



**SCHEME OF INSTRUCTION AND SYLLABI (R-22A)
OF
B.E. I to VIII SEMESTERS OF FOUR YEAR DEGREE COURSE
IN
CSE- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

(Inline with AICTE Model Curriculum with effect from AY 2024-25)

(R-22A Regulation)



CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

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R22-A

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(AUTONOMOUS)

AICTE Model Curriculum R 22-A with effect from AY 2024-25

B.E. CSE (Artificial Intelligence and Machine Learning)

SEMESTER – I

S. No	CourseCode	Category	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
				Hours perWeek			Durationof SEE in Hours	Maximum Marks		
				L	T	P/D		CIE	SEE	
THEORY										
1	22MTC01	BS	Linear Algebra and Calculus	3	1	-	3	40	60	4
2	22PYC01	BS	Optics and Semiconductor Physics	3	-	-	3	40	60	3
3	22CSC01N	BES	Problem Solving and Programming using C	2	1	-	3	40	60	3
4	22EGC01N	HS	English	2	-	-	3	40	60	2
PRACTICAL										
5	22PYC03	BS	Optics and Semiconductor Physics Lab	-	-	3	3	50	50	1.5
6	22EGC02N	HS	English Lab	-	-	2	3	50	50	1
7	22CSC02N	BES	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
8	22MEC01N	BES	Engineering Graphics	-	1	3	3	50	50	2.5
9	22MEC38N	BES	Digital Fabrication Workshop	-	-	3	3	50	50	1.5
TOTAL				10	3	14	-	410	490	20

L: Lecture

T: Tutorial

P: Practical

CIE - Continuous Internal Evaluation

SEE - Semester End Examination

22MTC01

LINEAR ALGEBRA & CALCULUS
(CSE (AIML))

Instruction
Duration of SEE
SEE
CIE
Credits

3 L+1T Hours per week
3 Hours
60 Marks
40 Marks
4

COURSE OBJECTIVE: This course aims to

1. To explain the Partial Derivatives and the extreme values of functions of two variables.
2. To discuss Physical interpretations of scalar and vector functions.
3. To discuss vector line, surface and volume integrals.
4. To explain the concepts of basis, dimension of vector space and matrix representation of a linear transformation.
5. To explain the solution of system of linear equations by Matrix Methods.

COURSE OUTCOMES:

Upon completing this course, students will be able to:

1. Determine the extreme values of functions of two variables.
2. Apply the vector differential operator to scalar and vector functions
3. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
4. Determine the basis and dimension of a vector space, compute linear transformation.
5. Apply the Matrix Methods to solve the system of linear equations

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	3	3	-	-	-	-	-	-	-	2
C02	3	3	3	3	-	-	-	-	-	-	-	2
C03	3	3	3	3	-	-	-	-	-	-	-	2
C04	3	3	3	3	-	-	-	-	-	-	-	1
C05	3	3	3	3	-	-	-	-	-	-	-	1

UNIT-I

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

UNIT-II

Vector Differential Calculus and multiple Integrals: Scalar and Vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities), Irrotational fields and Solenoidal fields, Double integral, Change of order of Integration and Triple integrals.

UNIT-III

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Verification of Green's theorem in a plane (without proof), verification of Stoke's theorem (without proof) and Gauss's divergence theorem (without proof).

UNIT-IV:

Vector space: Vector space, Subspace, linear combination of vectors, linear span, row and column spaces, linear dependent, independent vectors, basis, dimension, linear transformation, invertible transformation, matrix of linear transformation, kernel and range of LT, rank and nullity of LT-rank nullity theorem(without proof), change of basis.

UNIT-V

Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. Seymour Lipschutz, "Schaum's Outline of Linear Algebra", 5th Edition, McGraw Hill, 2013.
4. Gilbert Strang, "Introduction to linear algebra", 5th Edition, Wellesley - Cambridge press, 2016.

SUGGESTED READING:

1. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publications, 5th edition, 2016.
3. D. Poole, "Linear Algebra: A Modern Introduction, 2nd Edition", Brooks/ Cole, 2005.
4. Kuldeep Singh, "Linear algebra: step by step". OUP Oxford, 2013.

22PYC01

**OPTICS AND SEMICONDUCTOR PHYSICS
(CSE (AIML))**

Instruction
Duration of SEE
SEE
CIE
Credits

3 Hours per week
3Hours
60Marks
40Marks
3

COURSE OBJECTIVES: This course aims to

1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

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

1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	2	2	3	2	2	2	1	1	2	1	2
C02	3	3	3	3	3	3	3	3	2	2	3	2
C03	3	3	3	3	3	2	3	2	1	2	1	2
C04	2	2	2	1	2	2	2	2	1	2	2	2
C05	3	2	2	2	2	2	3	3	2	2	3	2

UNIT-I

Wave Optics: Huygen's principle –Super position of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings– Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT-II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO₂; semiconductor laser – Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction– Applications.

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

UNIT-III

Principles of Quantum Mechanics: Introduction – Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ – Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle –Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT-IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors – Charge carrier concentration in intrinsic semiconductors – Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) – Carrier generation and recombination – Carrier transport: diffusion and drift – P-N junction – Thermistor – Hall Effect – LED – Solar cell.

TEXT BOOKS:

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

SUGGESTD READING:

1. R. Murugesan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, Mc Graw-Hill Education Publications, 2013.
3. P. K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

22CSC01N**PROBLEM SOLVING AND PROGRAMMING USING C**

Instruction	2 L+1T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Pre-requisites: Basic 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: Upon completion of this course, students will be able to:

1. Formulate solutions to problems and represent those using algorithms/ Flowcharts.
2. Choose proper control statements and data structures to implement the algorithms
3. Decompose a problem into modules and use functions to implement the modules.
4. Develop programs using arrays, pointers and structures.
5. Develop applications using file I/O.

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	1	2	-	-	-	-	1	-	-	-
C02	3	2	1	2	-	-	-	-	1	-	-	-
C03	3	2	1	2	-	-	-	-	1	-	-	-
C04	3	2	-	2	-	-	-	-	1	-	-	-
C05	2	1	-	-	-	-	-	-	-	-	-	-

UNIT - I

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

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

UNIT - II

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

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

UNIT – III

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

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

UNIT - IV

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

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

Userdefined Datatypes: Structures- Declaring Structures and Structure Variables, Accessing the Members of a Structure, Initialization of Structures ,Typedef ,Nesting of Structures, Arrays and Structures, Structures and Pointers, Structures and Functions , 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.

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2012.

Suggested Reading:

1. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.
2. B.A.Forouzan and R.F. Gilberg A Structured Programming Approach in C, Cengage Learning,2007.
3. Byron Gottfried, Schaum“s”Outline of Programming with C”, McGraw- Hill.
4. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

Online Resources:

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

22EGC01N

ENGLISH

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

Instruction	2LHours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: Basic knowledge of English grammar and vocabulary.

Course Objectives: The course is taught with the objectives of enabling the students to:

1. Improve their understanding of communication skills while developing their usage of English for correct use of grammar and vocabulary.
2. Equip themselves with Reading Comprehension strategies and techniques.
3. Enhance their writing skills through paragraphs, précis and essays by using devices of cohesion and coherence.
4. Build appropriate, longer meaningful sentences for professional writing through formal letters and e-mails.
5. Demonstrate knowledge of drafting formal reports to define, describe and classify the processes by following a proper structure.

Course Outcomes:

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

1. Step-up the awareness of correct usage of English grammar and vocabulary by speaking fluently and comprehensively with a grip on communication skills.
2. Apply effective reading techniques through critical reading exercises to enhance quality of life and to support lifelong learning.
3. Develop their ability to write paragraphs independently on any context with cohesion, edit essays coherently while realizing brevity through précis writing.
4. Construct sentences clearly and comprehensively to write effective business letters and draft emails for a better professional communication.
5. Advance efficiency in writing, distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	1	1	1	1	1	1	1	2	3	3	2	3
C02	1	1	1	1	1	1	1	1	1	2	1	3
C03	1	2	1	1	-	1	1	1	1	3	1	3
C04	1	2	1	1	-	1	1	2	2	2	2	3
C05	1	2	1	2	1	2	2	2	3	3	2	3

UNIT-I Communication Skills:

Introduction, nature and importance of communication; Process of communication; Types of communication: verbal and non-verbal; Barriers to communication; Intrapersonal, Interpersonal communication; Understanding Johari Window.

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

Reading Task I.

UNIT-II Reading Skills:

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

Vocabulary and Grammar: Determiners. Use of Synonyms and Antonyms, Construction of Sentences.

Reading Task II.

UNIT-III Writing Skills II:

Paragraph Writing. – Structure and features of a paragraph; Essay writing, Cohesion and coherence. Techniques of writing précis.

Vocabulary & Grammar: Use of connectors and linkers, Tenses, Punctuation.

Reading Task III.

UNIT-IV Professional Writing Skills-1:

Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails, Email and Mobile etiquette.

Vocabulary and Grammar: Phrasal verbs, Misplaced modifiers, Subject-verb agreement.

Reading Task IV

UNIT-V Professional Writing Skills-2:

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

Vocabulary and Grammar: Words often Confused, Common Errors. Avoiding Ambiguity & Redundancy.

Reading Task V.

Text Books:

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

Suggested Readings:

1. Ashraf, M Rizvi, “Effective Technical Communication”, Tata McGraw-Hill, 2006.
2. Michael Swan, “Practical English Usage”, Oxford University Press, 4th Edition, 2016.
3. Meenakshi Raman and Sangeetha Sharma, “Technical Communication: Principles and Practice” 3rd Edition, Oxford University Press, 2015.

22PYC03**OPTICS AND SEMICONDUCTOR PHYSICS LAB**

Instruction
Duration of SEE
SEE
CIE
Credits

3P Hours per week
3Hours
50Marks
50Marks
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. Analyze the conduction behaviour of semiconductor materials and 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. Make use of lasers and optical fibers for engineering applications
4. Explain the V-I characteristics of some optoelectronic and semiconductor devices
5. Find the applications of thermistor

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	2	2	3	1	3	1	3	3	2	1	2
C02	3	2	1	2	2	2	1	2	2	1	1	3
C03	3	2	3	2	3	1	2	2	3	2	1	2
C04	3	3	2	2	2	1	2	3	2	1	1	3
C05	3	1	2	3	2	1	1	2	2	2	1	2

Experiments

1. Error Analysis : Estimation of errors in the determination of time period of a torsional Pendulum
2. Fresnel's Biprism : Determination of wavelength of given monochromatic source
3. Newton's Rings : Determination of radius of curvature of a given plano-convex lens using Na vapor lamp
4. Single Slit
Diffraction : Determination of wavelength of given monochromatic source
5. Diffraction Grating : Determination of wavelengths of two yellow lines of light of Mercury lamp
6. Laser : Determination of wavelength of given semiconductor laser
7. Holography : Recording and reconstruction of a hologram
8. Optical Fiber : Determination of numerical aperture and power losses of given optical fiber
9. Energy Gap : Determination of energy gap of given semiconductor
10. P-N Junction Diode : Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
11. Thermistor : Determination of temperature coefficient of resistance of given thermistor
12. Hall Effect : Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
13. LED : Study of I-V characteristics of given LED
14. Solar Cell : Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
15. Planck's Constant : Determination of Planck's constant using photo cell

NOTE: A minimum of TWELVE experiments should be done.

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

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

Prerequisite: Basic Knowledge of English Communication.

Course Objectives: This course will introduce the students

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation through computer-aided multi-media instruction.
2. To the significance and application of word and sentence stress and intonation.
3. To sufficient practice in listening to English spoken by educated English speakers in different socio-cultural and professional settings.
4. To reading and speaking activities enabling them to critically interpret and respond to different texts and contexts, and produce speech with clarity and confidence.
5. To team work, role behaviour while developing their ability to use language appropriately, to discuss in groups and make presentations.

Course Outcomes:

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

1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Produce speech with clarity and confidence using correct word and sentence stress, and intonation.
3. Achieve improved ability to listen, understand, analyse, and respond to English spoken in various settings.
4. Read, interpret, and review a variety of written texts, contexts, and perform appropriately in different situations.
5. Design effective posters collaboratively through creative decisions, give presentations, and efficiently participate in Group discussions.

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	-	-	-	-	-	-	1	1	2	1	3
C02	-	-	-	-	-	1	-	1	2	2	1	3
C03	-	-	-	-	-	1	1	1	2	1	1	2
C04	1	1	1	1	1	1	2	2	3	3	1	3
C05	-	1	1	1	1	2	2	2	3	3	2	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- structure of syllables (Introduction to syllables) - Basic phonetic transcription practice.
3. **Word and Sentence stress:** Rules of word stress -Primary stress, Secondary stress; Sentence stress (word emphasis in sentences) -Practice.
4. **Intonation:** Types of Intonation, Practice in Articulation – MTI-Errors in pronunciation.
5. **Listening skills:** understanding Listening- Practice in Listening comprehension texts.

Interactive Communication Skills Lab

1. **JAM-** Ice Breaking, Speaking Activity.
2. **Role play/Public speaking** – Speaking with confidence and clarity in different contexts on various issues.

3. **Group Discussions** - Dynamics of a Group Discussion, Group Discussion Techniques, Non-Verbal Communication.
4. **Read and Review** - Preparation for active reading and instructing the students to cultivate effective reading habits to read select texts, review and write their responses.
5. **Poster presentation** – Theme, poster preparation, team work and presentation.

Text Books:

1. T Balasubramanian, “A Textbook of English Phonetics for Indian Students”, Macmillan, 2nd Edition, 2012.
2. J Sethi et al., “A Practical Course in English Pronunciation (with CD)”, Prentice Hall India, 2005.
3. Priyadarshi Patnaik, “Group Discussions and Interview Skills”, Cambridge University Press Pvt. Ltd., 2nd Edition, 2015.
4. Aruna Koneru, “Professional Speaking Skills”, Oxford University Press, 2018.

Suggested Reading:

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

Suggested Software:

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

22CSC02N**PROBLEM SOLVING AND PROGRAMMING USING C LAB**

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

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:

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

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

CO-PO Articulation Matrix

PO-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	1	2	1	1	1	–	1	1	1	1	1
C02	3	2	3	2	2	1	–	1	2	1	1	2
C03	3	2	2	3	2	-	-	-	1	2	-	2
C04	3	2	3	2	2	-	-	-	1	1	2	3
C05	3	2	2	1	2	-	-	-	-	1	-	1

Laboratory / Practical Experiments:

1. Familiarization with programming environment.
2. Draw flowcharts using Raptor or Drakon Tool
3. Simple computational problems using arithmetic expressions.
4. Problems involving if-then-else structures.
5. Iterative problems e.g., sum of series, generating patterns.
6. Iterative and Recursive functions
7. 1D Arrays, 2D arrays and strings.
8. Sorting and Searching, Matrix problems.
9. Pointers and structures.
10. Dynamic memory allocation.
11. File Handling

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2012.

Suggested Reading:

1. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.
2. B.A.Forouzan and R.F. Gilberg A Structured Programming Approach in C, Cengage Learning, 2007.
3. Byron Gottfried, Schaum’s “Outline of Programming with C”, McGraw- Hill.
4. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

Online Resources:

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

22MEEC01N**ENGINEERING GRAPHICS**

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

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

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

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	2	1	2	2	-	1	2	3	1	3
C02	3	2	2	1	2	2	-	1	2	2	1	2
C03	3	3	2	1	2	2	-	1	2	2	1	2
C04	3	3	3	2	2	2	-	1	2	2	1	2
C05	3	2	2	1	2	2	-	1	2	2	1	2

LIST OF EXERCISES:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning, documentation and practice exercises using Auto CAD software.
2. Construction of Conic Sections by General method.
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane & inclined to both the planes (without traces and mid-point)
5. Projection of planes: Perpendicular planes
6. Projection of planes: Oblique planes
7. Projection of solids: Simple position
8. Projection of solids: Inclined to one plane
9. Sections of solids: Prism, pyramid in simple position
10. Sections of solids: Cone and Cylinder in simple position
11. Isometric projections and views
12. Conversion of isometric views to orthographic projections and vice-versa.

Text Books:

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

Suggested Reading:

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

22MEC38N**DIGITAL FABRICATION WORKSHOP**

Instruction

Duration of SEE

SEE

CIE

Credits

3P Hours per Week

3 Hours

50 Marks

50 Marks

1.5

Prerequisite: Nil**Course Objectives:** This course aims to:

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

Course Outcomes: Upon completion of this course, students will be able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in carpentry, house wiring and plumbing.
3. Make a given model by using workshop trades like carpentry, plumbing, House wiring and 3d modeling using solid works software for Additive Manufacturing.
4. Perform pre-processing operations on STL files for 3D printing, also understand reverse engineering process.
5. Conceptualize and produce simple device/mechanism of their choice.

CO-PO Articulation Matrix

PO-CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	1	1	1	1	-	-	-	1	-	-	-	1
C02	1	-	1	-	-	-	-	-	-	-	-	1
C03	1	-	1	-	-	1	-	-	-	-	-	1
C04	1	-	1	-	-	1	-	-	-	-	-	1
C05	2	2	2	1	3	1	-	1	1	2	-	2

Lab Experiments**Group 1: Workshop Practice**

1. To make a lap joint on the given wooden piece according to the given dimensions
2. To make a dovetail joint on the given wooden piece according to the given dimensions.
3. (a)Wiring of one light point controlled by one single pole switch, a threepin socket controlled by a single switch
- 3 (b)Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a threepin socket.
- 4 Stair case wiring Wiring of one light point controlled from two different places independently using two 2way switches.
- 5 To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings, and bends.
- 6 To connect the GI pipes as per the given diagram using, Coupling, Unions, reducers, and bends. To connect the GI pipes as per the given diagram using shower, tap, and valves and demonstrate by giving water connection.

Group 2: Additive Manufacturing /3D Printing

1. To Study the methods of Additive manufacturing process using a 3D printer.
2. To create a 3D CAD model of a door bracket using a modelling software.
3. To print a door bracket using an extruder type 3D printer.
4. To create a 3D CAD model using Reverse engineering.
5. Engraving, Drilling and Cutting operations on printed circuit boards using CNC PCB Mate.
6. To design an innovative component using the CAD software./print the selected innovative component by the student using a 3D printer.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.

Suggested Reading:

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



R22-A

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(AUTONOMOUS)

AICTE Model Curriculum R 22-A with effect from AY 2023-24

B.E. CSE (Artificial Intelligence and Machine Learning)

SEMESTER -II

S. No	CourseCode	Category	Title of the Course	Scheme ofInstruction			Scheme of Examination			Credits
				Hours per Week			Duratio nof SEE in Hours	Maximum Marks		
								CIE	SEE	
L	T	P/D								
THEORY										
1	22MTC04	BS	Differential Equations and Numerical Methods	3	1	-	3	40	60	4
2	22CYC01	BS	Chemistry	3	-	-	3	40	60	3
3	22EEC01	BES	Basic Electrical Engineering	2	1	-	3	40	60	3
4	22ITC20N	BES	Data Structures using C++	3	-	-	3	40	60	3
PRACTICAL										
5	22ITC21N	BES	Data Structures using C++ Lab	-	-	2	3	50	50	1
6	22ADC05N	BES	Python Programming Lab	-	1	2	3	50	50	2
7	22CYC02	BS	Chemistry Lab	-	-	3	3	50	50	1.5
8	22EEC02	BES	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
9	22MEC37N	BES	Robotics and Drones Lab	-	1	3	-	100	-	2.5
10	22MBC02N	HS	Community Engagement	-	-	2	-	50	-	1
TOTAL				11	4	14	-	510	440	22

L: Lecture

T: Tutorial

P: Practical

CIE - Continuous Internal Evaluation

SEE - Semester End Examination

DIFFERENTIAL EQUATIONS & NUMERICAL METHODS (CSE (AI&ML))

Instruction
Duration of SEE
SEE
CIE
Credits

3 L+1T per week
3 Hours
60 Marks
40 Marks
4

COURSE OBJECTIVES: This course aims to

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss numerical methods to solve algebraic and transcendental equations.
4. To discuss the interpolation and numerical differentiation.
5. To discuss convergence and divergence of Infinite series.

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

Upon completing this course, students will be able to:

1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Solve the algebraic, transcendental and system of equations.
4. Apply interpolation and numerical differentiation techniques for given data.
5. Test the convergence and divergence of Infinite series.

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	3	3	-	-	-	-	-	-	-	2
C02	3	3	3	3	-	-	-	-	-	-	-	2
C03	2	2	2	2	-	-	-	-	-	-	-	1
C04	2	2	2	2	-	-	-	-	-	-	-	1
C05	1	1	1	1	-	-	-	-	-	-	-	1

UNIT - I

Differential Equations of First Order: Exact Differential Equations, Equations Reducible to Exact Equations, Linear Equations, Bernoulli's Equations, Riccati's and Clairaut's Equations, Orthogonal trajectories, Rate of decay of radio-active materials.

UNIT-II

Higher Order Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution. Method of Variation of Parameters, solution of Cauchy- Euler equation. LR and LCR circuits.

UNIT-III

Numerical solution of equations: Numerical solutions of algebraic and transcendental equations by Bisection method, Regula-falsi method and Newton-Raphson's method, Solution of system of linear equations by LU decomposition methods, Crout's method, Jacobi's method, Gauss Seidel method.

UNIT-IV

Interpolation and Numerical Differentiation: Forward, Backward and Central differences, Newton's forward and backward interpolation formulae, Gauss's forward and backward interpolation formulae, Lagrange interpolation, Numerical differentiation at the tabulated points with forward, backward and central differences.

UNIT-V

Infinite Series: Convergence of sequence and series. Series of positive terms, Necessary condition for convergence, Comparison tests, limit form comparison test, D'Alembert's Ratio test, Raabe's test, Cauchy's root test, Alternating series, Leibnitz's rule, absolutely and conditionally convergence.

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.
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.

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. A.R.Vasishtha and R.K.Guptha, “Integral Transforms”, Reprint, Krishna’s Educational Publishers, 2014.

22CYC01**CHEMISTRY**

Instruction:	3L 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

This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers

1. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
2. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
3. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
4. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

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

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

CO-PO Articulation Matrix

PO- CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	2	2	-	-	2	2	-	-	-	-	2
C02	3	2	2	-	-	2	2	-	-	-	-	2
C03	3	2	3	-	-	2	2	-	-	-	-	2
C04	3	2	3	-	-	2	2	-	-	-	-	2
C05	3	2	2	-	-	2	2	-	-	-	-	2

UNIT-I

Atomic and molecular structure and Chemical Kinetics: **Atomic and molecular structure:** Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ , N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction- Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II

Use of free energy in chemical equilibria: Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, and – Reference electrodes (NHE, SCE) electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO₂ and Li-ion batteries. Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III

Stereochemistry and Organic reactions : Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – conformations of n-butane (Newman and sawhorse representations), Configurational isomerism -Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid)&Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (SN1& SN2); Free Radical Substitution (Halogenation of Alkanes)

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)

Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides), Cyclization (Diels - Alder reaction)

UNIT-IV

Water Chemistry: Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process), ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V

Engineering Materials and Drugs: Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.

Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).

Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi, 16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition(2019).
4. A Textbook of Polymer Science and Technology, Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition(2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

22EEEC01**BASIC ELECTRICAL ENGINEERING**

Instruction

Duration of SEE

SEE

CIE

Credits

2L+1T Hours per week

3 Hours

60 Marks

40 Marks

3

COURSE OBJECTIVES: This course aims to

1. Understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To comprehend the basic principle of operation of AC and DC machines
3. To infer about different types of electrical wires and cables, domestic and industrial wiring, safety rules 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 various theorems to get solution 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 the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.

Course Articulation Matrix

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

UNIT-I

DC Circuits: Electrical circuit elements (R,L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin's and Norton's Theorems.

UNIT-II

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, voltage and current relations in star and delta connections.

UNIT-III

Single Phase Transformer: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt generators. DC Motors: Classification, Torque Equation, Characteristics and Speed control of DC Shunt and Series Motors, Losses and efficiency Three - Phase Induction Motors: Principle of operation, Applications

UNIT-V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, and first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

TEXT BOOKS:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

SUGGESTED READING:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013

22ITC20N**DATA STRUCTURES USING C++**

Instruction

Duration of SEE

SEE

CIE

Credits

3 Hours per week

3 Hours

60 Marks

40 Marks

3

Prerequisites:

Programming and Problem Solving (22CSC01), Programming Laboratory (22CSC02).

Course Objectives: The objectives of this course are to:

1. Acquaint with OOP concepts.
2. Familiarize with the asymptotic analysis of Algorithms.
3. Learn sorting techniques.
4. Explore linear and nonlinear data structures.
5. Introduce pattern-matching algorithms and hashing.

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

1. Understand the concepts of OOPs.
2. Analyse the time complexity of operations on data structures.
3. Apply sorting techniques, pattern-matching algorithms, and hashing.
4. Demonstrate operations on linear and nonlinear data structures.
5. Devise solutions to problems using linear and nonlinear data structures.

Course Articulation Matrix

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

UNIT-I:

Object Oriented Design: Object-Oriented Design Goals, Object-Oriented Design Principles, Classes: Class Structure, Constructors and Destructor, Classes and Memory Allocation, Class Friends and Class Members, Standard Template Library; Inheritance: Inheritance in C++, Examples, Multiple Inheritance, Interfaces and Abstract Classes, Templates: Class Templates

UNIT-II:

Algorithm Analysis: Experimental Studies, Primitive Operations, Asymptotic notation, Asymptotic Analysis, Seven functions.

Sorting: Selection Sort, Insertion Sort, Merge-Sort: Divide-and-Conquer, Quick-Sort: Randomized Quick-Sort, Linear-Time Sorting: Bucket-Sort and Radix-Sort, Comparing Sorting Algorithms.

UNIT-III:

Linked Lists: Singly Linked Lists, Implementing a Singly Linked List, Insertion to the Front of a Singly Linked List, Removal from the Front of a Singly Linked List, Implementing a Generic Singly Linked List, Doubly Linked Lists, Insertion into a Doubly Linked List, Removal from a Doubly Linked List, Circularly Linked Lists, Reversing a Linked List

Stacks: The Stack Abstract Data Type, A C++ Stack Interface, A Simple Array-Based Stack Implementation, Reversing a Vector Using a Stack, Matching Parentheses; **Queues:** The Queue Abstract Data Type, A C++ Queue Interface, A Simple Array-Based Implementation, Implementing a Queue with a Circularly Linked List

UNIT-IV:

Trees: General Tree Definitions and Properties, Binary Trees, The Binary Tree ADT, Properties of Binary Trees, A Linked Structure for Binary Trees, A Vector-Based Structure for Binary Trees, Traversals of a Binary Tree, Representing General Trees with Binary Trees, **Binary Search Trees:** Searching, Update Operations, AVL Trees: Insertion; **Heaps:** The Heap Data Structure, Complete Binary Trees, Heap Sort.

UNIT-V:

Strings: Pattern Matching Algorithms: Brute Force, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm

Graphs: Graphs, Data Structures for Graph, Graph Traversals

Hash Tables: Hash Tables, Bucket Arrays, Hash Functions, Hash Codes, Compression functions, Collision-Handling Schemes, Load Factors and Rehashing

Text Books:

1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", Career Monk Publications, 5th Edition, 2017.
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++" 2nd Edition, Universities Press, 2007

Suggested Reading:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Addison-Wesley, 2007.
2. Narasimha Karumanchi, "Data Structures and Algorithms for GATE", Career Monk Publications, 2011.
3. D. Samantha, "Classic Data Structures", Prentice Hall India, 2nd Edition, 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>

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

Prerequisites:

Programming and Problem Solving (22CSC01), Programming Laboratory (22CSC02).

Course Objectives: The objectives of this course are to:

1. Acquaint with OOP concepts.
2. Learn sorting techniques.
3. Explore linear and nonlinear data structures.
4. Introduce pattern-matching algorithms
5. Explain hashing and Collision handling.

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

1. Practice the concepts of OOPs.
2. Define ADT for linear and nonlinear Data Structures.
3. Apply sorting techniques, pattern matching algorithm, and hashing.
4. Demonstrate standard operations on linear and nonlinear data structures.
5. Devise solutions to problems using linear and nonlinear data structures.

Course Articulation Matrix

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

List of Programs

1. Practice problems on Inheritance and Polymorphism
2. Implement the following sorting techniques: Insertion Sort, Selection Sort, Merge Sort, Quick Sort.
3. Define Linked List ADT and implement its operations.
4. Implement Stack ADT and perform arithmetic expression evaluation.
5. Implement Queues, Circular Queues.
6. Implement Heap sort.
7. Construct a Binary Search Tree and implement Tree Traversals.
8. Define String ADT and implement the Boyer Moore pattern matching algorithm.
9. Implement Hashing with chaining.
10. Implement Graph Traversals.

Text Books:

1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", Career Monk Publications, 5th Edition, 2017.
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++" 2nd Edition, Universities Press, 2007

Suggested Reading:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Addison-Wesley, 2007.
2. D. Samantha, "Classic Data Structures", Prentice Hall India, 2nd Edition, 2013.

Online Resources:

1. <https://takeuforward.org/strivers-a2z-dsa-course/strivers-a2z-dsa-course-sheet-2/>
2. <https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/>

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

Prerequisite: Programming for Problem Solving

Course Objectives:

This course aims to:

1. Introduce the fundamentals of writing Python scripts
2. Familiarize with Python variables, flow controls structures, and functions.
3. Equip students with the knowledge to select and work with appropriate data structures (lists, tuples, dictionaries) to efficiently organize and manipulate data.
4. Emphasize the importance of modularity and reusability by teaching students how to design well-structured programs using functions.
5. Enable students to confidently read data from external files, process it in Python, and write results back to files for storage and analysis.

Course Outcomes:

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

1. Demonstrate a solid understanding of basic Python syntax, variables, data types (integers, floats, strings, Boolean), and operators.
2. Construct programs that effectively utilize conditional statements (if, elif, else) and looping structures (for, while) to control program execution.
3. Choose and manipulate suitable data structures (lists, tuples, dictionaries) and files to effectively store, organize, and manage data within Python programs.
4. Write modular and well-structured code by defining and using functions with appropriate parameters and return values.
5. Design and implement modular Python code using packages, subpackages and functions to enhance code organization, reusability and maintainability.

Course Articulation Matrix

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

List of Experiments:

1. Set up your Python environment, write your first "Hello, World!" program, and experiment with basic print statements and calculations.
2. Write Python programs to work with different data types (integers, floats, strings, booleans) and use operators to perform calculations and manipulate text.
3. Create programs that utilize conditional statements (if, elif, else) to control the flow of execution based on different conditions.
4. Implement **for** and **while** loops for iterating over sequences and repeating tasks with controlled conditions.
5. Define functions with parameters and return values to break down code into manageable and reusable blocks.
6. Create and manipulate lists and tuples to store and manage ordered collections of data.
7. Leverage dictionaries to store and retrieve data efficiently using key-value associations.

8. Write programs to open, read from, and write to text files in Python for persistent data storage.
9. Design a simple class hierarchy (e.g., animals, shapes, vehicles) where you define classes, create objects, and demonstrate inheritance with methods and attributes.
10. Write Python scripts to handle exceptions.
11. Create a simple GUI with Tkinter library.
12. Design and build a small-scale Python project that demonstrates your understanding of core Python principles. Organize your code with modules, packages and subpackages.

Text Books:

1. R.S. Salaria, "Programming in Python", Khanna Book Publishing Co., Delhi.
2. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.

References:

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

Web Resources:

1. <https://docs.python.org/3/tutorial/index.html>
2. <https://realpython.com/>

Practice & Challenges:

1. <https://www.hackerrank.com/>
2. <https://exercism.org/>

22CYC02**CHEMISTRY LAB**

(Common to CSE, CSE-AIML, AIML CSE-IOT, AIDS)

Instruction:	3P 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. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

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

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Course Articulation Matrix

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

List of Experiments:

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2} & Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
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. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

TEXT BOOKS:

1. J. Mendham and Thomas , “Vogel’s text book of quantitative chemical analysis”, Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi(2011).

SUGGESTED READINGS:

1. Dr. Subdharani , “Laboratory Manual on Engineering Chemistry”, Dhanpat Rai Publishing, 2012.
2. S.S. Dara , “A Textbook on experiment and calculation in engineering chemistry”, S.Chand and Company,9th revised edition, 2015.

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

COURSE OBJECTIVES: This course aims to

1. To acquire the knowledge on different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power & energy.
3. To determine the characteristics of Transformers, dc, ac machines and switch gear components

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

1. Comprehend the circuit analysis techniques using various circuit laws and theorems.
2. Analyse the parameters of the given coil and measurement of power and energy in AC circuits
3. Determine the turns ratio/performance parameters of single-phase transformer
4. Infer the characteristics of DC shunt motor different tests.
5. Illustrate different parts and their function of electrical components, equipment and machines.

Course Articulation Matrix

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

List of Laboratory Experiments/Demonstrations:

1. Verification of KCL and KVL.
2. Verification of Thevenin's theorem.
3. Verification of Norton's theorem.
4. Charging and discharging of Capacitor.
5. Determination of parameters of a choke or coil by Wattmeter Method.
6. Power factor improvement of single-phase AC System.
7. Active and Reactive Power measurement of a single-phase system using
 - i. (i) 3-Ammeter method
 - (ii) 3-Voltmeter method
8. Measurement of 3-Phase Power in a balanced system
9. Calibration of single-phase energy meter.
10. Verification of Turns/voltage ratio of single-phase Transformer.
11. Open Circuit and Short Circuit tests on a given single phase Transformer
12. Brake test on DC Shunt Motor
13. Speed control of DC Shunt Motor
14. Demonstration of Measuring Instruments and Electrical Lab components.
15. Demonstration of Low-Tension Switchgear Equipment/Components
16. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted to cover all five Course Outcomes.

Instruction	1T + 3P Hours per week
Duration of SEE	-
SEE	-
CIE	100 Marks
Credits	2.5

Prerequisite: Nil

Course Objectives: The objectives of this course are to

1. To develop a thorough understanding of various autonomous robot structures
2. To gain expertise in working with various sensors and gain the ability to interface sensors with microcontrollers, read data, and seamlessly integrate them into robotics applications.
3. To acquire proficiency in understanding different types of motors, motor drivers, develop the skills to interface motors with microcontrollers, motors and construct two-wheel robots with controlled movements.
4. To attain proficiency in utilizing OpenCV for advanced image processing tasks master techniques such as RGB value extraction, creating colored shapes, and extracting Regions of Interest (ROI) from images.
5. To develop a thorough understanding of various drone structures/develop autonomous systems.

Course Outcomes: After completion of course, students would be able to

1. Understand mechanical structures, motors, sensors, and circuits essential for constructing robots.
2. Demonstrate the utilization of sensors (Ultrasonic, IR, Rotary Encoder) for Arduino interfacing, reading data, and integrating them seamlessly into robotics applications.
3. Demonstrate expertise in operating robot controllers, applying theory to precisely control servo and stepper motors, 2 wheel robots ensuring desired motion.
4. Able to apply Python and OpenCV for image processing, including RGB extraction and ROI tasks.
5. Proficiently assemble a quadcopter drone, showcasing understanding of its classification, parts, and operational principles/ Proficiency to develop autonomous systems fostering creativity and practical application.

Course Articulation Matrix

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

Lab Experiments:

Experiment No	Title	CO
1.	Introduction to Robotics, Definition and scope of robotics, Robot configurations-Cartesian, cylinder, polar and articulate. Uses and Significance of Robots, Parts of a Robot, Current applications and future trends. Introduction to Arduino, C++, Arduino Programming Environment. Interfacing Arduino with Electronic Devices such as LEDs/Piezo Buzzer	1
2.	Interfacing Arduino with Electronic Devices such as Push Button/Potentiometer	1
3.	Introduction to Sensors, Types of Sensors, Reading Data from Sensors, Interfacing Sensors with Microcontrollers. Interfacing Arduino with Ultrasonic Distance Sensor and Reading Sensor Data on Serial Monitor	2
4.	Interfacing Arduino with IR Sensor and Reading Sensor Data on Serial Monitor	2
5.	Interfacing Arduino with Rotary Encoder and Reading Sensor Data on Serial Monitor	2
6.	Introduction to motors, Types of motors, Motor drivers, Interfacing motors with Microcontrollers, Introduction to Li-ion, LIPO batteries, uses and safety precaution. Implement a system that utilizes an Arduino microcontroller to control the precise movement of	3

	a servo motor.	
7.	Implement a system that utilizes an Arduino microcontroller to control the precise and sequential movements of a stepper motor.	3
8.	Construct a two-wheel robot using DC motors controlled by an Arduino microcontroller. Implement a program that allows the robot to execute specific movements. The robot should: - Move forward with controlled acceleration. - Move backward with controlled deceleration.	3
9.	Construct an Obstacle avoidance robot	3
10.	Construct a Pick and place robot	3
11.	OpenCv for image processing: - Extraction of RGB values of a pixel - Create colored shapes and save image - Extraction of ROI	4
12.	Assembly of quad copter drone.	5

Open-Ended Project on Autonomous System

Note:

- Mandatory Open-Ended Project (20 marks) in CIE.
- Any 10 experiments the students must do among the 12 experiments.

Suggested readings:

1. <https://www.geeksforgeeks.org/robotics-introduction/>
2. <https://www.ohio.edu/mechanical-faculty/williams/html/PDF/IntroRob.pdf>
3. <https://www.idtechex.com/en/research-report/new-robotics-and-drones-2018-2038-technologies-forecasts-players/584>
4. <https://dronebotworkshop.com/>

Instruction
week

2P Hours per

Semester End Examination

Nil

CIE

50 Marks

Credits

1

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

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

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

1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

Course Articulation Matrix

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

Module I Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources. Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees.

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India. NRLM, MNREGA etc.

Text Books:

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

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).