Acquire knowledge of lasers and fiber optics.
3. Acquaint with quantum mechanics.
4. Learn the fundamental concepts of solids.
5. Introduce the concepts of quantum computing.

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

1. Demonstrate the physical properties of light.
2. Understand the properties and applications of laser and fiber optics in everyday life.
3. Prove the quantization of energy.
4. Categorize semiconductors for possible applications.
5. Assess the advantages of quantum computing over classical computing.

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	2	1	2	1	1	-	-	2	-	1	-	-	-
CO 2	3	2	2	2	2	2	1	1	1	1	1	-	-	-
CO 3	3	3	1	2	2	1	1	1	2	1	2	-	-	-
CO 4	3	2	2	1	2	1	1	1	1	1	2	-	-	-
CO 5	2	2	1	1	3	1	1	1	1	2	2	-	-	-

UNIT-I

Wave Optics: Introduction – Interference of light by wavefront splitting and amplitude splitting – Interference in thin films in reflected light – Newton's rings – Mach-Zander interferometer – Diffraction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction at single slit – Concept of N-slits – Diffraction Grating.

UNIT-II

Lasers: Characteristics of lasers – Einstein's coefficients – Metastable State – Population inversion – Different types of lasers: Ruby laser, He-Ne laser – Applications of lasers in engineering.

Fiber Optics: Introduction – Construction – Principle – Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded- index fibers – Modes of propagation – Fiber losses (qualitative) – Fiber optic communication system.

UNIT-III

Quantum Mechanics: Introduction – Wave nature of particles – de-Broglie hypothesis – Wave packets – Uncertainty principle – Born interpretation of ψ – Time-dependent and time-independent Schrodinger equations – Particle in an infinite square well potential – Salient features of free electron theory of metals (classical and quantum) – Kronig-Penney model (Qualitative) – Classification of solids into conductors, semiconductors and insulators.

UNIT-IV

Semiconductors: Introduction – Intrinsic and extrinsic semiconductors – Fermi distribution function (qualitative) – Density of states – Charge carrier concentration in intrinsic semiconductors – Energy gap – Carrier generation and recombination – Carrier transport: diffusion and drift – P-N junction – Hall Effect – Solar cell.

UNIT-V

Quantum Computing: Introduction – Dirac's Bra and Ket notation and their properties – Hilbert space – Bloch's sphere – concept of quantum computer – classical bits – Qubit – Quantum computing system for information processing – Quantum measurements – Entanglement – Quantum gates (single-qubit gates, multi-qubit gates) – Challenges and advantages of quantum computing over classical computation.

TEXT BOOKS:

1. Arthur Beiser, "Concepts of Modern Physics", 7th Edition, McGraw-Hill Higher Education, 2002.
2. John Morrison, "Modern Physics: for Scientists and Engineers", 1st Edition, Academic Press, 2009.
3. M.N. Avadhanulu and P.G. Kshirsagar, "A Text Book of Engineering Physics", 10th Edition, S. Chand Publications, 2014.
4. S.L. Gupta and Sanjeev Gupta, "Modern Engineering Physics", Dhanpat Rai Publications, 2011.
5. Michael A. Nielsen and Isaac Chuang, "Quantum Computation and Quantum Information", 10th Edition, Cambridge University Press, 2010.

SUGGESTED READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, "Modern Physics", 18th Edition, S. Chand Publications, 2014.
2. V. Rajendran, "Engineering Physics", 2nd Edition, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, "Engineering Physics", 2nd Edition, Scitech Publications, 2012.
4. V. Raghavan, "Materials Science and Engineering", 6th Revised edition, Prentice Hall India Learning Private Limited, 2015.
5. Eleanor Rieffel and Wolfgang Polak, "Quantum Computing: A Gentle Introduction", The MIT Press Cambridge, 2011.
6. Phillip Kaye, Raymond Laflamme and Michele Mosca, "An Introduction to Quantum Computing", 1st Edition, (ISBN-13:9780198570493).

ONLINE RESOURCES:

1. NPTEL Physics courses on wave optics, optical communications, and Quantum computing courses.
2. PhET Interactive Simulations.

26CSC01

PROBLEM SOLVING AND PROGRAMMING USING C

Instruction	3 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	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	2	1	-
CO 2	3	1	1	-	1	-	-	-	-	-	1	2	1	-
CO 3	3	1	1	-	1	-	-	-	-	-	1	2	1	-
CO 4	3	1	1	-	1	-	-	-	-	-	1	2	1	-
CO 5	3	1	1	-	1	-	-	-	-	-	1	2	1	-

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Introduction: Introduction to Computers and Programming, Algorithms, Flowcharts, from algorithms to programs, Languages – Machine Level, Assembly level, high level languages, Program development Tools (Editor, Compiler, Loader).

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

Search and Sorting: Searching algorithms, binary searching. Sorting algorithms: bubble 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/

26EGC01

COMMUNICATIVE ENGLISH

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

Instruction	2 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	2

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

COURSE OBJECTIVES: This course aims 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 devices of cohesion and 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 the completion of this course, the student 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	PSO 3
CO 1	-	-	-	-	1	2	2	2	3	3	3	1	1	1
CO 2	-	-	-	-	1	2	2	1	1	2	2	1	1	2
CO 3	-	1	-	-	-	2	2	1	1	2	1	1	1	1
CO 4	-	1	-	-	-	1	2	2	2	2	2	1	2	1
CO 5	-	1	-	1	1	2	2	2	2	2	2	1	2	1

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, 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 & style 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

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TEXT BOOKS:

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

SUGGESTED READING:

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

26ECC40

BASIC ELECTRONICS AND SENSORS

Instruction	3 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

PREREQUISITES: Concepts of Semiconductor Physics and Applied Physics.

COURSE OBJECTIVES: This course aims to

1. Describe semiconductor device's principles and understand the characteristics of junction diode and transistors.
2. Understand working principle of Op-Amp circuits and Sensors.
3. Understand Interfacing of various modules with myRIO.

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

1. Understand semiconductor devices and rectifier circuits.
2. Analyze BJT and FET characteristics.
3. Apply Op-Amp circuits and data converters.
4. Classify and apply different types of sensors in measurement and automation applications.
5. Implement sensor interfacing using LabVIEW and myRIO

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	3	2	1	-	-	-	-	-	-	1	3	1	1
CO 3	3	2	3	1	2	-	-	-	-	-	1	3	2	2
CO 4	2	2	2	1	1	1	-	-	-	-	1	2	3	3
CO 5	2	2	3	2	3	-	-	-	1	1	2	1	3	3

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Diodes and its Applications: Passive Elements - Overview of Semiconductors-Characteristics of P-N Junction diode-current equation-Characteristics of Zener Diode, Voltage regulator, Half Wave, Full Wave: Center tap, Bridge Rectifiers. Testing of Diodes – transistors – Testing of circuits (continuity, earthing, EMI/EMC).

UNIT-II

Bipolar Junction Transistors: Classification, Bipolar Junction Transistors Configurations. CE, CB Characteristics-BJT as switch.

Field Effect Transistor: Junction Field Effect Transistor: Principle of Operation, Characteristics of JFET and Operation of MOSFET- Applications.

UNIT-III

Op-Amps Circuits: Basic Principle, Ideal, and practical Characteristics, Voltage Follower, Op-Amp parameters, Applications-Summer, Integrator, Differentiator, Logic Gates with IC's.

Data Converters: Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC: Successive Approximation (Qualitative treatment Only).

UNIT-IV

Sensors: Definition, classification of sensors

Proximity Sensors: Principle, Inductive and Capacitive proximity sensors and its Applications

Velocity, motion sensors: Tachogenerator, Optical encoders

Force sensors: Strain Gauge ,Tactile sensors

Temperature and light sensors: Resistance Temperature detectors, Photo Diode

UNIT-V

Hardware/software platforms: Introduction to LabVIEW.

Data Acquisition System: hardware Overview of my RIO, Converting Raw Data Values to a Voltage.

Sensors interfacing with my RIO: Introduction, Pin configuration, Interfacing of My Rio with thermistor, photo cell, Bluetooth, Temperature Sensors.

TEXT BOOKS:

1. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", 12th edition, Pearson, 2022.
2. D Patranabis, "Sensors and Transducers", 2nd Edition, PHI 2013.
3. Ed Doering, "NI myRIO Project Essentials Guide", 2016.

SUGGESTED READING:

1. K. Maini, "Analog Electronics", Khanna Publishers, 2022
2. T. Karvinen and K. Karvinen, "Make: Sensors: A Hands-On Primer for Monitoring the Real World", 2nd Edition, Maker Media, 2014.
3. National Instruments, "Learning LabVIEW with myRIO: Lab Manual / Workbooks", National Instruments, 2020.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108101091, Basic Electronics, IIT Bombay.
2. https://nptel.ac.in/courses/108106193, Sensor Technologies: Physics, Fabrication, and Circuits, IISER Bhopal.
3. https://nptel.ac.in/courses/122106025, Basic Electronics and Lab, IIT Madras

26PYC03

OPTICS AND QUANTUM TECHNOLOGIES LAB

(CSE, IT, CSE (AI&ML), CSE (IoT & Cyber Security including Block Chain Technology), AI&DS)

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

COURSE OBJECTIVES: This course aims to

1. Apply theoretical physics knowledge in doing experiments.
2. Understand the behaviour of the light experimentally.
3. Acquire knowledge of the classification of solids.
4. Analyse the use of semiconductors for industrial application.
5. Understand the working of optoelectronic devices.

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

1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally.
3. Realize the classification of solids experimentally based on band gap.
4. Comprehend the role of semiconductors for device applications.
5. Analyse V-I characteristics of some optoelectronic and semiconductor devices.

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	2	3	1	3	3	3	-	1	2	-	-	-
CO 2	3	3	2	2	2	2	3	3	-	1	3	-	-	-
CO 3	3	3	3	3	3	1	3	3	-	1	2	-	-	-
CO 4	3	3	3	2	2	1	3	3	-	1	3	-	-	-
CO 5	3	2	2	3	2	1	3	3	-	1	2	-	-	-

Experiments

1. Error Analysis : Estimation of time period of a Torsional pendulum using theory of errors
2. Newton's Rings : Determination of radius of curvature of given Plano-convex lens by forming Newton's rings
3. Single Slit Diffraction : Determination of slit width
4. Double Slit : Verification of Interference, diffraction and their combined effect
5. Diffraction Grating : Determination of wavelengths of two yellow lines of light of mercury lamp
6. Laser : Determination of wavelength of given semiconductor laser
7. Optical Fiber : Determination of numerical aperture and acceptance angle of given optical fiber
8. Fiber losses : Determination of power losses of given optical fiber
9. Planck's Constant : Determination of Planck's constant using photo cell
10. P-N Junction Diode : Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
11. Energy Gap : Determination of energy gap of given semiconductor
12. Eigen values and Eigen functions : Determination of Eigen values and Eigen functions of a particle in a box
13. Hall Effect : Determination of Hall coefficient, carrier concentration and

mobility of charge carriers of given semiconductor specimen

14. LED : Study of I-V characteristics of given LED
15. Solar Cell : Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance

NOTE: A minimum of TWELVE experiments should be done.

TEXT BOOKS:

1. S. K. Srivastava and R. A. Yadav, Engineering Physics: Theory and Experiments, 12th Edition, New Age Publication, 2019

SUGGESTED READING:

1. D. B. Sirdeshmukh and K. G. Subhadra, Experiments in Solid State Physics, 2nd Edition, South Asian Publishers, 2008

ONLINE RESOURCES:

1. NPTEL Experimental Physics course.
2. PhET interactive simulations.
3. oPhysics: Interactive Physics Simulations

26EGC02

COMMUNICATION SKILLS LAB

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

Instruction	2 P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

PREREQUISITE: Basic Knowledge of English Communication.

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: After the completion of this course, the student 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	PSO 3
CO 1	-	-	-	-	-	-	-	1	1	-	1	1	-	2
CO 2	-	-	-	-	-	1	-	1	2	-	1	1	-	2
CO 3	-	-	-	-	-	1	1	1	2	-	1	1	-	2
CO 4	1	1	1	1	1	1	2	2	3	-	1	1	-	3
CO 5	-	1	1	1	1	2	2	2	3	1	2	1	-	3

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", 2nd Edition, Macmillan, 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", 2nd Edition, Cambridge University Press Pvt. Ltd., 2023.
4. Aruna Koneru, "Professional Speaking Skills", Oxford University Press, 2018.

SUGGESTED READING:

1. Kumar Rajesh, "English Language Communication Skills – Lab Manual cum Workbook", Cengage Learning India Pvt. Ltd., 2013.
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).

26CSC02

PROBLEM SOLVING AND PROGRAMMING USING C LAB

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

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	1	-
CO 2	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO 3	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO 4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO 5	3	1	-	1	-	-	-	-	-	-	-	2	1	-

1-Slightly, 2-Moderately, 3-Substantially

LABORATORY / PRACTICAL EXPERIMENTS:

1. Introduction to Application Development Tools: Visual Editor, Turbo C / Dev C++ / Code Blocks, Keil.
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/106/105/16105171/

26MEC02

COMPUTER AIDED ENGINEERING DRAWING

(Common to CSE, IT, CET, CIC, AI&DS and AI&ML)

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

PREREQUISITES: Nil

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: After the completion of this course, the 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.
4. Draw and analyze the internal details of solids through sectional views.
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	-	3	1	1	1	1	1	2	2	1	2
CO 2	3	2	2	1	2	1	1	-	1	-	1	1	1	1
CO 3	3	2	3	1	2	1	1	1	1	1	1	2	1	1
CO 4	3	2	3	1	2	1	1	1	1	1	1	2	1	1
CO 5	3	2	3	-	2	1	1	-	2	1	1	2	1	1

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 and inclined to one plane.
5. Projection of straight lines inclined to both the reference planes (without traces and mid-point).
6. Projection of Perpendicular Planes.
7. Projection of solids in simple positions.
8. Projection of Prisms and Pyramids with axis inclined to one plane.
9. Sections of Prisms and Pyramids in simple position.
10. Isometric projections of solids.

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”, 2nd Edition, McGraw-Hill Education (India) Pvt. Ltd.,.

SUGGESTED READING:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2nd Edition, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

26ECC41

BASIC ELECTRONICS AND SENSORS LAB

Instruction	2 P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

PREREQUISITES: Students should have prior knowledge of Applied Physics and Semiconductor Physics

COURSE OBJECTIVES: This course aims to

1. Learn about various electronic components and devices.
2. Study the transistor characteristics in different modes.
3. Familiarize to use customizable software and modular measurement hardware to create user-defined measurement systems.

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

1. Familiarize with basic electronic components, and devices.
2. Demonstrate the characteristic behaviour of PN junction diode and Zener diode and their applications.
3. Examine the characteristics of BJT and FET in various configurations.
4. Formulate the research problems associate with Transistor or Op-amp circuits.
5. Examine the Interfacing of myRIO with various sensors/transducers.

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	1	1	1	3	1	3	2	-	1	-
CO 2	3	3	3	3	1	2	1	3	1	3	3	1	1	1
CO 3	3	3	3	3	2	2	2	3	2	2	3	1	1	1
CO 4	1	2	3	3	3	2	3	3	2	3	2	1	-	-
CO 5	1	2	3	3	3	2	3	3	2	3	2	-	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Study of Semiconductor components.
2. Testing of all Electronic components using Multimeter.
3. V-I Characteristics of Silicon and zener diodes and measurement of static and dynamic resistances
4. CRO Applications- Measurement of time period and amplitude for standard signals and phase shift measurement for given signals.
5. Performance evaluation of half wave rectifier without filters and with Capacitor filter.
6. Performance evaluation of full wave rectifier without filters and with Capacitor filter.
7. Performance evaluation of Voltage Regulator in terms of load and line relations.
8. BJT characteristics in Common Emitter configuration and measurement of h-parameters.
9. Drain and Transfer characteristics of JFET in CS configuration and measurement of Transconductance, Drain resistance and Amplification Factor.
10. Performance analysis of inverting amplifier and adder circuits using operational amplifier.
11. Performance analysis of integrator and differentiator using operational amplifier.
12. Interfacing Thermister / Photo Cell with myRIO (Intensity control of LED with respect to Illumination).
13. Interfacing Bluetooth module with myRIO. (Temperature Thresholding Application)

Structured Enquiry: Design a switching circuit using BJT and analyse its operation.
Open ended Enquiry: Design a LED running lights circuit for vehicles to avoid accidents in fog/rain condition.

Note: At least 10 experiments are to be performed.

SUGGESTED READING:

1. Paul B. Zbar, Albert P.Malvino, Michael A. Miller, "Basic Electronics, a Text- Lab Manual", 7th Edition, TMH, 1994.
2. Paul B. Zbar, "Industrial Electronics, a Text- Lab Manual", 4th Edition, 2008.
3. Jeffrey Travis and Jim Kring, "LabVIEW for Everyone: Graphical Programming Made Easy and Fun", 3rd Edition, Prentice Hall, 2007.
4. Ed Doering, "NI myRIO Project Essentials Guide", xx Edition, xx Publisher, Feb. 2016.

ONLINE RESOURCES:

1. https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html
2. https://mevlsi-iitkgp.vlabs.ac.in/List%20of%20experiments.html

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Computer Science and Engineering)

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.	26MTC04	Linear Algebra	3	-	-	3	40	60	3
2.	26CYC03	Biomaterials and Quantum Chemistry	3	-	-	3	40	60	3
3.	26EEC01	Basic Electrical Engineering	3	-	-	3	40	60	3
4.	26CSC03	Data Structures using C	4	-	-	3	40	60	4
5.	26CSC05	Python Programming	2	-	-	3	40	60	2
PRACTICAL									
6.	26CYC04	Biomaterials and Quantum Chemistry Lab	-	-	2	3	50	50	1
7.	26MBC02	Community Engagement	-	-	2	-	50	-	1
8.	26CSC04	Data Structures using C Lab	-	-	3	3	50	50	1.5
9.	26CSC06	Python Programming Lab	-	-	2	3	50	50	1
10.	26EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
TOTAL			**15**	**-**	**11**	**-**	**450**	**500**	**20.5**
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Dissertation** **SEE-Semester End Examination**

26MTC04

LINEAR ALGEBRA

(CSE, CSE (AI&ML), CSE (IOT & Cyber Security including Block Chain Technology), IT, AI&DS)

Instruction	3 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. To develop proficiency in solving systems of linear equations using matrix methods.
2. To provide a clear understanding of vector spaces, including basis and dimension.
3. To introduce and analyze the matrix representation of linear transformations.
4. To explain inner product spaces and related concepts such as vector length and angles between vectors.
5. To familiarize students with matrix decompositions, with emphasis on Singular Value Decomposition.

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

1. Apply matrix methods to solve systems of linear equations efficiently.
2. Determine the basis and dimension of a given vector space.
3. Compute linear transformation.
4. Construct orthonormal bases using appropriate methods.
5. Perform matrix decompositions, including Singular Value Decomposition.

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	2	-	-	-	-	-	1	3	1	1
CO 2	3	2	1	1	1	-	-	-	-	-	2	2	1	1
CO 3	3	2	2	1	2	-	-	-	-	-	1	2	1	1
CO 4	3	2	1	2	1	-	-	-	-	-	2	2	1	1
CO 5	3	3	2	2	2	-	-	-	-	-	2	3	1	1

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Matrices: Linear system of equations, Echelon form, Rank of a matrix and consistency. Eigenvalues, Eigenvectors, Properties of Eigenvalues and Eigenvectors, Cayley Hamilton theorem, Quadratic form, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Vector Spaces: Definition of Vector space, Linear Combinations and Spanning sets, Subspace, Linear span, Row space of a matrix, Linear Dependence and Independence, Basis and Dimension.

UNIT-III

Linear Transformation: Introduction to Linear Transformation, The null space and range of a linear map , Dimension of Null space and Range space , Rank - Nullity theorem (without proof), Matrix of a Linear Transformation.

UNIT-IV

Inner Product Space: Inner product space, norm or length of a vector, Cauchy-Schwarz inequality, triangle inequality, parallelogram law, normed vector space and distance, angle between the vectors, orthogonal and orthonormal vectors, Gram-Schmidt orthogonalisation process.

UNIT-V

Factorization Methods: LU decomposition, Eigenvalue decomposition, Singular value decomposition and related problems.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, 2017, Khanna Publishers.
2. Seymour Lipschutz, "Schaum's Outline of Linear Algebra", 6th Edition, 2018, McGraw Hill.
3. David Poole, "Linear Algebra: A Modern Introduction, 4th Edition", Brooks/ Cole, 2018

SUGGESTED READING:

1. Gilbert Strang, "Introduction to linear algebra", 6th Edition, Wellesley - Cambridge press, 2019
2. R.K. Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publications, 2017,

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111107164
2. https://onlinecourses.nptel.ac.in/noc20_ma11/preview

26CYC03

BIOMATERIALS AND QUANTUM CHEMISTRY

(Common to CSE, CSE-AIML, CSE (IoT & Cyber Security including Block Chain Technology), AI & DS)

Instruction	3 L Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Integrate concepts of biomaterials, role of metal ions in biological systems and drugs.
2. Develop concepts of applications of electrochemical methods in biosensors and microbial fuel cells.
3. Explain the chemistry and biological importance of biomolecules.
4. Develop the fundamental principles of quantum mechanics.
5. Apply quantum chemistry concepts to atomic structure and chemical bonding.

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

1. Assess the synthesis techniques and applications of biomaterials & drugs.
2. Apply the electrochemical methods in real-world problems related to environmental analysis and industry.
3. Correlate the structure of biomolecules with their role in bioengineering systems.
4. Explain the basic principles of quantum mechanics, including wave-particle duality and uncertainty principles.
5. Apply and correlate quantum mechanical concepts with spectroscopic observations.

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	3	-	-	3	-	-	-	-	2	-	-	1
CO 2	3	2	2	-	-	2	-	-	-	-	2	-	-	1
CO 3	3	2	3	-	-	2	-	-	-	-	2	2	2	1
CO 4	3	2	3	-	-	3	-	-	-	-	2	1	1	1
CO 5	3	2	2	-	-	2	-	-	-	-	2	-	-	1

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Biomaterials in Healthcare: Biomaterials: Definition of biomaterials and their applications in healthcare, especially in medical implants and devices. Classification of biomaterials with examples. Properties and applications of metals (stainless steel, titanium alloys), ceramics (hydroxyapatite), polymers (PMMA, silicone) and composites (hydroxyapatite–polyethylene).

Role of metal ions in biological systems: Role of Na, K, Fe, Co in biological systems. Toxicity of Cd, As, Hg and Pb. Oxygen transport and storage - Structure of haemoglobin, its binding and transport of oxygen.

Drugs: Introduction, synthesis and uses of aspirin (Analgesic), paracetamol (Antipyretic) and atenolol (Antihypertensive).

UNIT-II

Energy Generation and Storage: Electrochemistry: Electrode potentials, Cell potentials, Reference electrodes – construction and working of standard hydrogen electrode 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).

Bio-electrochemistry: Introduction, membrane potential, biosensors (glucose sensor) and microbial fuel cell.

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

Quantum Chemistry: Need for quantum mechanics in chemistry. Postulates of Quantum mechanics, Quantum mechanical operators, Black body radiation, Planck's quantum hypothesis, photoelectric effect and Einstein's explanation. Atomic spectra and Bohr's model of the hydrogen atom with its limitations. de Broglie's hypothesis and wave-particle duality. Heisenberg's uncertainty principle - statement, physical significance. Quantum confinement and tunneling - effects and applications

UNIT-V

Applications of Quantum Chemistry: Applications in Chemical Bonding: Need for quantum-mechanical description of chemical bonding, limitations of classical bond concepts and valence bond theory. Molecular orbital theory- linear combination of atomic orbitals (LCAO), bonding, antibonding and non-bonding molecular orbitals. Molecular orbital treatment of homonuclear and heteronuclear diatomic molecules (H_2, He_2^+, N_2, O_2, CO, NO).

Applications in spectroscopy: Origin of absorption and emission spectra. Electronic, vibrational and rotational spectroscopy- energy levels and selection rules. Raman spectroscopy (principle only).

TEXT BOOKS:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi, 17th edition, 2025.
2. Peter Atkins, Julio de Paula, and James Keeler,"Atkins' Physical Chemistry", Oxford University Press, 12th edition, 2022.
3. A.K. Bajpai, Jaya Bajpai, Rajesh Kumar Saini, Priyanka Agrawal, and Atul Tiwari, "Smart Biomaterial Devices: Polymers in Biomedical Sciences, CRC Press, Taylor & Francis Group, 2017.

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.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/102106057
2. https://nptel.ac.in/courses/113104009
3. https://nptel.ac.in/courses/102104459
4. https://nptel.ac.in/courses/104105076
5. https://nptel.ac.in/courses/104101124

26EEC01

BASIC ELECTRICAL ENGINEERING

Instruction	3 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	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	PSO 3
CO 1	3	3	2	-	-	-	-	1	2	-	3	-	-	-
CO 2	3	3	2	-	-	-	-	1	2	-	3	-	-	-
CO 3	3	3	2	1	-	-	-	1	2	-	3	-	-	-
CO 4	2	1	-	-	-	-	-	1	2	-	3	-	1	-
CO 5	2	-	2	-	-	-	-	1	2	-	3	2	1	1

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. B. L. Theraja & A. K. Theraja, Electrical Technology in S.I units (Volume-1 and Volume-2), S. Chand Publishing, 2021
2. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2nd Edition, 2019
3. Wadhwa, C L, "Basic Electrical Engineering", New Age International Publishers, 5th Edition, 2023.
4. Jacob Fraden," Handbook of Modern Sensors (Physics, Designs, and Applications)" 5th Edition, 2016.

SUGGESTED READINGS:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,4th edition, 2019.
2. S.K.Sahdev, "Basic Electrical Engineering", Pearson Education, 2015.
3. P.V. Prasad, S. S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering", Cengage Learning, 1st Edition, 2012.

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

26CSC03

DATA STRUCTURES USING C

Instruction	4 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

PREREQUISITES: Problem Solving and Programming using C (26CSC01), Problem Solving and Programming using C Lab (26CSC02).

COURSE OBJECTIVES: This course aims to

1. Understand and analyze algorithms using recursion, complexity, searching, and sorting techniques.
2. Develop skills to implement linear data structures such as linked lists, stacks, and queues.
3. Learn to design and apply non-linear data structures, including trees, graphs, and hashing, for efficient data management.

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

1. Apply algorithm design techniques, including recursion, complexity analysis, and sorting methods, to evaluate computational efficiency in Data Structures problems.
2. Implement linked list data structures and perform operations such as insertion, deletion, and traversal to represent dynamic data.
3. Apply stack, queue, and circular queue data structures to develop efficient solutions for computational applications.
4. Construct and analyze tree and graph structures using traversals, binary search trees, heaps, and minimum spanning tree algorithms.
5. Design efficient searching and indexing mechanisms using hashing techniques and balanced search trees.

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	3	1	-	-	-	-	-	-	-	-	1	1	-
CO 2	2	3	2	1	-	-	-	-	-	-	-	1	1	-
CO 3	2	3	2	1	-	-	-	-	-	-	-	1	1	-
CO 4	2	3	2	1	-	-	-	-	-	-	-	1	1	-
CO 5	2	3	2	1	-	-	-	-	-	-	-	1	1	-

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

Sorting: Insertion sort, Quick sort, Merge Sort, Comparison of sorting algorithms.

UNIT-II

Linked List: Singly Linked Lists, operations on single linked list - Insertion to the Front, end, and at a position of a Singly Linked List, Removal from the Front, end, and a position of a Singly Linked List. Double Linked Lists, operations on Double Linked List, Circular Linked Lists, operations on circular linked list, Reversing a single Linked List.

UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, matching Parenthesis, Infix to postfix conversion, evaluation of postfix. implementation of stack using array and linked list. Introduction to queues, applications of queues and implementation of queue using array and linked list, Circular queue and its implementation

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Tree Traversal. **Binary Search Trees:** Definition, Representation, and insert and delete operations. Heap Tree: definition, representation, Priority Queues and applications, Heap Sort.

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees. (Prim's and Kruskal algorithms).

UNIT-V

Hashing: Introduction, Hashing Functions- Modulo, Middle of Square, Folding, Collision Techniques-separate chaining, Linear Probing, Quadratic Probing, Double Hashing, **Balanced Search Trees:** AVL Trees -definition, insert operation, B-Trees- definition, insert operation.

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed "Fundamentals of Data structures in C", 2nd Edition, Universities Press, 2008.
2. ReemaThareja, "Data Structures using C", 2nd Edition, Oxford University Press, 2014.

SUGGESTED READING:

1. D.S.Kushwaha and A.K.Misra, "Data Structures: A Programming Approach with C", 2nd Edition, PHI, 2014.
2. Seymour Lipschutz, "Data Structures with C", 1st Edition, Schaums Outlines, Mc Graw Hill India, 2017.
3. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", 5th Edition, Career Monk Publications, 2017.

ONLINE RESOURCES:

1. NPTEL Videos: Introduction to data structures and algorithms - http://nptel.ac.in/courses/106102064/1
2. https://takeuforward.org/strivers-a2z-dsa-course/strivers-a2z-dsa-course-sheet-2/
3. https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
5. https://visualgo.net/en

26CSC05

PYTHON PROGRAMMING

Instruction	2 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	2

PREREQUISITE: Problem Solving and Programming Using C.

COURSE OBJECTIVES: This course aims to

1. Master the fundamentals of writing Python scripts, learn core Python scripting elements such as variables, data types, operators and flow control structures.
2. Discover how to work with lists and sequence data and write Python functions to facilitate code reuse.
3. Explore Python Arrays, Perform Searching/Sorting using Collections, Use Python to read and write files.

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

1. Understand fundamentals of python programming.
2. Apply control structures, functions, recursion, lambda expressions, and modules to design and implement Python programs.
3. Implement object-oriented programming concepts and develop modular applications.
4. Develop Python programs to perform file handling operations and implement error and exception handling mechanisms.
5. Analyze and visualize datasets using Python libraries NumPy, Pandas, and Matplotlib.

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	1	2	-	-	-	-	-	1	-	2	2
CO 2	3	2	2	1	3	-	-	-	-	-	2	-	2	2
CO 3	3	2	2	1	3	-	-	-	-	-	2	-	2	3
CO 4	2	2	2	2	3	-	-	-	-	-	2	-	3	3
CO 5	2	3	2	2	3	-	-	-	-	1	2	-	3	3

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Basics of Python Programming: Features of Python, Structure of a Python Program, Python Interpreters, Variables, Identifiers, Data types, Input/ Output operations, Operators and Expressions, Operations on Strings.

List, Dictionary, Set and tuple.

UNIT-II

Decision Control Statement: Selection/Conditional Branching, Loop Control Structures, Nested Loops.

Functions and Modules: Uses of functions, Function definition, function call, Variable scope and Lifetime, Recursion, Lambda functions, map, reduce and filter built-in functions, Recursive Functions, Modules, and Packages.

UNIT-III

Introduction to Object Oriented Programming: Features of Object Oriented Programming.

Classes and Objects: Introduction, Classes and Objects, init method, Class variables, and Object variables, Public and Private Data members, calling methods from other methods, built-in class attributes, garbage collection, class methods, static methods.

Inheritance: Introduction, Inheriting classes, Polymorphism and method overloading, operator overloading, Composition or Containership.

UNIT-IV

File Handling: File types, opening and closing files, reading and writing files, file positions.

Error and Exception Handling: Introduction to errors and exceptions, Handling Exceptions, User-defined exceptions.

UNIT-V

Data visualization in data analysis: Introduction to Matplotlib library, Installing and importing Matplotlib (matplotlib.pyplot).

Introduction to NumPy, Introduction to Pandas DataFrame, data import and export using .csv files, data aggregation and analysis.

TEXT BOOKS:

1. Jeeva Jose, "Taming Python by Programming", 2nd Edition, Khanna Book Publications, 2019.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter", 3rd Edition, O'Reilly Media, 2022.

SUGGESTED READING:

1. Reema Thareja, "Python Programming", 1st Edition, Oxford Press, 2017.
2. Yashavant Kanetkar and Aditya Kanetkar, "Let Us Python", 1st Edition, BPB Publications, 2019.
3. Zed A. Shaw, "Learn Python3 the Hard Way", 1st Edition, Pearson Education Inc., 2018.

ONLINE RESOURCES:

1. https://www.python.org.
2. https://www.learnpython.org/
3. https://developers.google.com/edu/python

26CYC04

BIOMATERIALS AND QUANTUM CHEMISTRY LAB

(Common to CSE, CSE-AI & ML, CSE (IoT & Cyber Security including Block Chain Technology), AI & DS)

Instruction	2 P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

COURSE OBJECTIVES: This course aims to

1. Impart fundamental knowledge in handling the equipment/glassware and chemicals in chemistry laboratory.
2. Provide the knowledge in qualitative chemical analysis of organic compounds.
3. Get familiarized with the volumetric principles for quantitative analysis.
4. Understand and apply the various instrumental methods to analyse the chemical compounds.
5. Develop the ability to interpret spectral data for the structural elucidation.

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

1. Identify the basic chemical methods to analyze the substances quantitatively & 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. Analyze the electronic transitions and determine λ_{max} using UV-Vis spectroscopy.

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	2	1	-	2	-	-	-	-	2	-	-	1
CO 2	3	3	2	2	-	2	-	-	-	-	2	-	-	1
CO 3	3	2	2	2	-	2	-	-	-	-	2	-	-	1
CO 4	3	2	2	2	-	2	-	-	-	-	2	-	-	1
CO 5	3	2	3	2	-	2	-	-	-	-	2	-	-	1

1-Slightly, 2-Moderately, 3-Substantially

LIST OF EXPERIMENTS:

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Identification of bio molecules (carbohydrates and proteins) in the given samples.
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. Estimation of amount of HCl potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} potentiometrically using $KMnO_4$ solution.
11. Quantum electronic transition analysis and determination of λ_{max} using UV–Visible Spectroscopy.
12. Computational visualization of molecular orbitals and quantum electron density using IQmol Software
13. Synthesis of aspirin and Paracetamol drugs

TEXT BOOKS:

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

SUGGESTED READING:

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", 9th revised edition, S.Chand and Company, 2015.

ONLINE RESOURCES:

1. https://www.vlab.co.in/ba-nptel-labs-chemical-sciences

26MBC02

COMMUNITY ENGAGEMENT

Instruction	2 P Hours per week
Duration of Semester End Examination	-
Semester End Examination	-
Continuous Internal Evaluation	50 Marks
Credits	1

COURSE OBJECTIVES: This course aims 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, the 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	PSO 3
CO 1	1	2	2	2	-	3	1	2	-	-	2			
CO 2	-	1	2	2	-	2	-	2	1	-	1			
CO 3	-	1	1	2	-	3	1	3	1	2	1			
CO 4	2	2	3	2	-	2	1	2	2	1	-			
CO 5	1	2	2	1	-	2	-	1	-	1	1			

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", 3rd Edition, Sage Publications, New Delhi, 2015.
2. Desai, Vasant, "Rural Development in India", 2nd Edition, Himalaya Publishing House, 2020.
3. Chambers, R., "Rural Development: Putting the last first", 1st Edition, Routledge, 2014.
4. Helen Sheil, "Growing and Learning in Rural Communities", 2nd Edition, 2024.

SUGGESTED READING:

1. Seth Appiah-Opoku , Usha Iyer-Raniga, "Contemporary Rural Development Programs", 1st edition, 2025
2. Journal of Rural development, National Institute of Rural Development and Panchayati Raj (NIRDPR), Hyderabad.
3. Indian Journal of Social Work, Tata Institute of Social Sciences (TISS), Mumbai.
4. Manjeet Singh Nain, Editorial Indian Journal of Extension Education, 62(2) (2026)..
5. Kurukshetra Journal, Ministry of Rural Development, Government of India

ONLINE RESOURCES:

1. https://www.rural.gov.in/
2. https://nirdpr.org.in/
3. https://sdgs.un.org/goals
4. https://onlinecourses.nptel.ac.in/e-learning
5. https://idronline.org/

26CSC04

DATA STRUCTURES USING C LAB

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

PREREQUISITES: Problem Solving and Programming using C (26CSC01), Problem Solving and Programming using C Lab (26CSC02)

COURSE OBJECTIVES: This course aims to

1. Introduce students to the implementation of fundamental searching and sorting algorithms and analyze their efficiency.
2. Develop skills in implementing dynamic data structures such as linked lists, stacks, and queues.
3. Provide practical experience in constructing and manipulating hierarchical and non-linear data structures like trees and graphs.

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

1. Implement and analyze searching and sorting algorithms to evaluate computational efficiency in data structure applications.
2. Develop and manipulate linked list structures (singly, doubly, and circular) to perform dynamic data operations.
3. Apply stack and queue implementations using arrays and linked lists to solve computational problems such as expression evaluation.
4. Construct and traverse tree and graph structures using Binary Search Trees, DFS, BFS.
5. Build efficient searching and indexing mechanisms using hashing techniques.

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	3	1	-	-	-	-	-	-	-	-	1	2	-
CO 2	2	3	2	1	-	-	-	-	-	-	-	2	2	-
CO 3	2	3	2	1	-	-	-	-	-	-	-	2	2	-
CO 4	2	3	2	1	-	-	-	-	-	-	-	2	2	-
CO 5	2	3	2	1	-	-	-	-	-	-	-	2	2	-

1-Slightly, 2-Moderately, 3-Substantially

LIST OF EXPERIMENTS:

1. Implementation of Insertion Sort, Merge sort and Quick sort.
2. Implement Singly Linked List and perform operations: insertion, deletion, and traversal.
3. Implement Doubly Linked List with insertion and deletion operations.
4. Implement Circular Linked List and demonstrate operations such as insertion, deletion, and display.
5. Implement Stack using Array and Linked List.
6. Implement applications of stack- parentheses checking and postfix evaluation.
7. Implement a queue using Array and Linked List and demonstrate operations (enqueue, dequeue, display).
8. Implement a Binary Search Tree (BST) with insertion, deletion and display operations.
9. Implement Graph Traversals using DFS and BFS.
10. Implement Hash Table with Collision Handling (Linear Probing / Quadratic Probing).

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data structures in C", 2nd Edition, Universities Press, 2008.
2. Reema Thareja, "Data Structures using C", 2nd Edition, Oxford University Press, 2014.

SUGGESTED READING:

1. D.S.Kushwaha and A.K.Misra, "Data Structures: A Programming Approach with C", 2nd Edition, PHI, 2014.
2. Narasimha Karumanchi, "Data Structures and Algorithms for GATE", 1st Edition, Career Monk Publications, 2011.
3. D. Samantha, "Classic Data Structures", 2nd Edition, Prentice Hall India, 2013.

ONLINE RESOURCES:

1. NPTEL Videos: Introduction to data structures and algorithms - http://nptel.ac.in/courses/106102064/1
2. https://takeuforward.org/strivers-a2z-dsa-course/strivers-a2z-dsa-course-sheet-2/
3. https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
5. https://visualgo.net/en

26CSC06

PYTHON PROGRAMMING LAB

Instruction	2 P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

PREREQUISITE: Basic Computer Skills.

COURSE OBJECTIVES: This course aims to

1. Enable students to set up the Python environment and develop basic programs using input/output operations and fundamental data types.
2. Familiarize students with control flow mechanisms using conditional statements and iterative loops for efficient program execution.
3. Promote modular programming through the use of user-defined functions, collections (lists, tuples, dictionaries), and file handling techniques.
4. Introduce object-oriented programming concepts, exception handling, and database connectivity for building applications.
5. Provide hands-on experience in developing real-time projects using Python, including data analysis with NumPy and Matplotlib, emphasizing problem-solving and code organization.

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

1. Demonstrate the basic Python syntax, variables, data types (integers, floats, strings, Boolean), and operators.
2. Develop Python programs using control structures, user-defined functions with appropriate parameters, and collection types (lists, tuples, dictionaries) to solve real-time problems efficiently.
3. Apply file handling operations and implement object-oriented programming features such as classes, objects, inheritance, and exception handling to build applications.
4. Design and implement modular Python code using packages, sub packages, functions and classes to enhance reusability.
5. Analyse and generate visualization using Matplotlib, Numpy and Pandas.

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	-	-	-	-	-	-	-	2	2
CO 2	3	2	2	2	3	-	-	-	2	-	-	-	2	2
CO 3	3	2	2	2	3	-	-	-	-	-	-	-	2	3
CO 4	3	2	2	2	3	-	-	-	2	-	-	-	3	3
CO 5	3	2	2	3	3	-	-	-	-	-	-	-	2	3

1-Slightly, 2-Moderately, 3-Substantially

LABORATORY / PRACTICAL EXPERIMENTS:

1. Set up the Python environment and write the first Python program using print statements. Explore input/output operations.
2. Develop Python programs using various data types (int, float, string, boolean) and apply arithmetic, relational, logical, and assignment operators.
3. Implement conditional statements (if, elif, else) to control the program flow based on user inputs and create programs on for and while loops for iterating over sequences and repeating tasks with controlled conditions.
4. Define user-defined functions with parameters and return values to create modular and reusable program components.

5. Create and manipulate core Python collections- lists, tuples, and dictionaries by performing insertion, deletion, traversal, and update operations, and demonstrate appropriate use cases and methods for each.
6. Perform file handling operations: open, read, write, and append text files in python for persistent data storage.
7. Design and implement basic classes and objects in Python. Demonstrate inheritance and method overriding through a sample hierarchy.
8. Write Python scripts to handle exceptions using try, except, and finally blocks. Demonstrate handling user-defined exceptions.
9. Design and build a small-scale Python project that demonstrates your understanding of core Python principles. Organize your code with modules, packages and sub packages
10. Perform data manipulation using NumPy and visualize the results with Matplotlib

TEXT BOOKS:

1. R.S. Salaria, "Programming in Python", 1st Edition, Khanna Book Publishing Co., 2024.
2. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", 3rd Edition, No Starch Press, 2023.

SUGGESTED READING:

1. Jeeva Jose, "Taming Python by Programming", 2nd Edition, Khanna Book Publishing Co., Delhi, 2019.
2. Mark Lutz, "Learning Python", 5th Edition, O'Reilly Media, Inc., 2013.

ONLINE RESOURCES:

1. https://docs.python.org/3/tutorial/index.html
2. https://realpython.com/
3. https://docs.python.org/3/tutorial/datastructures.html.
4. https://www.sqlitetutorial.net/sqlite-python/

26EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

COURSE OBJECTIVES: This course aims to

1. Acquire to verify the basic electrical circuit laws and theorems.
2. Explore the concept of single phase AC and Three phase AC concepts.
3. 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 and protection equipment.

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	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	1	1	-	-	-	-	-	-	-	-	-
CO 3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
CO 4	3	2	1	2	1	-	-	-	-	-	1	-	1	-
CO 5	2	1	1	-	1	1	-	-	-	-	1	1	1	1

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

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)", 5th 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