UG-R22 Curriculum
With effective from 2022-23

Artificial Intelligence and Machine Learning

Scheme of Instruction and Syllabi of
B.E I to IV Semester of
Four Year Degree Course

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institute | Affiliated to Osmania University)
Accreditated by NBA & NAAC (A++)
Kokapet Village, Gandipet Mandal, Hyderabad -500075, Telanagana.
E-mail: principal@cbit.ac.in, Website: www.cbit.ac.in
Phone No. : 040-24193276 / 277 / 279

SCHEME OF INSTRUCTION AND SYLLABI

Of

B.E. I to IV SEMESTERS

FOR

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

(Inline with AICTE Model Curriculum with effect from AY 2022-23)

(R–22 Regulation)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

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

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

Phone Nos.: 040-24193276 / 277 / 279

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

DEPARTMENT OF AIML

PROGRAMME: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

INSTITUTE VISION AND MISSION:

Vision: To be a Centre of Excellence in Technical Education and Research

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

DEPARTMENT VISION AND MISSION:

Vision: To produce professionals in artificial intelligence and machine learning through the best possible education, acquire international recognition as a destination, and advance society in exciting and creative ways.

Mission:

• Impart rigorous training to generate knowledge through the state-of-the-art concepts and technologies in Artificial Intelligence and Machine Learning.
• Develop technical proficiency in students through creativity and leadership.
• Encourage lifelong learning, social responsibility, environmental conservation, and professional ethics.
• Establish centres of excellence in leading areas of computer and artificial intelligence disciplines.

PROGRAM EDUCATION OBJECTIVES (PEOs):

PEO 1: Work effectively in inter-disciplinary field with the knowledge of Artificial Intelligence and Machine Learning to develop appropriate solutions to real-world problems.

PEO 2: Excel in their professional careers and pursues advanced study in the area of machine learning and artificial intelligence.

PEO 3: Use ongoing education to apply their expertise to the technology transformation.

PEO 4: Excel as socially responsible engineers or entrepreneurs with high moral and ethical standards.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO 1: Ability to evaluate and apply knowledge of data engineering, artificial intelligence, machine learning, and human cognition to real-world issues in order to solve potential challenges.

PSO 2: Ability to acquire computational knowledge and project development abilities using novel tools and methodologies to tackle challenges in the fields related to Deep Learning, Machine learning, Artificial Intelligence.

PSO 3: Capacity to direct a team or firm that develops products and to use the knowledge learned to recognize actual research issues.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

(Inline with AICTE Model Curriculum with effect from AY 2022-23)

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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	22MTC01	Linear Algebra & Calculus	3	1	0	3	40	60	4
2	22PYC01	Optics and Semiconductor Physics	3	0	0	3	40	60	3
3	22CSC01	Problem Solving And Programming	2	1	0	3	40	60	3
4	22EGC01	English	2	0	0	3	40	60	2
PRACTICAL									
5	22PYC03	Optics and Semiconductor Physics Lab	0	0	3	3	50	50	1.5
6	22EGC02	English lab	0	0	2	3	50	50	1
7	22CSC02	Problem Solving and Programming Lab	0	0	3	3	50	50	1.5
8	22MEC01	CAD AND DRAFTING	0	1	3	3	50	50	2.5
9	22MEC38	Digital Fabrication Lab	0	0	3	3	50	50	1.5
TOTAL			**10**	**3**	**14**	**27**	**410**	**490**	**20**

L: Lecture **T: Tutorial** **P: Practical**

CIE - CIE **SEE – Semester End Examination**

22MTC01

LINEAR ALGEBRA & CALCULUS

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

COURSE OBJECTIVES: This course aims to

1. To 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: After completion of 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/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	-	-	-	-	-	-	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	1
CO 5	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 Stroke'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, KhannaPublishers, 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, IT, CSE (AI&ML), CSE (IoT & Cyber Security including Block Chain Technology), AI&ML, AI&DS)

Instruction	3L Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	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 completion of this course, students 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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	2	2	2	1	1	2	1	2
CO2	3	3	3	3	3	3	3	3	2	2	3	2
CO3	3	3	3	3	3	2	3	2	1	2	1	2
CO4	2	2	2	1	2	2	2	2	1	2	2	2
CO5	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 & CO_2; 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. Murugeshan 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.

22CSC01

PROBLEM SOLVING AND PROGRAMMING

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

COURSE OBJECTIVES: This course aims to

1. Develop logical skills and basic technical skills so that students should be able to solve basic computational problems.
2. Learn any basic programming language.

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

1. Understand real world problems and develop computer solutions for those problems.
2. Understand the basics of Python.
3. Apply Python for solving basic programming solutions.
4. Create algorithms/flowcharts for solving real-time problems.
5. Build and manage dictionaries to manage data.
6. Handle data using files.

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	PO 12
CO1	3	1	1	-	1	-	-	-	-	-	-	1
CO2	3	1	1	-	1	-	-	-	-	-	-	1
CO3	3	1	1	-	1	-	-	-	-	-	-	1
CO4	3	1	1	-	1	-	-	-	-	-	-	1
CO5	3	1	1	-	1	-	-	-	-	-	-	1
CO6	3	1	1	-	1	-	-	-	-	-	-	1

UNIT I

Introduction to Programming - *Evolution of languages*: Machine, Assembly and High-level languages. *Software requirements for programming*: OS, compiler, linker, loader, editor. Design specification: Algorithms and Flowcharts.

UNIT II

Data Types and Operators, Variable, Sequences and Iteration - Data types, Expressions, Precedence Rules, Operators: arithmetic, relational, logical, bit-wise and miscellaneous operators; local variable, global variables, List, String, Tuples, Sequence mutation and accumulating patterns.

UNIT III

Conditional Statement, Loops, Arrays and Strings, user-defined Data Types – if, else, for, while, nested iteration, Concept and use of arrays, declaration and usage of arrays, 2-dimensional arrays, different types of user defined data types.

UNIT IV

Dictionaries and Dictionary Accumulation, Functions/Methods - Dictionary basics, operations, methods, accumulation, advantages of modularizing program into functions, function definition and function invocation. Positional parameters passing arrays to functions, recursion, library functions.

UNIT V

File Handling and Memory Management - Concepts of files and basic file operations, writing/reading data to/from a .csv file, Memory Management Operations.

TEXT BOOKS AND REFERENCES:

1. R.S. Salaria, “Programming for Problem Solving”, First Edition, Khanna Book Publishing Co., Delhi.
2. Jeeva Jose, “Taming Python by Programming”, Revised Edition, Khanna Book Publishing Co., Delhi.

3. Mark Lutz, “Learning Python”, 5th Edition, O'Reilly Media, Inc.
4. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.
5. “Programming in Python”, R.S. Salaria, Khanna Book Publishing Co., Delhi.

NPTEL/SWAYAM COURSES:

1. Introduction to Problem Solving and Programming, Video Lectures, Prof. D Gupta, IIT Delhi.
2. Problem Solving Aspects and Python Programming, Dr. S Malinga, Dr Thangarajan, Dr. S V Kogilavani, Kongu Engineering College.
3. https://www.coursera.org/specializations/python-3-programming

22EGC01

ENGLISH

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

PREREQUISITE: Basic knowledge of English grammar and vocabulary.

COURSE OBJECTIVES: This course aims to

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal Emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

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

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques.

CO-PO-PSO 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	PO 12
CO 1	1	1	1	1	1	1	1	2	3	3	2	3
CO 2	1	1	1	1	-	1	1	1	2	2	1	2
CO 3	-	2	1	1	-	2	1	1	2	2	1	2
CO 4	1	2	1	2	1	2	2	1	2	2	1	2
CO 5	1	2	1	2	1	1	1	1	1	2	1	2

UNIT-I Understanding Communication in English:

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

Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:

Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.

Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:

Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response.

Vocabulary and Grammar: Subject-verb agreement. Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:

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

Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often Confused; Use of standard abbreviations.

TEXT BOOKS:
1. "Language and Life: A Skills Approach", Board of Editors, 2018th Edition, Orient Black Swan, 2018.
2. Swan Michael, "Practical English Usage", OUP, 1995.

SUGGESTED READING:
1. Wood F.T, "Remedial English Grammar", Macmillan, 2007.
2. Zinsser William, "On Writing Well", Harper Resource Book, 2001.
3. Sanjay Kumar and Pushp Lata, "Communication Skills", Oxford University Press, 2011.

22PYC03

OPTICS AND SEMICONDUCTOR PHYSICS LAB

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

Instruction	3P Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
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. Analyze the conduction behaviour of semiconductor materials and optoelectronic devices

COURSE OUTCOMES: After completion of this course, students 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

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

LIST OF EXPERIMENTS:

1. Error Analysis : Estimation of errors in the determination of time period of a torsional Pendulum
2. Fresnel's Biprism : Determination of wavelength of given monochromatic source
3. Newton's Rings : Determination of 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 ofcharge 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.

22EGC02

ENGLISH LAB

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 aims to

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behaviour while developing their ability to discuss in groups and making oral presentations.

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

1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

CO-PO-PSO 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	PO 12
CO 1	-	-	-	-	-	-	-	-	1	1	-	1
CO 2	-	-	-	-	-	1	-	1	2	2	1	2
CO 3	-	-	-	-	-	1	1	1	2	1	1	2
CO 4	1	-	-	-	-	1	2	2	2	3	1	3
CO 5	1	1	1	1	1	2	2	2	3	3	2	3

LIST OF EXERCISES:

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to International Phonetic Alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material.
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given.
10. **Poster presentation –** Theme, poster preparation, team work and e presentation.

SUGGESTED READING:

1. T Balasubramanian, “A Textbook of English Phonetics for Indian Students”, Macmillan, 2008.
2. J Sethi et al., “A Practical Course in English Pronunciation (with CD)”, Prentice Hall India, 2005.
3. Priyadarshi Patnaik, “Group Discussions and Interviews”, Cambridge University Press Pvt. Ltd., 2011.
4. Aruna Koneru, “Professional Speaking Skills”, Oxford University Press, 2016.

22CSC02

PROBLEM SOLVING AND PROGRAMMING LAB

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

COURSE OBJECTIVES: This course aims to

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

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

1. Understand various Python program development Environments.
2. Demonstrate the concepts of Python.
3. Implement algorithms/flowcharts using Python to solve real-world problems.
4. Build and manage dictionaries to manage data.
5. Write Python functions to facilitate code reuse.
6. Use Python to handle files and memory.

CO-PO ARTICULATION MATRIX

PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	1
CO3	2	3	3	2	3	-	-	-	-	-	-	1
CO4	2	3	3	2	2	-	-	-	-	-	-	1
CO5	2	3	3	3	3	-	-	-	-	-	-	1
CO6	2	3	3	3	3	-	-	-	-	-	-	1

LABORATORY / PRACTICAL EXPERIMENTS:

1. Explore various Python Program Development Environments.
2. Demonstration of input/output operations.
3. Demonstration of operators.
4. Demonstration of selective control structures.
5. Demonstration of looping control structures.
6. Demonstration of List, Tuple and Set
7. Demonstration of Python Dictionaries.
8. Implementation of searching and sorting techniques.
9. Implementation of string manipulation operations.
10. File handling and memory management operations.

TEXT BOOKS AND REFERENCES:

1. R.S. Salaria, “Programming for Problem Solving”, First Edition, Khanna Book Publishing Co., Delhi.
2. Jeeva Jose, “Taming Python by Programming”, Revised Edition, Khanna Book Publishing Co., Delhi.
3. Mark Lutz, “Learning Python”, 5th Edition, , O'Reilly Media, Inc.,
4. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.
5. “Programming in Python”, R.S. Salaria, Khanna Book Publishing Co., Delhi.

NPTEL/SWAYAM Courses:

1. Introduction to Problem Solving and Programming, Video Lectures, Prof. D Gupta, IIT Delhi.
2. Problem Solving Aspects and Python Programming, Dr. S Malinga, Dr Thangarajan, Dr. S V Kogilavani, Kongu Engineering College.
3. https://www.coursera.org/specializations/python-3-programming.

22MEC01

CAD AND DRAFTING

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

COURSE OBJECTIVES: This course aims to

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

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

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse 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
CO1	3	3	2	1	2	2	-	1	2	3	1	3
CO2	3	2	2	1	2	2	-	1	2	2	1	2
CO3	3	3	2	1	2	2	-	1	2	2	1	2
CO4	3	3	3	2	2	2	-	1	2	2	1	2
CO5	3	2	2	1	2	2	-	1	2	2	1	2

LIST OF EXERCISES:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
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
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. 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.

22MEC38

DIGITAL FABRICATION LAB

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

COURSE OBJECTIVES: This course aims to

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &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, welding, casting, manufacturing, metrology, and allied skills.
5. Advance important hard & 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: After 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

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

LIST OF EXERCISES:

GROUP-1

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dove tail-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 three pin socket controlled by a single pole switch

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 three pin socket

4. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.
5. To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings & bends.
6.

a. A. To connect the GI pipes as per the given diagram using, couplings, unions, reducer & bends.

b. To connect the GI pipes as per the given diagram using shower, tap & valves and Demonstrate by giving water connection

GROUP- 2

1. To Study the method of Additive Manufacturing process using a 3D printer
2. To create a 3D CAD model of a door bracket using a modeling software
3. To print a door bracket using an extruder type 3D Printer.
4. To create a 3D CAD model by reverse Engineering
5. To Design an innovative component using the CAD software
6. To Print the selected innovative component by the students 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.
3. Sachidanand Jha, 3D PRINTING PROJECTS: 200 3D Practice Drawings For 3D Printing On Your 3D Printer, June 7, 2019.

SUGGESTED READING:

1. Gowri P. Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.

Oliver Bothmann , 3D Printers: A Beginner's Guide , January 1, 2015

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Inline with AICTE Model Curriculum with effect from AY 2022-23

B.E. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

SEMESTER – II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination	Maximum Marks		Credits
			Hours per Week			Duration of SEE in Hours	CIE	SEE	
			L	T	P/D				
THEORY									
1	22MTC04	Differential Equations & Numerical Methods	3	1	0	3	40	60	4
2	22CYC01	Chemistry	3	0	0	3	40	60	3
3	22EEC01	Basic Electrical Engineering	2	1	0	3	40	60	3
4	22CSC03	Object Oriented Programming	2	1	0	3	40	60	3
PRACTICAL									
5	22CYC02	Chemistry Lab	0	0	3	3	50	50	1.5
6	22MBC02	Community Engagement	0	0	3	3	50	-	1.5
7	22CSC04	Object-Oriented Programming Lab	0	0	2	3	50	50	1
8	22MEC37	Robotics & Drones Lab	0	2	2	-	100	-	3
9	22EEC02	Basic Electrical Engineering Lab	0	0	2	3	50	50	1
TOTAL			**10**	**5**	**12**	**24**	**460**	**390**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - CIE **SEE – Semester End Exam**

22MTC04

DIFFERENTIAL EQUATIONS & NUMERICAL METHODS

(AI&ML)

Instruction	3 L+1T per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	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 completion of 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/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	-	-	-	-	-	-	-	2	1	1	-
CO 2	3	3	3	3	-	-	-	-	-	-	-	2	1	1	-
CO 3	2	2	2	2	-	-	-	-	-	-	-	1	2	2	-
CO 4	2	2	2	2	-	-	-	-	-	-	-	1	2	2	-
CO 5	1	1	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
(COMMON TO CSE, CSE-AIML, AIML, CSE-IOT, AIDS)

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

COURSE OBJECTIVES: This course aims to

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. 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 completion of this course, students will be able to

At the end of the course 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	2	-	-	2	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	3	-	-	2	2	-	-	-	-	2
CO 5	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-MnO_2 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 confirmations 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 (S_N1& S_N2); 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 READING:

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).

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).

22EEC01

BASIC ELECTRICAL ENGINEERING

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

COURSE OBJECTIVES: This course aims to

1. To 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 completion of this course, students 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.

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	PO 12
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
CO-5	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

22CSC03

OBJECT ORIENTED PROGRAMMING

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

COURSE OBJECTIVES: This course aims to

1. Explore the concepts object-oriented programming like classes, constructors, Polymorphism, Inheritance, and File handling.
2. Prepare student for solving real-world problems using OOPs concepts.

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

1. Understand the concepts of Object-Oriented features.
2. Apply OOPs concepts and different libraries to solve programming problems.
3. Understand the advanced concepts of Python.
4. Develop programs to access databases and web data.
5. Understand APIs and third-party libraries to be used with Python.

CO-PO ARTICULATION MATRIX

PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	1	2	-	1	-	-	-	-	-	-	1
CO2	3	1	3	2	2	-	-	-	-	-	-	2
CO3	3	1	2	1	1	-	-	-	-	-	-	1
CO4	3	2	3	1	2	-	-	-	-	-	-	2
CO5	3	2	3	1	2	-	-	-	-	-	-	2

UNIT I:

Introduction to Object Oriented Programming Paradigms - Programming paradigms, advantages of OOP, comparison of OOP with Procedural Paradigms; Classes and Objects: Prototyping, referencing the variables in functions, inline, static functions, Memory allocation for classes and objects, arrays of objects, constructors.

UNIT II:

Polymorphism and Inheritance: Overriding methods, type conversions, base classes and derived classes, types of inheritance, various types of classes, invocation of constructors and destructors inheritance, aggregation, composition, classification hierarchies, metaclass/ abstract classes, unit testing and exceptions.

UNIT III:

Python Libraries -Basics of Open Source libraries for data pre-processing, modeling and visualization.

UNIT IV:

Python to access Web Data - Regular Expressions, extracting data, sockets, using the Developer Console to Explore HTTP, Retrieving Web Page, and Passing Web Pages.

UNIT V:

Using Databases with Python - Using Databases, Single Table CRUD, Designing and representing a data model, reconstructing data with JOIN, many-to-many relationships.

TEXT BOOKS AND REFERENCES:

1. Allen Downey, Jeff Elkner, Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python”, SoHo Books, 2009.
2. R.S. Salaria, “Mastering Object-Oriented Programming”, 6th Edition, Khanna Book Publishing Co., Delhi.
3. Jeeva Jose, “Introduction to Computing & Problem Solving with Python”, First Edition, Khanna Book Publishing, 2019.
4. Paul Barry, “Head First Python”, O′Reilly, 2010.

NPTEL/SWAYAM COURSES:

1. Python for Data Science, Prof. Raghunathan Rengasamy, IIT Madras.
2. The Joy of Computing using Python Prof. Sudarshan, Prof. Yayati Guptaingar, IIT Ropar, IIIT Dharwad.
3. https://www.coursera.org/specializations/python-3-programming#courses.

22CYC02

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

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE:	50 Marks
CIE	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 theorical concepts in the preparation of new materials like drugs and polymers.

COURSE OUTCOMES: At the end of the course student will be able to
1. Identify the basic chemical methods to 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.

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	PO 12
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	2	-	-	-	-	2
CO 5	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.

22MBC02

COMMUNITY ENGAGEMENT

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

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. Utilize the opportunities provided by Rural Development Programmes.

Module I

Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II

Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Animal Husbandry, 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, Local Civil Society, Local Administration.

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, Gram Panchayat Decentralised Planning, 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).

22CSC04

OBJECT-ORIENTED PROGRAMMING LAB

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

COURSE OBJECTIVES: This course aims to

1. Master the concepts of Object Oriented Programming.
2. Explore the OOPs features of Python and build applications.

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

1. Demonstrate the features of Object-Oriented Programming.
2. Understand APIs and third-party libraries to be used with Python.
3. Use Python libraries to solve real-world problems.
4. Write scripts to solve data science/machine leaning problems using NumPy and Pandas.
5. Develop applications by accessing web data and databases.

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	PO 12
1	3	2	3	1	3	-	-	-	-	-	-	2
2	3	3	2	2	2	-	-	-	-	-	-	2
3	3	3	3	2	3	-	-	-	-	-	-	2
4	3	3	3	3	3	-	-	-	-	-	-	2
5	3	3	3	3	3	-	-	-	-	-	-	2

LABORATORY / PRACTICAL:

1. Demonstration of classes and objects with referencing the class variables, instance variables and static variables.
2. Demonstration of Inheritance types with constructor and destructor invocation in inheritance.
3. Demonstration of Exception handling and unit testing.
4. Write a NumPy program to compute the cross product of two given vectors.
5. Write NumPy program to calculate the QR decomposition of a given matrix.
6. Write a Pandas program to convert a Panda Module Series to Python list and its type.
7. Write a Pandas program to convert a NumPy array to a Pandas series.
8. Create a Python project to get the citation from Google scholar using title and year of publication and volume and pages of journal.
9. Create a Python project to get total COVID-19 cases, total deaths due to Covid-19, total Covid-19 patients recovered in the world.
10. Demonstration of database connectivity and different types of JOIN operations on tables.

Note: Programs need to be on OOPS concepts.

TEXT BOOK:

1. Reema Thareja, "Python Programming", First Edition, Oxford Press, 2017.

ONLINE RESOURCES:

1. https://vknight.org/cfm/labsheets/04-object-oriented-programming/
2. http://learning-python.com/class/Workbook/x-exercises.htm
3. https://inst.eecs.berkeley.edu/~cs61a/fa14/lab/lab06/#inheritance
4. https://anandology.com/python-practice-book/object_oriented_programming.html
5. http://stanfordpython.com/
6. https://docs.python.org/3/

22MEC37

ROBOTICS AND DRONES LAB

(Common to All Branches)

Instruction	2T + 2P Hours per week
CIE	100 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. To develop the students' knowledge in various robot and drone structures and their workspace.
2. To develop multidisciplinary robotics that have practical importance by participating in robotics competitions
3. To develop students' skills in performing spatial transformations associated with rigid body motions, kinematic and dynamitic analysis of robot systems.
4. Through projects done in lab, increase the true hands-on student learning experience and enhance their conceptual understanding, increase students' ability, competence and teamwork skills on dealing with real-life engineering problems

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

1. Demonstrate knowledge of the relationship between mechanical structures of robotics and their operational workspace characteristics
2. Understand mechanical components, motors, sensors and electronic circuits of robots and build robots.
3. Demonstrate knowledge of robot controllers.
4. Use Linux environment for robotic programming.
5. Write Python scripts to control robots using Python and Open CV.

COURSE ARTICULATION MATRIX

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

LAB EXPERIMENTS:

1. Assembling of robot mechanical components, mounting of motors, sensors, electronic circuits to the chassis.
2. Connecting to electronic circuitry: motor drivers, incremental encoders proximity sensors, micro controller,
3. Different types of batteries, selection of suitable battery for application, safety precaution.
4. Introduction to Linux Command Line Interface: basic file and directory management and other useful commands
5. Controlling robot using Python: i) Move robot using Python code, ii) Make robot move in patterns using Python
6. Robot programming with Sensor inputs: i) Read sensor data using Python, ii) Visualize sensor data using Python, iii) Code robot to avoid obstacles by using sensor data
7. Open CV: i) Create an Image and display an image; ii) Read and change pixel values; iii) Create colored shapes and save image; iv) Extract the RGB values of a pixel; v) Reading and Writing Videos
8. Open CV: i) Extraction of Regions of Interest; ii) Extraction of RGB values of a pixel
9. Coding robot to work with colors, follow colored objects, identifying shape of the object-oriented
10. Projects: i)Making a line follower robot using a Camera; ii) Writing code for a complex function
11. Assembly of a drone

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/

22EEC02

BASIC ELECTRICAL ENGINEERING LAB

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

COURSE OBJECTIVES: This course aims to

1. To acquire 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: At the end of the course, the students are expected to

1. Comprehend the circuit analysis techniques using various circuital laws and theorems.
2. Analyse the parameters of the given coil and measurement of power and energy in AC circuits
3. Determine the turns ration/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.

CO-PO 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	PO 12
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	2	-	-	-	-	2
CO 5	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) 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.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Inline with AICTE Model Curriculum with effect from AY 2023-24

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SEMESTER – III

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	22CSC05	Data Structures	3	0	0	3	40	60	3
2	22CSC11	Database Management Systems	3	0	0	3	40	60	3
3	22CSC32	Discrete Mathematics	3	0	0	3	40	60	3
4	22MBC01	Engineering Economics and Accountancy	3	0	0	3	40	60	3
5	22ECC38	Analog and Digital Electronics	3	0	0	3	40	60	3
6	22MEC39	Design Thinking	3	0	0	3	40	60	3
PRACTICAL									
7	22CSC31	Data Structures Lab	0	0	2	3	50	50	1
8	22CSC33	Database Management Systems Lab	0	0	2	3	50	50	1
9	22MEC40	Design Thinking Lab	0	0	2	3	50	50	1
10	22AMI01	MOOCs/ Training/ Internship	0	0	3-4 w or 90 hrs	-	-	50	2
TOTAL			**18**	**0**	**10**		**390**	**560**	**23**

L: Lecture **T: Tutorial** **P: Practical**

CIE - CIE **SEE – Semester End Examination**

22CSC05

DATA STRUCTURES

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

PRE-REQUISITES: Basic knowledge of programming language such as python.

COURSE OBJECTIVES: This course aims to
1. Study various linear and non-linear data structures.
2. Understand the performance of operations on data structures.
3. Explore various searching and sorting techniques.

COURSE OUTCOMES: After completion of this course, students will be able to
1. Understand the basic concepts and types of data structures.
2. Analyze various linear and nonlinear data structures.
3. Identify the applications of linear and nonlinear data structures and significance of balanced search trees, hashing.
4. Evaluate various searching and sorting techniques.
5. Use appropriate data structures to design efficient algorithms.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	-	-	-	-	-	-	-	-	-	-	1	1	1
CO 2	3	3	-	-	-	-	-	-	-	-	-	-	1	1	1
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	2	1	1
CO 4	3	2	-	-	-	-	-	-	-	-	-	-	2	2	1
CO 5	3	3	1	-	-	-	-	-	-	-	-	-	1	2	1

UNIT-I

Introduction: Data structures, Classification of data structures, Abstract Data Types, Analysis of Algorithms; **Recursion**: Examples illustrating Recursion (Factorial, Binary Search), Analyzing Recursive Algorithms; **Sorting:** Quick sort, Merge Sort, Selection Sort, Radix sort, Comparison of Sorting Algorithms.

UNIT–II

Stacks: Stack ADT, Applications of stack, Array based stack implementation**; Queues:** Queue ADT, applications of queues, Array based queue implementation, Double Ended Queues, Circular queues.

UNIT-III

Linked Lists: Introduction, Linked lists, Representation of linked list, types of linked list, singly linked lists, implementing stack with a singly linked list and Queue, Circular linked lists, doubly linked lists, Applications of linked lists.

UNIT-IV

Trees: General Trees, Binary Trees, Implementing Trees, Tree traversals; **Search Trees:** Binary Search Trees, Balanced search trees- AVL trees, B- trees; **Priority Queue and Heaps:** Priority queue ADT, Priority queue applications, Heap Trees, implementing a priority queue with a Heap, Heap Sort.

UNIT-V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals.

Hashing: Introduction, Hash Functions-Modulo, Middle of Square, Folding, Collision Resolution Techniques-Separate Chaining, Open addressing,- Linear Probing, Quadratic Probing, Double Hashing.

TEXT BOOKS:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structure and Algorithms in Python”, Wiley, 2021.
2. Narasimha karumanchi, “Data Structures and Algorithms Made Easy”, Career Monk Publications, 2020
3. S. Sahni and Susan Anderson-Freed, “Fundamentals of Data structures in C”, E. Horowitz, Universities Press, 2nd Edition.
4. Reema Thareja, “Data Structures using C”, Oxford University Press, 2nd Edition, 2014.

SUGGESTED READING:

1. D. S. Kushwaha and A K. Misra, “Data structures A Programming Approach with C”, PHI, 2nd edition, 2014.
2. Seymour Lipschutz, “Data Structures with C”, Schaums Outlines, MGH, Kindle Edition, 2017.
3. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018
4. D. Samantha, “Classic Data Structures”, Prentice Hall India, 2nd Edition, 2013

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-#DS
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms
5. https://www.coursera.org/specializations/data-structures-algorithms

22CSC11

DATABASE MANAGEMENT SYSTEMS

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

PRE-REQUISITES: Discrete mathematics of computer science, Programming and Data Structures.

COURSE OBJECTIVES: This course aims to

1. Familiarize students with fundamental concepts of database management. These concepts include aspects of database design, database languages and database-system implementation.
2. Understand about data storage techniques and indexing.
3. Impart knowledge in transaction management, concurrency control techniques and recovery procedures.

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

1. Design database schema for an application using RDBMS concepts.
2. Write SQL queries for tasks of various complexities.
3. Build applications using database system as backend.
4. Understand internal working of a DBMS including data storage, indexing, query processing, transaction processing, concurrency control and recovery mechanisms.
5. Analyse non-relational and parallel/distributed data management systems with a focus on scalability.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	2	2	3	-	-	-	-	-	-	1	1	1	1
CO 2	2	3	2	2	3	-	-	-	-	-	-	1	1	1	1
CO 3	2	1	2	1	3	-	-	-	-	-	-	-	2	2	2
CO 4	2	1	1	-	-	-	-	-	-	-	-	-	2	2	2
CO 5	2	1	-	1	-	-	-	-	-	-	-	-	2	2	1

UNIT - I

Introduction: Motivation, Introduction to Data Models (Relational, Semi structured, ER).
Relational Data Bases: Relational Data Model, Relational Algebra, Relational Calculus.

UNIT - II

SQL + Interaction with Database: SQL Data Types, Basic Structure of SQL Queries, Modification of the Database, Set Operations, Aggregate Functions, Data-Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.
Simple Queries (select/project/join/ aggregate queries), Complex queries (With Clause, Nested Subqueries, Views), Programming in a standard language and interfacing with a DB backend.

UNIT- III

Big Data: Key-value Stores and Semi structured Data, using JSON and MongoDB, or other combinations
Database Design: Introduction to ER model, Mapping from ER to relational model, Functional Dependencies, Normalization.

UNIT - IV

Physical Design: Overview of Physical Storage (Hard Disks, Flash/SSD/RAM), sequential vs random I/O, Reliability via RAID, Storage Organization (Records, Pages and Files), Database Buffers, Database Metadata, Indexing, B+-Trees.

UNIT - V

Query Processing and Optimization: Query Processing, External sort, Joins using nested loops, indexed nested loops.

Overview of Query Optimization: Equivalent expressions and concept of cost based optimization.
Transaction Processing: Concept of transactions and schedules, ACID properties, Conflict-serializability, C**oncurrency control:** locks, 2PL, Strict 2PL, optional: isolation levels, Recovery using undo and redo logs.

TEXT BOOKS:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill. Indian Edition, 2021
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Pubs, 2017
3. Lemahieu, Broucke and Baesens, "Principles of Database Management", Cambridge University Press, 2018
4. RP Mahapatra, "Database Management Systems", Khanna Publishing House, 2020.
5. Krishnan, "Database Management Systems", McGraw Hill.

SUGGESTED READING:

1. MySQL Explained: Your Step By Step Guide To Database Design
2. Pro SQL Server 2008 Relational Database Design and Implementation (Expert's Voice in SQL Server) 1st Edition

ONLINE RESOURCES:

1. http://www.nptelvideos.in/2012/11/database-managementsystem.html.
2. https://www.oracle.com/news/connect/json-database-semistructured-sql.html

22CSC32

DISCRETE MATHEMATICS

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

COURSE OBJECTIVES: This course aims to
1. Introduce Propositional and Predicate Logic
2. Introduce various proof techniques for validation of arguments.
3. Develop an understanding of counting, functions and relations.
4. Familiarize with fundamental notions and applicability of graph theory and algebraic systems

COURSE OUTCOMES: After completion of this course, students will be able to
1. Describe rules of inference for Propositional and Predicate logic.
2. Demonstrate use of Set Theory, Venn Diagrams, and relations in Real-world scenarios.
3. Model solutions using Generating Functions and Recurrence Relations.
4. Determine the properties of graphs and trees to solve problems arising in computer science applications.
5. Distinguish between groups, semi groups and monoids in algebraic systems

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	3	1	-	-	-	-	2	-	-	2	1	2
CO 2	3	3	1	3	-	-	-	-	-	-	-	1	1	1	1
CO 3	2	3	1	3	1	-	-	-	-	-	-	-	2	1	2
CO 4	3	3	2	3	1	-	-	-	-	-	-	1	2	2	2
CO 5	3	3	1	1	-	-	-	-	-	-	-	-	1	1	1

UNIT – I

Introduction to Propositional Calculus: Basic Connectives and Truth tables, Logical Equivalence: Laws of Logic, Logical Implication; Rules of Inference. Predicates: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems

UNIT – II

Sets: Sets and Subsets, Operations on sets and the Laws of Set Theory, Counting and Venn Diagrams. **Relations**: Cartesian Products and Relations. Partial ordering relations, POSET, Hasse diagrams, Lattices as Partially Ordered Sets, Equivalence relations. Pigeon hole principle.

UNIT – III

Generating Functions: Generating Functions, Calculating Coefficient of generating functions.
Recurrence Relations: The First Order Linear Recurrence Relation, Second Order Linear. Homogeneous Recurrence relations with constant coefficients, Non Homogeneous Recurrence relations.

UNIT – IV

Introduction to Graphs: Graphs and their basic properties- degree, path, cycle, Sub graphs, Complements and Graph Isomorphism, Euler trails and circuits, Hamiltonian paths and cycles, planar graphs, Euler formula, Graph Coloring.
Trees: Definitions, Properties, Spanning Trees, Minimum Spanning trees: The Algorithms of Kruskal and Prims

UNIT - V

Algebraic Structures: Algebraic Systems, Examples and General Properties, Semi groups and Monoids. Groups: Definitions and Examples, Subgroups, Homomorphisms and cyclic groups.

TEXT BOOKS:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics- An Applied Introduction", 5th Edition, Pearson Education, 2016.
2. Rosen, K. H. (2019). Discrete Mathematics and Its Applications. (8th Edition) ISBN10: 125967651X ISBN13: 9781259676512.
3. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TATA Mc Graw-Hill Edition, 1995.

SUGGESTED READING:

1. Singh, S.B., Discrete Mathematics, Khanna Book Publishing Company, New Delhi. SBN: 9789382609407, 9789382609407, 3rd Edition, 2019
2. R. K. Bisht, H. S. Dhami, "Discrete Mathematics", Oxford University Press, Published in 2015.
3. David D. Railey, Kenny A. Hunt, "Computational Thinking for the Modern Problem Solving", CRC Press, 2014
4. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", 8th Edition, PHI, 1986

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111107058/
2. https://nptel-discrete-mathematics-5217

22MBC01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

COURSE OBJECTIVES: This course aims to

1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

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

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	1	3	1	1	1	1	1	1	1	-	-	1	1	-
CO 2	2	2	2	2	-	1	1	1	-	1	-	1	1	1	-
CO 3	1	2	1	2	2	-	2	1	-	1	-	-	-	1	1
CO 4	2	2	1	2	2	1	1	3	-	1	-	-	-	-	1
CO 5	1	3	1	2	1	1	2	-	-	1	2	1	1	1	1

UNIT-I

Introduction to Managerial Economics: Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

UNIT-II

Demand and Supply Analysis: Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

UNIT-III

Production and Cost Analysis: Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns.

Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features of Perfect Competition, Price Output Determination under Perfect Competition, Features of Monopoly Competition, Price Output Determination under Monopoly Competition Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

UNIT-IV

Accountancy: Book-keeping, Principles and Significance of Double Entry Bookkeeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

UNIT-V

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

TEXT BOOKS:

1. Mehta P.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 12th Edition, 2018.

SUGGESTED READINGS:

1. Panday I.M. "Financial Management", 11th edition, Vikas Publishing House, 2016.
2. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
3. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
4. A R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2018.

22ECC38

ANALOG AND DIGITAL ELECTRONICS

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

PREREQUISITE: Knowledge of Electronic device concepts.

COURSE OBJECTIVES: This course aims to:
1. Learn basic concepts and working principles of analog devices.
2. Learn various techniques for logic minimization.
3. Comprehend the concepts of various combinational circuits and sequential circuits.

COURSE OUTCOMES: After completion of this course, students will be able to
1. Understand the basic concepts related analog devices and digital circuits.
2. Design the combinational and sequential circuits.
3. Examine the behavior of logic gates.
4. Analyze the behavior of the digital system design.
5. Evaluate the performance of real time combinational circuits and sequential circuits.

CO-PO ARTICULATION MATRIX

PO/ PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	1	1	1	2	1	2	2	1	-	-
CO2	2	3	3	3	3	-	1	1	3	1	1	2	2	1	1
CO3	1	2	1	1	1	-	1	1	-	-	2	2	1	1	-
CO4	1	3	1	2	1	-	-	1	1	1	2	2	1	1	1
CO5	2	1	2	1	2	-	1	1	1	-	2	2	1	1	1

UNIT -I

Devices: Concepts of semiconductors, V-I Characteristics of P-N Junction diode, current equation. Characteristics of Zener Diodes, Special diodes: LED, Photo Diode.

Applications: Zener Diode as a voltage regulator, Half Wave Rectifier and Full Wave Rectifier.

UNIT-II

Bipolar Junction Transistors: Classification, Operation of Bipolar Junction Transistor, Configurations: CB, CE Characteristics, Applications.

Field Effect Transistor: Junction Field Effect Transistor: Principle of Operation, Characteristics of JFET, parameters and Operation of MOSFET

UNIT-III

Boolean Algebra and Logic Simplification: Number system representation and conversion, Binary Arithmetic, Complements, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to all Logic Gates, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-IV

Introduction to Combinational Design: Binary Adders, Subtractors, Code converters Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers.

UNIT-V

Sequential Logic Design: Latches, Flipflops, Difference between latch and flipflop, types of flipflops like S-R, D, T JK and Master-Slave JK FF, flipflop conversions, Ripple and Synchronous counters, Shift registers.

TEXT BOOKS:

1. Robert L.Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson Education, 9th Edition, LPE, Reprinted, 2006.
2. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", 5th Edition, Pearson 2013.

SUGGESTED READING:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th Edition, 2009.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11th Edition, 2015.

22MEC39

DESIGN THINKING

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

COURSE OBJECTIVES: This course aims to

1. Create awareness of design thinking approaches
2. Identify a systematic approach for defining/identifying a problem
3. Create design thinking teams and conduct design thinking sessions collaboratively
4. Apply both critical thinking and design thinking in parallel to solve problems
5. Motivate to apply design thinking concepts to their real life scenarios

COURSE OUTCOMES: At the end of the course, the students are able to

1. Empathize on the needs of the users
2. Define the problems for stimulating ideation
3. Ideate on problems to propose solutions by working as a design thinking team
4. Prototype and test the proposed solutions focusing on local or global societal problems

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	2	2	2	2	2	2	2	2	2	2	2	1	2
CO 2	2	2	1	2	1	3	2	2	1	2	1	2	1	2	2
CO 3	2	2	2	2	1	2	2	1	2	2	1	2	2	2	2
CO 4	2	1	1	2	1	2	2	2	2	2	1	2	2	2	2
CO 5	2	1	2	2	2	2	2	1	2	2	2	2	2	2	2

UNIT – I

Introduction to Engineering & Thinking: Engineering for social and economic development; impact of science/engineering. Thinking and behaviour; Types of thinking – Linear thinking, lateral thinking, systems thinking, design thinking.

Introduction to Design Thinking: Importance of Design Thinking & Human centric approach – Phases in design thinking process, five-stage model as iterative method, applications of design thinking in various domains.

UNIT – II

Empathize phase: Understanding the unique needs of the user, empathize with the users, steps in empathize phase, developing empathy towards people, assuming a beginner's mind-set (what? why?), steps in immersion activity, body storming; Case studies.

UNIT – III

Define phase: Define the problem and interpret the result, analysis and synthesis, Personas – Four different perspectives on Personas, steps to creating personas, problem statement, affinity diagrams, empathy mapping; Point of View – "How might we" questions, Why-how laddering; Case studies.

UNIT – IV

Ideation phase: What is ideation, need, uses, ideation methods; Brainstorming, rules for brainstorming; Mind maps, guidelines to create mind maps; Ideation games; Six Thinking Hats; Doodling, use of doodling in expressing creative ideas; Case studies.

UNIT – V

Prototyping phase: Types of prototyping, guidelines for prototyping, storytelling, characteristics of good stories, reaching users through stories, importance of prototyping in design thinking; Value proposition, guidelines to write value proposition; Case studies.

Testing phase: Necessity to test, user feedback, conducting a user test, guidelines for planning a test, how to test, desirable, feasible and viable solutions, iterate phase.

TEXT BOOKS:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires, 1st Edition, HarperCollins, 2009.
2. Michael Luchs, Scott Swan, Abbie Griffin, Design thinking: New product development essentials from the PDMA. John Wiley & Sons, 2015.
3. Pavan Soni, Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Penguin Random House India Private Limited, 2020.

SUGGESTED READING:

1. Jeanne Liedtka, Andrew King, Kevin Bennett, Solving problems with design thinking: Ten stories of what works. Columbia University Press, 2013.
2. Bala Ramadurai, Karmic Design Thinking - A Buddhism-Inspired Method to Help Create Human-Centered Products & Services, Edition 1, 2020.

22CSC31

DATA STRUCTURES LAB

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

PRE-REQUISITES: Any Programming Language.

COURSE OBJECTIVES: This course aims to
1. Understand the basic concepts of data structures and abstract data types.
2. Explore linear and non-linear data structures.
3. Study various searching, sorting and hashing techniques.

COURSE OUTCOMES: After completion of this course, students will be able to
1. Implement the abstract data type.
2. Implement linear and non-linear data structures.
3. Evaluate various sorting techniques.
4. Analyze various algorithms of linear and nonlinear data structures.
5. Choose or create appropriate data structures to solve real world problems.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO 2	3	3	-	-	-	-	-	-	-	-	-	-	1	1	1
CO 3	2	3	-	-	-	-	-	-	-	-	-	-	2	1	1
CO 4	2	3	-	-	-	-	-	-	-	-	-	-	2	2	1
CO 5	2	3	1	-	-	-	-	-	-	-	-	-	1	2	1

LIST OF EXPERIMENTS:
1. Implementation of Quick sort, Merge sort and Selection sort.
2. Implementing Stack using array.
3. Conversion of Infix expression to Postfix expression.
4. Implement the algorithm for Evaluation of Postfix.
5. Implementing Queues using array
6. Implementation of Insert, Delete and Display operations on Single Linked List.
7. Implementation of Stack and Queue using linked list.
8. Implementation of Insert, Delete and Display operations on doubly Linked List.
9. Implementation of Binary Search Tree operations.
10. Implementation of Heap Sort.

TEXT BOOKS:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structure and Algorithms in Python”, Wiley, 2021.
2. Narasimha karumanchi, “Data Structures and Algorithms Made Easy”, Career Monk Publications, 2020.

22CSC33

DATABASE MANAGEMENT SYSTEMS LAB

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

COURSE OBJECTIVES: This course aims to

1. Become familiar with the concepts of structured query language.
2. Understand about programming language / structured query language (PL/SQL).
3. Become familiar with generation of form and open database connectivity.
4. Add constraints on Databases implement DCL, TCL and advanced SQL commands.
5. Develop programs using cursors, triggers, exceptions, procedures and functions in PL/SQL.

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

1. Outline the built-in functions of SQL and apply these functions to write simple and complex queries using SQL operators.
2. Demonstrate Queries to Retrieve and Change Data using Select, Insert, Delete and Update. Construct Queries using Group By, Order By and Having Clauses.
3. Demonstrate Commit, Rollback, Save point commands, SQL Plus Reports and formulate the Queries for Creating, Dropping and Altering Tables, Views, constraints.
4. Develop queries using Joins, Sub-Queries and Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update, Creating Password and Security features.
5. Develop PL/SQL code using Cursors, Exception, Composite Data Types and Procedures, Functions and Packages.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	2	3	-	-	-	2	-	1	3	1	1	1
CO 2	3	3	2	3	3	-	-	-	2	-	1	3	1	1	2
CO 3	3	2	2	2	3	-	-	-	2	-	1	1	2	1	1
CO 4	3	1	1	1	-	-	-	-	2	-	1	-	2	2	2
CO 5	3	1	-	1	-	-	-	-	1	-	1	-	2	2	1

LIST OF EXPERIMENTS:

SQL:

1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using operators in SQL.
3. Queries to Retrieve and Change Data: Select Insert, Delete and Update.
4. Queries using Group By, Order By and Having Clauses.
5. Queries on Controlling Data: Commit, Rollback and Save point.
6. Queries to Build Report in SQL *PLUS.
7. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
8. Queries on Joins and Correlated Sub-Queries.
9. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update,
10. Creating Password and Security features.
11. Querying in NoSql

PL/SQL:

1. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
2. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/SQL.
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL.

4. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
5. Write a PL/SQL code using Procedures, Functions and Packages.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

TEXT BOOKS / SUGGESTED READING:

1. "Oracle: The complete Reference", by Oracle Press.
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007.
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007.

22MEC40

DESIGN THINKING LAB

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

COURSE OBJECTIVES: This course aims to

1. Create awareness of design thinking approaches
2. Identify a systematic approach for defining/identifying a problem
3. Create design thinking teams and conduct design thinking sessions collaboratively
4. Apply both critical thinking and design thinking in parallel to solve problems
5. Motivate to apply design thinking concepts to their real life scenarios

COURSE OUTCOMES: At the end of the course, the students are able to

1. Understand the key principles of design thinking and apply in problem solving.
2. Empathize on the needs of the customers and use human centric approach in developing solutions.
3. Develop and apply customer journey maps for proposing innovative solutions.
4. Ideate on problems to propose solutions by working in collaboration.
5. Test the proposed solutions by focusing on local or global societal problems through prototyping.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
CO 2	1	1	2	1	2	2	2	2	1	2	2	2	2	2	2
CO 3	1	1	2	2	1	2	2	2	1	2	2	1	2	2	2
CO 4	2	1	2	2	1	2	2	2	1	2	2	2	2	2	2
CO 5	2	1	2	2	1	2	2	2	1	2	2	2	2	2	2

LIST OF EXPERIMENTS:

1. Innovation exercises for thinking outside the box.
2. Creating a persona step by step for guiding design thinking process.
3. Creating customer Journey Maps
4. How might we …? Exercise.
5. Exercise on Ideation Matrix – creative matrix.
6. Creating Idea Napkin.
7. Six Thinking Hats.
8. Testing the concepts using prototypes.
9. Advanced exercises in 3D printing.
10. Open ended exercise: Proposing innovative solutions to simple problems related to a product /service.

TEXT BOOKS:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires, 1st Edition, HarperCollins, 2009.
2. Pavan Soni, Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Penguin Random House India Private Limited, 2020.
3. Christian Müller-Roterberg Hochschule Ruhr West, Handbook of Design Thinking, Kindle Direct Publishing ISBN: 978-1790435371, November 2018

SUGGESTED READING:

1. Jeanne Liedtka, Andrew King, Kevin Bennett, Solving problems with design thinking: Ten stories of what works. Columbia University Press, 2013.
2. Bala Ramadurai, Karmic Design Thinking - A Buddhism-Inspired Method to Help Create Human Centered Products & Services, Edition 1, 2020.

22AMI01

INTERNSHIP-I
(MOOCs/Training/Internship)

Instruction	3 to 4 weeks or 90 hours
CIE	50 Marks
Credits	2

COURSE OBJECTIVES: This course aims to

1. Exposing the students to the industrial environment and technologies
2. Provide possible opportunities to learn, make them to understand and sharpen them to the real time technical/ managerial skills required at the job
3. Expose with the current technological developments relevant to program domain
4. Understand Engineer's responsibilities and ethics and provide opportunity to interact with the people of industry/society to understand the real conditions.

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

1. Learn new technologies and solve real time projects.
2. Expose to the industrial environment problems and technologies
3. Gain knowledge on contemporary technologies industrial requirements.
4. Identify , Design and Develop solutions for real world problems
5. Communicate their ideas and learning experiences through reports and presentation.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	2	2	1	1	3	2	3	3	3	2	3
CO 2	2	2	2	1	1	2	2	1	3	2	3	3	3	2	3
CO 3	3	2	1	1	1	2	2	1	2	2	3	3	3	2	2
CO 4	2	3	3	3	1	2	1	-	3	3	3	3	3	2	3
CO 5	1	1	1	1	1	1	-	-	2	3	3	3	2	2	3

PROCESS TO BE FOLLOWED FOR CARRYING OUT INSTRUCTIONS TO STUDENTS:

1. Students may apply for internships through the AICTE Portal or through CDC of the institute by filling the application form IAP-101.
2. Industry shall scrutinize the students based on their criteria and communicate a provisional offer or confirmation letter to the student.
3. If students apply through CDC, then CDC shall nominate the students for various opportunities accordingly by issuing NOC (IAP-104).
4. The respective head of the department shall assign a faculty mentor.
5. Student shall undergo internship/industrial training at the concerned Industry/Organization by submitting the form, IAP-103.
6. During the internship, Faculty Mentor will evaluate the performance of students twice either by visiting the Industry/Organization or through obtaining periodic reports from students.
7. Student shall submit internship report to the industry/organization at the end of internship program.
8. On successful completion of the Internship, Industry/Organization shall issue Internship Certificate to the students
9. All the students should maintain discipline, professional ethics and follow the health and safety precautions during internship
10. Students should get approval for MOOCS and Training Programs and same evaluation process will be followed

Student shall maintain diary during the internship and submit the internship report at the end of the internship. The report will be evaluated by the supervisor on the basis of the following criteria:

- Originality
- Adequacy and purposeful write-up
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience

- Practical applications, relationships with basic theory and concepts taught in the course

EVALUATION OF INTERNSHIP: The internship of the students will be evaluated in three stages:

a. Evaluation by the Industry (in the scale of 1 to **10** where 1-Unsatisfactory; 10-Excellent)
b. Evaluation by faculty Mentor on the basis of site visit(s) or periodic communication (**15marks**)
c. Evaluation through seminar presentation/Viva-Voce at the Institute(This can be reflected through marks assigned by Faculty Mentor (**25 marks**)

For further details regarding templates, assessment guidelines please refer to the document from page number 16 onwards available at: https://www.cbit.ac.in/wp-content/uploads/2019/04/R22-Rules-with-internship-guidelines-10-11-2022..pdf

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Inline with AICTE Model Curriculum with effect from AY 2023-24

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SEMESTER – IV

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	22AMC01	Computer Architecture and Microprocessor	3	0	0	3	40	60	3
2	22AMC02	Principles of Artificial Intelligence	3	0	0	3	40	60	3
3	22AMC03	Introduction to Machine Learning	3	0	0	3	40	60	3
4	22AMC08	Agile Software Development	3	0	0	3	40	60	3
5	22CSC15	Operating Systems	3	0	0	3	40	60	3
6	22MTC13	Mathematical Foundation for Data Science and Security	3	0	0	3	40	60	3
PRACTICAL									
7	22AMC04	Principles of Artificial Intelligence Lab	0	0	3	3	50	50	1.5
8	22AMC05	Introduction to Machine Learning Lab	0	0	3	3	50	50	1.5
9	22AMC09	Principles of Operating Systems Lab	0	0	2	3	50	50	1
10	22MTC14	Mathematical Foundation for Data Science and Security Lab	0	0	2	3	50	50	1
TOTAL			**18**	**0**	**10**		**440**	**560**	**23**

L: Lecture **T: Tutorial** **P: Practical**

CIE - CIE **SEE – Semester End Examination**

22AMC01

COMPUTER ARCHITECTURE AND MICROPROCESSOR

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

PRE-REQUISITES: Analog and digital circuits.

COURSE OBJECTIVES: This course aims to

1. To understand the basic principles of Instruction Level Architecture and Instruction Execution, Memory System Design.
2. To learn various I/O devices and its operations, knowledge on Instruction Level Parallelism.
3. To impart the knowledge on Micro Programming and Pipelining techniques.

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

1. Understand the functional block diagram of single bus architecture of a computer, and the process of performing arithmetic operations.
2. Comprehend the 8086 microprocessor architecture.
3. Design assembly language programs using 8086 instruction set.
4. Analyze memory transfer operations and performance enhancement using pipelining,
5. Interpret the working of memory system and Large computer systems.

CO-PO ARTICULATION MATRIX

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	1	-	-	-	-	-	2	1	-	-	-	-
CO2	2	1	1	2	3	-	-	-	3	1	2	-	-	-	-
CO3	1	2	-	1	-	-	-	-	-	2	-	1	-	-	1
CO4	-	2	2	1	-	-	-	-	3	1	-	1	1	-	2
CO5	-	3	2	1	1	-	-	-	-	1	-	1	-	-	2

UNIT - I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers.

Arithmetic: Addition and Subtraction of Signed numbers, Design of fast adders, Multiplication of positive numbers, Signed-Operand Multiplication, Integer Division.

UNIT - II

Basic Processing Unit: Fundamental concepts, Execution of a complete instruction, Multiple-Bus organization, Hardwired control, Microprogrammed control.

8086 Architecture: CPU Architecture, Internal operation, Machine language instructions, Addressing modes.

UNIT- III

Assembly Language Programming: Instruction format, Instruction execution timing. Data transfer instructions, Arithmetic instructions.

Branch instructions, Loop instructions, NOP and HLT, Flag manipulation instructions, Logical instructions, Shift and Rotate instructions, Directives and Operators. Procedures, Interrupts and Interrupt routines, Macros.

UNIT - IV

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers– Program Controlled, Interrupt Driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes role of interrupts in process state transitions, I/O device interfaces– SCSI, USB.

Pipelining: Basic concepts, Data hazards, Instruction hazards, Structural hazard. Influence on instruction sets, Data path and control considerations.

UNIT – V

The Memory System: Memory hierarchy, Semiconductor RAM Memories, Cache Memories, Performance considerations, Virtual Memories, Memory Management requirements, Secondary Storage.

Large Computer Systems: Forms of Parallel Processing, Array Processors, Structure of general-purpose multiprocessors, Program parallelism and shared variables.

TEXT BOOKS:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, McGraw Hill Education Edition2011.
2. Yu-chengLiu, Glenn A.Gibson, "Microcomputer Systems: The 8086/ 8088 Family", 2nd Edition, PHI Learning 2011.

SUGGESTED READING:

1. M. M. Mano, "Computer System Architecture", 3rdedition, Prentice Hall, 1994.
2. William Stallings, "Computer Organisation and Architecture, Design for Performance", Pearson, 9th Edition, 2013.
3. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata McGraw Hill, Revised 2nd Edition, 2007.
4. Brey B. Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing", 4thEdition, Prentice Hall.

22AMC02

PRINCIPLES OF ARTIFICIAL INTELLIGENCE

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

PRE-REQUISITES: Data structures, Discrete Mathematics, Probability Theory.

COURSE OBJECTIVES: The objectives of this course are

1. To list the significance of AI.
2. To discuss the various components that is involved in solving an AI problem.
3. To analyze the various knowledge representation schemes, reasoning and learning techniques of AI.

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

1. Explain the role of agents and interaction with the environment to establish goals.
2. Identify and formulate search strategies to solve problems by applying suitable search strategy.
3. Compare and contrast the various knowledge representation schemes of AI.
4. Appraise probabilistic reasoning and model building
5. Apply Markov decision Process to solve real world Problems.

CO-PO ARTICULATION MATRIX

PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	1	-	-	-	-	-	2	1	-	-	-	-
CO2	2	1	1	2	3	-	-	-	3	1	2	-	-	-	-
CO3	1	2	-	1	-	-	-	-	-	2	-	1	-	-	1
CO4	-	2	2	1	-	-	-	-	3	1	-	1	1	-	2
CO5	-	3	2	1	1	-	-	-	-	1	-	1	-	-	2

UNIT - I

Introduction: Foundations of AI, History, State of the Art, Risks and Benefits.
Intelligent agents: Agents and Environment, The Concept of Rationality, Structure of an Agent.
Solving problems by Search- Problem-Solving Agents, State space representation, Search graph and Search tree Searching for Solutions,

UNIT - II

Uninformed Search Strategies: Uniform cost search, Iterative deepening Depth-first search, Bidirectional search**.**
Informed (Heuristic) Search Strategies: Heuristic Functions, Hill- climbing, Greedy best-first search, A* search, Simulated Annealing search.

UNIT – III

Adversarial Search: Game Theory, Alpha–Beta Pruning, Constraint Satisfaction Problems.
Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau, Predicate Logic, Resolution Refutation in Propositional Logic and Predicate Logic

UNIT - IV

Knowledge Representation: Introduction, approaches to knowledge Representation, Knowledge Representation using Semantic Network, Knowledge Representation using Frames.
Probabilistic Reasoning: Probability, inference using full joint distributions, Bayes rule, Bayesian networks-representation, construction, exact and approximate inference, temporal model, hidden Markov model.

UNIT – V

Markov Decision process: MDP formulation, utility theory, multi attribute utility functions, decision networks, sequential decision problems value iteration, policy iteration partially observable MDP.

TEXTBOOKS:

1. Russell, Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, 4th Edition, 2020.
2. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, First Edition, 2011.

SUGGESTED READING:

1. Rich, Knight, Nair, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition 2009.
2. Trivedi. M.C., “A classical approach to Artificial Intelligence”, Khanna Publishing House, Delh

ONLINE RESOURCES:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

22AMC03

INTRODUCTION TO MACHINE LEARNING

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

COURSE OBJECTIVES: This course aims to

1. To understand the Concepts of Machine Learning.
2. To study various machine learning techniques.
3. To design solutions for real world problems using machine learning techniques.

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

1. Define the basic concepts related to Machine Learning.
2. Describe the Feature Engineering Methods and Regression techniques.
3. Comparison between Supervised and Unsupervised Learning.
4. Classification of algorithms.
5. Applying Machine Learning techniques to real world problems.

CO-PO ARTICULATION MATRIX

CO/PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	1	1	-	1	-	-	1	-	-	1
CO2	1	1	-	-	1	-	-	-	1	-	-	1	-	-	1
CO3	2	1	1	-	-	-	1	-	1	1	-	1	-	-	2
CO4	1	1	2	1	-	-	1	-	1	1	1	1	-	1	2
CO5	1	1	1	1	-	-	-	1	1	1	-	-	1	1	2

UNIT-I

Introduction to Machine Learning: Introduction, Well-Posed Learning Problems, Types of Learning, Perspectives and Issues in Machine Learning.

Concept Learning: Concept Learning Task, Concept learning as Search: General to Specific Ordering of Hypothesis, Find-S: Finding Maximally Specific Hypothesis, Candidate Elimination Algorithm.

UNIT-II

Feature Engineering: Introduction to Features and need of Feature Engineering, Feature Extraction and Selection.

Regression: Linear Regression, Multivariate Regression, Regression Types: Ridge, Lasso, Elastic Net.

UNIT-III

Naïve Bayes and Discriminant Analysis: Naïve Bayes Classifiers, Discriminant Analysis.

Ensemble Learning: Introduction to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier.

Instance-based Learning: Logically Weighted Regressions, Radial Basis functions, Linear SVM, K-means, Evaluation methods, DBSCAN.

UNIT-IV

Unsupervised Learning: Clustering, types of clustering, K-Means clustering, Hierarchical clustering, Birch Algorithm, CURE Algorithm, Principal Component Analysis (PCA), Principal Component Regression (PCR).

Classification Algorithms: KNN, Linear Classification, Logistic Classification.

Reinforcement Learning: Introduction, Q-Learning.

UNIT-V

Neural Network: Neural network –gradient descent, Activation functions, Parameter initialization, convolutional neural networks, recurrent neural networks, Introduction to Recommender System.

TEXT BOOKS:

1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018.
2. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018.
3. Tom Mitchel “Machine Learning”, Tata McGraw Hill, 2017.

SUGGESTED READING:

1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018.
2. Marsland, S.”Machine Learning: An Algorithmic Perspective” 1st Edition, Chapman and Hall/CRC, 2009.https://doi.org/10.1201/9781420067194.
3. Reema Thareja “Python Programming”, Oxford Press, 2017.
4. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017.

ONLINE RESOURCE:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning _with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

22AMC08

AGILE SOFTWARE DEVELOPMENT

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

PRE-REQUISITES: Data structures, Design Thinking

COURSE OBJECTIVES: This course aims to

1. Demonstrate the ability to participate effectively in Agile Process for Software Development.
2. Explain the Purpose behind common Agile practices.
3. Apply Agile Principles and Values to a given real time problem.

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

1. Interpret the concept of agile software engineering and its advantages in software development.
2. Analyse the core practices behind several specific agile methodologies.
3. Identify the roles and responsibilities in agile projects and their difference from projects following traditional methodologies.
4. Access implications of functional testing, unit testing, and continuous integration.
5. Determine the role of design principles in agile software design.

CO-PO ARTICULATION MATRIX

PO/PSO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	2	2	2	1	-	2	2	2	1	1	2	2	2	2	2
CO 2	2	2	2	2	-	2	2	2	1	1	2	2	2	2	2
CO 3	2	1	2	1	-	2	2	2	2	2	2	2	1	1	2
CO 4	2	2	1	1	-	2	1	2	2	2	2	2	1	1	2
CO 5	2	1	3	1	-	2	2	2	2	2	2	2	2	1	2

Unit I

Introduction: Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility.

Unit II

Project Planning: Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations.

Unit III

Project Design: Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation.

Unit IV

Design Methodologies: Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development.

Unit V

Testing: The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.

TEXT BOOKS:

1. Ken Schawber, Mike Beedle, “Agile Software Development with Scrum”, International Edition, Pearson.
2. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, First International Edition, Prentice Hall.
3. Pedro M. Santos, Marco Consolaro, and Alessandro Di Gioia, “Agile Technical Practices Distilled: A learning journey in technical practices and principles of software design”, First edition, Packt Publisher.

REFERENCE BOOKS:

1. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, International edition, Addison Wesley.
2. Alistair Cockburn, “Agile Software Development: The Cooperative Game”, 2nd Edition, Addison-Wesley

E-BOOKS AND ONLINE LEARNING MATERIAL:

1. “The Complete Guide to Agile Software Development” https://clearbridgemobile.com/complete-guide- agile-software-development/
2. “Agile Fundamentals Ebook: A Complete Guide for Beginners”, https://agileken.com/agile- fundamentals-ebook/

ONLINE COURSES AND VIDEO LECTURES:

1. “Agile Software Development”, https://www.edx.org/course/agile-software-development Accessed on August 27, 2021.
2. “Agile Software Development”, https://www.coursera.org/learn/agile-software-development Accessed on August 27, 2021.

22CSC15

OPERATING SYSTEMS

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

PRE-REQUISITES: Computer Architecture and Programming Fundamentals.

COURSE OBJECTIVES: This course aims to
1. Understand the basic concepts and design of an operating system.
2. Interpret the structure and organization of the file system
3. Learn Inter Process Communication mechanisms and memory management approaches.
4. Explore cloud infrastructures and technologies.

COURSE OUTCOMES: After completion of this course, students will be able to
1. Understand the basics of Operating systems and its major components.
2. Illustrate the concepts related to process management.
3. Distinguish various memory management techniques.
4. Apply concepts of process synchronization and deadlocks to a given situation.
5. Evaluate various file allocation methods and Apply security as well as recovery features in the design Operating system.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	1	-	-	-	-	-	-	-	-	-		1	1
CO 2	3	3	-	3	1	-	-	-	-	-	-	-	1	1	1
CO 3	3	3	2	1	1	-	-	-	-	-	-	-	1	2	1
CO 4	3	3	1	3	-	-	-	-	-	-	-	-	1	1	1
CO 5	3	3	2	3	1	-	-	-	-	-	-	-	1	1	1

UNIT – I

Introduction to Operating Systems: Computer System overview, Components of a computer system, functions of OS, Examples, different types of OS (RTOS vs. desktop vs. mobile etc.), OS distributions and versions.
OS architectures: Micro-kernel, Layered, Kernel Approaches and examples.

UNIT – II

Process management: Program vs. process, process states, Process Control Block (PCB), OS services and system calls (fork, wait, exec, getpid, getppid etc.), system calls vs. System programs, Process scheduling- Process context switching, Scheduling algorithms, scheduling criteria.
Inter Process Communication: Linux IPC Mechanisms, RPC, RPC exception handling, Security issues.

UNIT – III

Memory Management: Memory view of a process, Process memory usage requirements, virtual and physical memory related system calls (mmap, munmap, sbrk, mprotect). Address translation mechanisms --- static mapping, segmentation, paging, page faults, page replacement algorithms,page sharing, read/write permissions, swapping.
Secondary Memory Management: Disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels.

UNIT – IV

Concurrency and Synchronization: Introduction to threads, benefits, types and thread APIs, Synchronization, issues, hardware and software solutions for synchronization, Classical problems of synchronization.

Deadlocks: Introduction, necessary conditions for deadlock occurrence, RAG, deadlock handling mechanisms - prevention, avoidance and recovery.

UNIT - V

File Systems: File concepts, file types, allocation and organization methods, file handling system calls, File system metadata, directory structure, caching optimizations File Systems case study.

OS Security: Types of threats in OS, basic security mechanisms, malware taxonomy, viruses, worms, and rootkits; Defense: overview, logging, auditing, and recovery, OS-level memory protection.

TEXT BOOKS:

1. Galvin, Silberschatz, "Operating system Concepts", 10th Edition, John Wiley & Sons, 2018.
2. Maurice J. Bach, "Design of the UNIX Operating System", Pearson Education India; 1st Edition, 2015.
3. Ekta Walia Khanna, "Operating System Concepts", Publishing House; 2nd Edition, 2019.
4. Dhananjay Dhamdhare, "Operating Systems-A Concept Based Approach", 3rd Edition, McGraw Hill Education, 2017.

SUGGESTED READING:

1. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX® Environment" Pearson Education India; 3rd Edition, 2013.

ONLINE RESOURCES:

1. Remzi H. Arpaci-Dusseau and Andrea C. , "Three Easy Pieces", Arpaci-Dusseau Arpaci-Dusseau Books, LLC https://pages.cs.wisc.edu/~remzi/OSTEP/ (online version)
2. Frans Kaashoek, Robert Morris, and Russ Cox, Xv6, a simple Unix-like teaching operating system [T4-R] https://github.com/mit-pdos/xv6-riscv (RISC-V version) [T4-X] https://github.com/mit-pdos/xv6-public (x86 version)

22MTC13

Mathematical Foundation for Data Science & Security (AIML)

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

COURSE OBJECTIVES: This course aims to

1. Able to learn and Analyzing data in Linear and Non-Linear form.
2. Able to fit the hypothetical data using probability distribution.
3. To know the characteristics of various continuous probability distributions.
4. To discuss the testing of hypothesis of sample data.
5. To know the security issues of Cryptography.

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

1. Analyze the coefficient of skewness and fitting of the data by various methods.
2. Apply properties of Mathematical Expectations and analyze the various distributions.
3. Evaluate areas of curves by using various distributions.
4. Apply various tests for testing the significance of sample data.
5. Apply RSA –PKC for solving security issues.

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	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	3	-	-	-	-	-	-	-	2	1	1	-
CO2	3	3	2	3	-	-	-	-	-	-	-	2	1	1	-
CO3	3	3	2	3	-	-	-	-	-	-	-	2	1	1	-
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	1	-
CO5	3	3	2	3	-	-	-	-	-	-	-	2	1	1	-

UNIT-I: Basic Statistics

Measures of Central Tendency, Measures of Dispersion, Moments (Moments about the mean and moments about a point). Skewness, Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness for frequency distribution, Kurtosis. Correlation, coefficient of correlation, limits of correlation coefficient. Linear Regression, Regression coefficients, Properties of Regression Coefficients. Curve fitting by the Method of Least Squares, Fitting of Straight lines and Exponential curve.

UNIT-II: Mathematical Expectation and Discrete Probability Distribution

Conditional Probability, Baye's theorem. Random variable, discrete random variable, Probability Mass Function, continuous random variable, probability density function. Mathematical expectation, properties of Expectation, properties of variance. Poisson distribution, MGF and Cumulates of the Poisson distribution, Recurrence formula for the probabilities of Poisson distribution (Fitting of Poisson distribution)

UNIT-III: Continuous Probability Distributions

Normal distribution, Characteristics of normal distribution and Normal probability Curve, MGF and CGF of Normal distribution, Areas under normal curve. Uniform distribution, Moment generating function, Mean and Variance of uniform distribution. Exponential distribution, MGF, CGF, Mean and Variance of Exponential distribution.

UNIT-IV: Testing of Hypotheses

Test of significance, null and alternative hypotheses, Errors in sampling, level of significance. Large sample test: Test of significance for single proportion, difference of proportions, single mean and difference of means. Small Sample Tests: T-Test for single mean, differences of Means. F- test for equality of two population variances. Chi-Square test of Goodness of fit.

UNIT-V: Number Theory & CRYPTOGRAPHY (RSA – PKC)

Division Algorithm, Greatest Common Divisor, Euclidean Algorithm, Wilson's Theorem, Euler's Phi-Function, Euler's Theorem, Some Properties of the Phi-Function. The RSA public key cryptosystem, Implementation and security issues, Pollard's $p-1$ factorization algorithm, Quadratic Residues and quadratic reciprocity.

TEXT BOOKS:

1. S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. Burton, David M. (2007) Elementary Number Theory (7^{th}edu.). Tata McGraw Hill Edition, Indian Reprint
3. Mathematical Cryptography by Jeffrey Hoffstein, Jill Pipher, Joseph H. Silverman Springer Science+ Business Media LLC.

SUGGESTED READING:

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3rd Ed., Wiley, 1968.
2. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.
3. Koshy, T.Elementary Number Theory with Applications, Elsevier Publications, New Delhi, 2002.
4. G.A.Jones & J.M.Jones "Elementary Number Theory", Springer UTM, 2007.

22AMC04

PRINCIPLES OF ARTIFICIAL INTELLIGENCE LAB

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

PRE-REQUISITES: Programming Basics, Probability and Statistics.

COURSE OBJECTIVES: This course aims to

1. To design and analyze various computing algorithms and techniques using Python.
2. To apply different learning algorithms to solve real time problems.
3. To recognize the underlying mathematical models and logics behind various AI techniques.

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

1. Understand the basic components of library environment and installations.
2. Analyze the design heuristics and apply various techniques to solve real world problems.
3. Apply variety of algorithms to solve problems.
4. Identify how to use GitHub and submit back genuine contributions.
5. Implement problems using game search algorithms.

CO-PO ARTICULATION MATRIX

PO/PSO / CO	PO1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO 1	2	2	2	2	3	-	-	2	2	2	1	3	3	2	2
CO 2	3	3	3	3	3	1	2	2	2	2	1	3	3	3	3
CO 3	3	3	3	3	3	2	1	2	2	2	1	3	3	3	3
CO 4	3	2	3	3	3	2	1	2	1	2	1	3	3	3	1
CO 5	3	3	2	3	3	3	1	2	2	2	1	3	3	3	3

LIST OF EXPERIMENTS:

1. Design/construct the workflow of a general AI project using draw.io
2. Implement Water Jug Problem using A* search
3. Implement an 8-puzzle solver using Heuristic search technique.
4. Implement the Constraint Satisfaction problem using backtracking.
5. Implement a program for game search.
6. Implement a Bayesian network from a given data and infer the data from that Bayesian network.
7. Implement a MDP to run value and policy iteration in any environment.
8. Build a bot to build any game using easy AI libraries
9. Understanding of GitHub and Anaconda environments.
10. Use the GitHub packages and libraries to frame a standard project and commit back to GitHub.

TEST BOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, 2010.
2. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011.

SUGGESTED READING:

1. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi, 2018.
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition, 2017.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106105077
2. https://nptel.ac.in/courses/106106126
3. https://aima.cs.berkeley.edu
4. https://ai.berkeley,edu/project_overview.html

22AMC05

INTRODUCTION TO MACHINE LEARNING LAB

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

COURSE OBJECTIVES: This course aims to

1. To make use of Data sets in implementing the machine learning algorithms.
2. To implement the machine learning concepts and algorithms.
3. To use real world data and implement machine learning models.

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

1. Identify the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
2. Identify and utilize modern tools that are useful for data analysis.
3. Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
4. Implement and evaluate various Machine Learning approaches on real world problems.
5. Apply Keras and Tensorflow to implement ML techniques.

CO-PO ARTICULATION MATRIX

CO-PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	1	-	-	1	-	-	-	1	-	-	1	-	-	-
CO2	-	1	1	1	1	-	-	-	1	-	-	-	-	-	1
CO3	-	2	1	-	-	-	-	-	1	-	1	1	-	-	1
CO4	-	-	1	1	1	-	-	-	1	-	-	2	-	1	1
CO5	-	-	-	1	1	-	-	-	1	-	-	-	1	1	-

LIST OF EXPERIMENTS:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import scikitlearn, keras and tensorflows etc.
2. Build linear regression model using gradient descent, least squares, polynomial, LASSO and RIDGE approaches also compare all the algorithms and draw a table for all the metrics.
3. Demonstration of decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build the decision tree classifier compare its performance with ensemble techniques like random forest, bagging, boosting and voting Demonstrate it with different decision trees.
5. Build FIND-S and Candidate-Elimination algorithm on a different data set.
6. Demonstration of Logistic Regression for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
7. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file.
8. Implementation of Gradient Descent Algorithm using Tensorflow.
9. Case study on supervised learning algorithms.
10. Demonstration of clustering algorithms- k-Means, Agglomerative and DBSCAN to classify for the standard datasets.

TEXT BOOKS:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing, 2017.

ONLINE RESOURCES:

1. http://www.cs.cmu.edu/~tom/
2. http://www.holehouse.org/mlclass/

22AMC09

PRINCIPLES OF OPERATING SYSTEMS LAB

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

PRE-REQUISITES: Programming for problem solving.

COURSE OBJECTIVES: This course aims to
1. To explore Unix/Linux operating system.
2. To analyze various system calls available in Linux/Unix.

COURSE OUTCOMES: After completion of this course, students will be able to,
1. Understand Linux/Unix environment.
2. Understand and implement shell programming.
3. Simulate memory management and file allocation techniques.
4. Analyze process and file management system calls by creating and/or modifying concurrent programs.
5. Build network-oriented applications using system calls.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	-	1	-	-	-	-	-	-	-	-	1	1	1
CO 2	2	-	-	-	2	-	-	-	-	-	-	-	1	1	1
CO 3	2	-	2	-	-	-	-	-	-	-	-	-	1	2	1
CO 4	2	2	2	1	-	-	-	-	-	-	-	-	1	1	1
CO 5	2	1	1	1	-	-	-	-	-	-	-	-	1	1	1

LIST OF EXPERIMENTS:
1. Shell programming.
2. Demonstration and Performance Evaluation of CPU scheduling algorithms
3. Implementation of memory management techniques like paging and segmentation.
4. Implementation of Linked, Indexed and Contiguous file allocation methods.
5. Demonstration of Linux/Unix file related system calls: mkdir, link, unlink, mount, unmount, users+, chown, chmod, open, close, read, write, lseek, stat, sync.
6. Implementation of producer-consumer, readers- writers and dining philosophers problem using semaphores
7. Demonstration of Bankers Algorithm for Deadlock Avoidance.
8. Development of applications using Linux/Unix system calls: signal, socket, accept, snd, recv, connect.

TEXT BOOKS:

1. Galvin, Silberschatz, “Operating System Concepts”, 10th Edition, John Wiley & Sons, 2018.
2. Dhananjay Dhamdhare, “Operating Systems-A Concept Based Approach”, 3rd Edition, McGraw Hill Education, 2017.

SUGGESTED READING:

1. Ekta Walia, “Operating System Concepts”, Khanna Book Publishing, 2020.
2. William Stallings, “Operating Systems Internals and Design Principles”, Pearson Ed., 2012.
3. Charles Crowley, “Operating Systems –A Design Oriented Approach”, McGraw Hill Education, 2017.
4. Andrew S. Tanenbaum, Albert S Woodhull, “Operating systems Design and Implementation”, Pearson Ed., 2009.

22MTC14

MATHEMATICAL FOUNDATION FOR DATA SCIENCE & SECURITY (LAB)
R- PROGRAMMING (AIML)

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

COURSE OBJECTIVES: This course aims to

1. To know the graphical visualizations for the data.
2. To learn the measures of central tendency and dispersion.
3. To learn and analyze data in linear and non-linear form.
4. To learn the probabilities of various distributions.
5. To know the various cryptographic schemes for the encryption and decryption.

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

1. Create graphs and charts for the statistical data.
2. Analyze the data set using measures of central tendency and dispersion.
3. Develop the linear and non-linear regression models for the statistical data.
4. Evaluate the probabilities of various discrete and continuous distributions.
5. Demonstrate RSA – PKC technique of number theory for solving security issues.

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	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	1	-	-	-	-	-	-	-	2	-	1	-
CO 2	2	2	1	1	-	-	-	-	-	-	-	2	-	1	-
CO 3	2	2	1	1	-	-	-	-	-	-	-	2	-	1	-
CO 4	2	2	1	1	-	-	-	-	-	-	-	2	-	1	-
CO 5	2	2	1	1	-	-	-	-	-	-	-	2	-	1	-

LIST OF PROGRAMS:

1. Write a Program to create Graphs and Charts.
2. Write a Program to calculate the measures of Central Tendency for the data.
3. Write a Program to compute measures of disposition for the data.
4. Write a Program for Correlation and Covariance using Pearson method.
5. Write a Program for simple linear Regression and Logistic regression.
6. Write a Program to compute probabilities using Binomial Distribution.
7. Write a Program to compute probabilities using Poisson Distribution.
8. Write a Program to compute probabilities using Normal Distribution.
9. Write a program for hypothesis testing
10. Write a Program to compute gcd of any two positive integers using Euclidian algorithm.
11. Write a Program to encrypt the given data, using RSA algorithm.
12. Write a Program to decrypt the given data, using RSA algorithm

TEXT BOOKS:

1. S.R.Mani Sekhar, Dr. T.V. Suresh Kumar, “Programming with R” CENGAGE Publishers, 2017.
2. K.G.Srinivasa, G.M.Siddesh, “Statistical Programming in R”, Oxford University Press, 2017.
3. Jared P Lander, “R for Everyone” Pearson.2018.
4. http://www.cyclismo.org/tutorial/R/

TM

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

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Accreditated by NBA & NAAC (A++)

Kokapet Village, Gandipet Mandal, Hyderabad -500075, Telanagana.

E-mail: principal@cbit.ac.in, Website: www.cbit.ac.in

Phone No. : 040-24193276 / 277 / 279