UG-R22 Curriculum
With effective from 2022-23

Computer Science and Engineering

Scheme of Instruction and Syllabi of
B.E I to VIII 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.
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SCHEME OF INSTRUCTION AND SYLLABI (R-22)

OF

B.E. I to VIII SEMESTERS OF FOUR YEAR DEGREE COURSE

IN

BE-COMPUTER SCIENCE AND ENGINEERING

(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)

OUR MOTTO: SWAYAM TEJASWIN BHAVA

Institute Vision	To be a Centre of excellence in technical education and research	
Institute Mission	To address the emerging needs through quality technical education and advanced research.	
Department Vision	To be in the frontiers of Computer Science and Engineering with academic excellence and Research.	
Department Mission	M1	To be in the frontiers of Computer Science and Engineering with academic excellence and Research.
	M2	Develop professionals with sound knowledge in theory and practice of Computer Science and Engineering
	M3	Facilitate the development of academia-industry collaboration and societal outreach programs
	M4	Prepare students for full and ethical participation in a diverse society and encourage lifelong learning
PEO 1	Graduates will apply their knowledge and skills to succeed in their careers and/or obtain advanced degrees, provide solutions as entrepreneurs.	
PEO 2	Graduates will creatively solve problems, communicate effectively, and successfully function in multi-disciplinary teams with superior work ethics and values.	
PEO 3	Graduates will apply principles and practices of Computer Science, mathematics and Science to successfully complete hardware and/or software-related engineering projects to meet customer business objectives and/or productively engage in research.	
PSO 1	Able to acquire knowledge and practical competency for providing solutions to the problems related to Computer Science and Engineering.	
PSO 2	Able to design and develop innovative solutions for complex problems by applying the concepts of emerging domains including AI, ML, IoT, Data Science, security and cloud .	
PSO 3	Able to gain knowledge and skills to develop, deploy and maintain software using modern Software Engineering principles and practices.	

Program Outcomes of BE (CSE) Program

Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution of complex engineering problems
Problem analysis	Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Communication	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
Life-long learning	Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

B.E. - COMPUTER SCIENCE & ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Durationof 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 SemiconductorPhysics	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	2	40	60	2
PRACTICAL									
5	22PYC03	Optics and Semiconductor Physics Lab	0	0	3	1.5	50	50	1.5
6	22EGC02	English lab	0	0	2	1	50	50	1
7	22CSC02	Problem Solving andProgramming Lab	0	0	3	1.5	50	50	1.5
8	22MEC01	CAD AND DRAFTING	0	1	3	2.5	50	50	2.5
9	22MEC38	Digital Fabrication Lab	0	0	3	1.5	50	50	1.5
TOTAL			**10**	**3**	**14**	**19**	**410**	**490**	**20**

L: Lecture T: Tutorial D: Drawing P: Practical CIE - CIE SEE - Semester End Examination

22MTC01

LINEAR ALGEBRA & CALCULUS

Instruction	3 L + 1 T 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: Upon 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 offunctions 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 ofIntegration 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), changeof 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 canonicalform 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), AI&ML, AI&DS)

Instruction	3 L 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: Upon 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

PO/PSO CO	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 – Classificationof 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 Revisededition, 2015.

22CSC01

PROBLEM SOLVING AND PROGRAMMING

Instruction	2 L + 1 T 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 computationalproblems.
2. Learn any basic programming language.

COURSE OUTCOMES: Upon 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 userdefined 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
(Common to All Branches)

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

COURSE OBJECTIVES: This course aims to
1. To the role and importance of communication while developing their basic communication skills inEnglish.
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 reportsfollowing a proper structure.
5. To gaining adequate reading comprehension techniques.

COURSE OUTCOMES: Upon 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 andappropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by draftin g formal reports.
5. Critique passages by applying effective reading techniques

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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; Intrapersonaland 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, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP.1995.

Suggested Readings:
1. Wood F.T, Remedial English Grammar, Macmillan, 2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, 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	3 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: This course aims to:
1. 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: Upon 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

PO/PSO / CO	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 onfluency rather than accuracy.
5. To team work, role behaviour while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: Upon 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 Groupdiscussions.

CO-PO Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 ofspeech: 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 withthe 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	3 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: This course aims to

1. 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: Upon 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/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 StarchPress.
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	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives: This course aims to
1. 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: Upon 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/PSO / 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 andManufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &teamwork 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 ofindustrial workshop components and processes and can communicate their work in a technical, clear and effective way.

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

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

CO-PO Articulation Matrix

PO/PSO / CO	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 poleswitch
   b. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuitwith 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. 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 givingwater 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, PearsonEducation India Edition, 2002.
3. Sachidanand Jha, 3D PRINTING PROJECTS: 200 3D Practice Drawings For 3D Printing On Your 3DPrinter, June 7, 2019.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. 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 COMPUTER SCIENCE AND ENGINEERING

SEMESTER –II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC04	Differential Equations & Numerical Methods	3	1	0				4
2	22CYC01	Chemistry	3	0	0				3
3	22EE C01	Basic Electrical Engineering	2	1	0				3
4	22CSC03	Object Oriented Programming	2	1	0				3
PRACTICAL									
5	22CYC02	Chemistry Lab	0	0	3				1.5
6	22MBC02	Community Engagement	0	0	3				1.5
7	22CSC04	Object-Oriented ProgrammingLab	0	0	2				1
8	22ME C37	Robotics & Drones Lab	0	2	2				3
9	22EE C02	Basic Electrical Engineering Lab	0	0	2				1
TOTAL			**10**	**5**	**12**				**21**

22MTC04

DIFFERENTIAL EQUATIONS & NUMERICAL METHODS

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: Upon 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	3	-	-	-	-	-	-	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	2
CO 3	2	2	2	2	-	-	-	-	-	-	-	1
CO 4	2	2	2	2	-	-	-	-	-	-	-	1
CO 5	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 forwardand backward interpolation formulae, Gauss's forward and backward interpolation formulae, Lagrangeinterpolation, 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 roottest, 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 andComputation", New age International Publications, 2008.

Suggested Reading:

1. R.K.Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", 5th edition, Narosa Publications, 2016.
2. Ramana B.V, "Higher Engineering Mathematics", 11th Reprint, Tata McGraw Hill New Delhi, 2010.
3. A.R.Vasishtha and R.K.Guptha, "Integral Transforms", Reprint, Krishna's Educational Publishers, 2014.

22CYC01

CHEMISTRY

Instruction	3P 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 studentsaspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they canbe 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: Upon completion of this course, students will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemicalreactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role inbatteries 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/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 combinationof 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:

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 & RedoxTitrations, Numerical.

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 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
3. Ltd., 46th edition (2013).

4. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, “Organic Chemistry”, Wiley, 12th edition (2017).
5. P.W. Atkins, J.D. Paula, “Physical Chemistry”, Oxford, 8th edition (2006).

22EEC01

BASIC ELECTRICAL ENGINEERING

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

Course Objectives: This course aims to

1. To understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical ACcircuit 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 andmethods of earthing.

Course Outcomes: Upon 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 inelectrical installations and electric shock and its safety and energy calculations.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 energyconsumption

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: Upon 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/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	2	-	1	-	-	-	-	-	-	1
2	3	1	3	2	2	-	-	-	-	-	-	2
3	3	1	2	1	1	-	-	-	-	-	-	1
4	3	2	3	1	2	-	-	-	-	-	-	2
5	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 BookPublishing, 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

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 chemistrylaboratory.
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 understandingof theoretical concepts.
5. To interpret the theorical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes: Upon completion of this course, students 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 usingNaOH 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	-
CIE	50 Marks
Credits	1.5

Course Objectives: This course aims 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: Upon completion of this course, students will be able to:

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

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: SarvaShikshaAbhiyan, BetiBhachao, BetiPadhao, Ayushman, Bharat, Swachh Bharat, PM AwasYojana, 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	3	1	3	-	-	-	-	-	-	2
CO 2	3	3	2	2	2	-	-	-	-	-	-	2
CO 3	3	3	3	2	3	-	-	-	-	-	-	2
CO 4	3	3	3	3	3	-	-	-	-	-	-	2
CO 5	3	3	3	3	3	-	-	-	-	-	-	2

List of Experiments:

1. Demonstration of classes and objects with referencing the class variables, instance variables and staticvariables.
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 volumeand pages of journal.
9. Create a Python project to get total COVID-19 cases, total deaths due to Covid-19, total Covid-19 patientsrecovered 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: Upon completion of this course, students will be able to:

1. Demonstrate knowledge of the relationship between mechanical structures of robotics and their operationalworkspace 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.

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	P0 10	PO 11	PO 12
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 usefulcommands
5. Controlling robot using Python: i) Move robot using Python code, ii) Make robot move in patterns usingPython
6. Robot programming with Sensor inputs: i) Read sensor data using Python, ii) Visualize sensor data usingPython, 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 coloredshapes 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
SEEE	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 circuitlaws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLCcircuits 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: Upon completion of this course, students will be able 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 Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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)

BE (Computer Science and Engineering)

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	-	-	3	40	60	3
2.	22CSC06	Discrete Structures	3	1	-	3	40	60	4
3.	22CSC07	Digital Logic Design	2	1	-	3	40	60	3
4.	22ECC36	Basic Electronics and Sensors	3	0	-	3	40	60	3
5.	22EGM01	Indian Constitution And Fundamental Principles	2	-	-	2	-	50	No Credit
PRACTICALS									
6.	22CSC08	Data Structures and Algorithms Lab	-	-	3	3	50	50	1.5
7.	22ECC37	Basic Electronics and Sensors Lab	-	-	2	3	50	50	1
8.	22CSC09	Latex Lab	-	-	2	3	50	50	1
9.	22CSV01	Engineering Leadership(MOOCs)	-	1	-	-	50	-	1
10.	22CSI01	Internship – I	-	-	-	-	50	-	2
11.		Extra Academic Activities (EEA) -3	-	-	3	-	*APts	-	No Credit
Total			**13**	**3**	**10**	**-**	**410**	**440**	**19.5**
Clock Hours Per Week: 26									

L: Lecture D: Drawing **CIE: CIE**

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

*** Activity points as per institutional guidelines**

22CSC05

DATA STRUCTURES
(Common to CSE, CSE-AIML, AIML, CET, IT, AIDS)

Instruction	3L 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: Upon completion of this course, students will be able to:
1. Understand the basic concepts and types of data structures.
2. Analyse 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	PO 1	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	3	3	-	-	-	-	-	-	-	-	-	-	1	1	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-	1	1	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO 4	3	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO 5	3	3	1	-	-	-	-	-	-	-	-	-	1	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, applicationsof 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,- LinearProbing, Quadratic Probing, Double Hashing.

Text Books:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structure and Algorithms inPython", 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
4. Press, 2nd Edition.
5. 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

22CSC06

DISCRETE STRUCTURES

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

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: Upon 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, relations, and functions 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	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	2	3	1	-	-	-	-	2	-	-	1	2	-
CO 2	3	3	1	3	-	-	-	-	-	-	-	-	1	2	-
CO 3	2	3	1	3	1	-	-	-	-	-	-	-	1	1	-
CO 4	3	3	2	3	1	-	-	-	-	-	-	-	2	2	3
CO 5	3	3	1	1	-	-	-	-	-	-	-	-	3	2	-

UNIT – I

Introduction to Propositional Calculus: Basic Connectives and Truth tables, Logical Equivalence: Laws of Logic, Logical Implication; Rules of Inference. Predicates: Use of 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.
Relationsand Functions: Cartesian Products and Relations. Partial ordering relations, POSET, Hasse diagrams, Lattices as Partially Ordered Sets, Equivalence relations. Pigeon hole principle.
Functions: Types of Functions, Composition of functions and Inverse of functions.

UNIT – III

Fundamental Principles of counting: The Rules of Sum and Product, Permutations, Combinations, Binomial Theorem; **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, GraphColoring and Chromatic polynomial, Matching, Applications.
Trees: Definitions, Properties, Rooted Trees, Spanning Trees, Minimum Spanning trees: The of Kruskal and PrimAlgorithms.

UNIT - V
Algebraic Structures: Algebraic Systems, Examples and General Properties, Semi groups and Monoids.
Groups: Definitions and Examples, Subgroups, Homomorphism's and cyclic groups.

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

Suggested Reading:
1. Singh, S.B., "Discrete Mathematics", Khanna Book Publishing Company, New Delhi, 3rd Edition, 2019.
2. R. K. Bisht, H. S. Dhami, "Discrete Mathematics", Oxford University Press, 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

22CSC07

DIGITAL LOGIC DESIGN

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. Introduce the basic building blocks of digital hardware and various minimization techniques.
2. Introduce analyse and design the Combinational and Sequential circuits.
3. Introduce designing the circuits using verilog HDL.

Course Outcomes: Upon completion of this course, students will be able to:
1. Demonstrate the number system conversions and simplify Boolean functions.
2. Recall basic theorems and properties of Boolean algebra to represent logical functions in canonical andstandard forms.
3. Analyze and simplify Boolean expressions using Karnaugh-maps and tabulation method.
4. Analyze and Design various combinational circuits and Sequential circuits using Verilog HDL.
5. Design different applications using registers and counters by applying state reduction methods.

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

UNIT - I

Digital and Binary Numbers: Digital systems, Binary numbers, Number base conversions, Octal and Hexadecimal numbers, Complements of Numbers, Binary codes.

Boolean Algebra and logic Gates: Binary logic, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.

UNIT – II

Minimization of Switching Functions: Introduction, the map method, minimal functions and their properties,the tabulation procedure, the prime implicant chart.

NAND and NOR Gates: NAND Circuits, Two-level Implementation, Multilevel NAND Circuits, NOR Circuits.Exclusive OR Gates: Odd Function, Parity Generation and Checking.

UNIT- III

Combinational Logic Design: Combinational Circuits; Analysis **Procedure:** Derivation of Boolean Functions,Derivation of the Truth Table, Logic Simulation.

Design Procedure: Decoders, Encoders, Multiplexers - Designing Combinational Circuits using Multiplexers, Binary Adders, Adder-Subtractor, Binary Multiplier, HDL Representations – Verilog.

UNIT - IV

Sequential Circuits: Sequential circuit definitions, Latches, Flip Flops, Sequential circuit analysis, Sequentialcircuit design, Design with D Flip Flops, Designing with JK Flip-Flops, HDL representation for sequential circuits
- Verilog.

UNIT – V

Sequence Detection and State Reduction Methods: Moore and Mealy state graphs for sequence detection,Methods for reduction of state tables, Methods for state assignment.
Registers: Registers, Shift registers.
Counters: Ripple counters, synchronous counters, and other counters.

Text Books:

1. Morris Mano M. and Michael D. Ciletti, "Digital Design, With an Introduction to Verilog HDL", Pearson
2. 5th edition, 2013.
3. ZVI Kohavi, "Switching and Finite Automata Theory", Tata McGraw Hill 2nd Edition, 1995.
4. Roth, Jr., Charles H., et al. "Fundamentals of Logic Design", Enhanced Edition, Singapore, CengageLearning, 2020.

Suggested Reading:

1. Ronald J Tocci, Neal Widmer, Greg Moss, "Digital Systems: Principles and Applications", Pearson 11th
2. Edition, 2011.
3. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL design, McGraw Hill 2nd
4. Edition, 2009.
5. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice-Hall, 2nd Edition, 2003.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ee39/preview

22ECC36

BASIC ELECTRONICS AND SENSORS
(Common for CSE and CET)

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

Prerequisite: Concepts of Semiconductor Physics and Applied Physics.

Course Objectives:

This course aims to:

1. Describe semiconductor device's principles and understand the characteristics of junction diode and transistors.
2. Understand working principles of Analog to Digital and Digital to Analog conversion.
3. Understand Interfacing of various modules myRIO.

Course Outcomes:

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

1. Identify various types of semiconductor devices for building electronic circuits.
2. Describe the operation of various sensors, data convertors and actuators.
3. Acquire the data from various sensors.
4. Analyse usage of sensors/actuators for the development of real-time applications.
5. Apply theoretical learning to implement practical real-time problems for automation.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	1	1	3	3	2	1	2	-	-	-
CO 2	3	3	3	1	1	1	1	2	3	2	2	2	2	-	1
CO 3	3	2	2	1	2	2	2	1	3	2	2	2	2	2	1
CO 4	3	3	3	3	1	2	2	2	3	2	2	2	0	-	-
CO 5	3	3	3	2	1	2	2	2	3	2	2	2	0	-	1

UNIT-I

Diodes and its Applications: Overview of Semiconductors, Characteristics of P-N Junction diode, current equation. Characteristics of Zener Diode , Voltage regulator, Half Wave, Full Wave: Center tap, Bridge Rectifiers.**Display Systems:** Constructional details of C.R.O and Applications.

UNIT-II

Bipolar Junction Transistors: Classification, Bipolar Junction Transistors Configurations. CE, CB Characteristics, h-parameters, Analysis of BJT amplifier using h-parameters in CE, CB configuration.
Field Effect Transistor: Junction Field Effect Transistor: Principle of Operation, Characteristics of JFET andOperation of MOSFET.

UNIT- III

Op-Amps Circuits: Basic Principle, Ideal, and practical Characteristics, Voltage Follower, Op-Amp parameters,Applications-Summer, Integrator, Differentiator, Instrumentation amplifiers, Logic Gates-IC's.
Data Converters: Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC-Parallel Comparator.,Successive Approximation and Dual Slope(Qualitative treatment Only).

UNIT-IV

Sensors: Definition, classification, Proximity Sensors**,** Tachogenerator as a Velocity, Optical encoder as motionand Strain Gauge as force Sensor; Temperature and light sensors, Collision Avoidance sensors.

ROBOT Sensors: Sensors in robot – Touch sensors**;** Camera Systems in Machine: Camera Technology, Historyin Brief, Machine Vision versus closed Circuit Television (CCTV).

Actuators: Introduction, Types of actuators in IOT, Real life examples of actuators in IOT.

UNIT-V

Hardware/software platforms: Introduction to LabVIEW, Data Acquisition System: hardware Overview of myRIO, Converting Raw Data Values to a Voltage.

Sensors interfacing with my RIO: Introduction, Pin configuration, diagrams of thermistor, photo cell, HallEffect, IR Range Finder, Bluetooth, Temperature Sensors.

Text Books:

1. Robert L.Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson Education, 9th Edition, LPE, Reprinted, 2006.
2. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
3. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013.
4. Ed Doering, NI myRIO Project Essentials Guide, Feb. 2016.

Suggested Reading:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
2. Anindya Nag, Subhas Chandra Mukhopadhyay, Jurgen Kosel, Printed Flexible Sensors: Fabrication, Characterization and Implementation, Springer International Publishing, Year: 2019, ISBN: 978-3-030- 13764-9,978-3-030-13765-6.
3. User guide and specifications NI myRIO-1900.

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES
(Common to B.E/B.TECH all branches)

Instruction	2L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
Credits	-

Course Objectives: This course aims to:
1. Understand the history of framing of the Indian Constitution.
2. Aware them on Fundamental Rights, Duties and Directive Principles of State Policy.
3. Explore the organization of Union Government, and functions of President and Prime Minister.
4. Gain an insight into the inter-functionality of Union Legislature and Judiciary.
5. Educate on the local governance and problems in development of rural and urban areas.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the history of framing of the Indian Constitution and its features.
2. Assess the realization of Fundamental Rights and Directive Principles of State Policy.
3. Analyse the challenges to federal system and position of the President and the Prime Minister in the UnionGovernment.
4. Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
5. Evolve the development of the local governments in India and assess the role of Collector in districtadministration.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	-	-	1	-	-	1	1	1	1	-	-	-	-	-	-
CO 2	-	-	2	-	-	3	2	2	1	-	-	-	-	-	-
CO 3	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-
CO 4	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	3	2	1	1	-	-	-	-	-	-

UNIT-I

Constitutional History and Framing of Indian Constitution: East India Company rule (1757-1857): Social, Economic, Political and Administrative impact of Company rule in India. British Rule (1858-1947): Indian National Movement, Government of India Acts 1909, 1919 and 1935, and Indian Independence Act 1947. Framing of the Indian Constitution: Constituent Assembly, Preamble and Salient Features.

UNIT-II

Fundamental Rights, Duties and Directive Principles of State Policy: The Fundamental Rights**:** Features andsignificance of Rights. Fundamental Duties: Importance and the legal status of Duties. Directive Principles of State Policy: Socialist, Gandhian and Liberal-intellectual principles, importance and relevance.

UNIT-III

Union Government and its Administration: Federalism: Division of legislative and financial powers between the Union and the State. Union Executive: Role and position of President, Prime Minister and Council of Ministers. Emergency Provisions: National Emergency, Constitutional Emergency and Financial Emergency.

UNIT-IV

Union Legislature and Judiciary: Union Legislature: Parliament of India-Composition and functions of Parliament, and Parliamentary Committees. Union Judiciary: Supreme Court of India-Composition and Functions.

UNIT-V

Local Self Governments : Rural Local Governments: Zilla Parishad- CEO and functions of Zilla Parishad, Mandal Parishad- Role of Elected and Officials, Gram Panchayat- Sarpanch, Secretary and Gram Sabha. Urban Local Governments: Structure and functions of Municipalities and Municipal Corporations. District Collector: Powers and functions of Collector.

Textbooks:

1. Ed Prof V Ravindra Sastry, "Indian Government & Politics", Telugu Akademy, 2nd edition, 2018.
2. NCERT, "Indian Constitution at Work"**,** First edition 2006, Reprinted in 2022.

Suggested Reading:

1. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st edition, 2015.
3. Granville Austin, The Indian Constitution: the Cornerstone of a Nation, OUP, 2nd Edition 1999.
4. M.V. Pylee, India's Constitution, S. Chand Publishing, 16th Edition, 2017.
5. Rajeev Bhargava (ed), Politics and Ethics of the Indian Constitution, OUP, 2008.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

22CSC08

DATA STRUCTURES AND ALGORITHMS LAB

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

Pre-Requisites: Any Programming Language.

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

Course Outcomes: Upon completion of this course, students will be able to:
1. Implement the abstract data type.
2. Implement linear and non-linear data structures.
3. Analyze various sorting techniques.
4. Analyze various algorithms of linear and nonlinear data structures.
5. Design and develop real world problem using suitable data structures.

CO-PO Articulation Matrix

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

List of Experiments:
1. Implementation of Searching and Sorting Algorithms.
2. Implementation of Stacks.
3. Implementation of Infix expression to Postfix expression conversion using Stack.
4. Implementation of Postfix expressions using stack.
5. Implementation of Queues.
6. Implementation of Singly Linked List.
7. Implementation of Binary Search Tree.
8. Implementation of Heap Sort.
9. Implementation of Graph Traversal Techniques.
10. Implementation of Hashing.
11. **Case studies** – Solve Data Structure algorithms in online platforms such as HackerRank and Codechef.

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.

22ECC37

BASIC ELECTRONICS AND SENSORS LAB

(Common for CSE and CET)

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

Prerequisite: Students should have prior knowledge of Applied Physics and Semiconductor Physics.

Course Objectives: This course aims to

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

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

1. Familiarize with basic electronic components, devices, and systems.
2. Formulate the research problems associate with Transistor or Op-amp circuits.
3. Examine the Interfacing of myRIO with various sensors/transducers, Motors.
4. Examine and Measure the problems encountered in Robotos or sensor related systems.
5. Justify the solutions related with transistorized circuits for real-time applications.

CO-PO Articulation Matrix

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

List of Experiments:

1. Study of Semiconductor components, sensors, transducers.
2. Characteristics of Semiconductor Diodes.
3. CRO Applications
4. Half Wave Rectifier with and without filters.
5. Full Wave Rectifiers with and without filters
6. Voltage Regulator using Zener diode.
7. CB Input and Output Characteristics
8. FET Characteristics
9. Operational Amplifiers – Inverting Op-Amp, Adder.
10. Operational Amplifiers – Integrator, Differntiator.
11. Interfacing LDR/Photo Resistor and LED with myRIO (Intensity control of LED with respect toIllumination).
12. Interfacing LM35, Thermistor, and Buzzer with myRIO. (Temperature Thresholding Application)
13. Interfacing IR Range Finder with myRIO. (Obstacle detection and Ranging)
14. Interfacing Motor with Motor Adapter using myRIO. (Motor momentum control)
15. Interfacing Accelerometer and Inbuilt accelerometer with myRIO. (Vibration calculation in specific axis)
16. **Structured Enquiry:** Design a switching circuit using BJT and analyse its operation.
17. **Open ended Enquiry:** Design a LED running lights circuit for vehicles to avoid

accidents in fog/raincondition.

Note: At least 12 experiments are to be performed.

Suggested Reading:

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

22CSC09

LATEX 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. Familiarize the students with documentation and visualization tools like LaTeX.
2. Develop proficiency in documentation for presentation and report writing.
3. Explore the utilities in LaTeX.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the need of documentation tools.
2. Install the documentation tools.
3. Generate templates for generation report using LaTeX.
4. Generate templates for presentation reports using Beamer.
5. Explore the utilities of LaTeX.

CO-PO Articulation Matrix

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

Lab Experiments:
1. Exploring various environments and Installation of LaTeX.
2. Understanding LaTeX compilation, basic syntax.
3. Create a LaTeX document with various formatting styles.
4. Understand Page Layout –Titles, abstract, chapters, sections, references, equation, references, citation, tableof contents, generating new commands.
5. Create a LaTeX document with following mathematical equations along with equation numbers in Italic format: Ex-summation (represent in sigma symbol), integration, integral of summation.
6. Create a LaTeX documents with images and image caption at centre alignment, table with thick border and table caption with centre alignment, row height, content with cell centre alignment.
7. Create a LaTeX document to write an algorithm using algpseudocode and algorithm packages. Use the lstlisting package in LaTeX to write source code in any programming language.
8. Work on basic power point utilities and tools in LaTeX which help them create basic power point presentation. PPT Orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, AutoShapes, Lines and Arrows Beamer, slides preparation.
9. Create a Resume, Lab Report, Article.
10. Create a technical report according to IEEE format includes title of the paper, authors name and affiliations,abstract and keywords, introduction section, background section, and other sections, references.

Text Books:
1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education India,2005.
2. LaTeX Companion – Leslie Lamport, PHI/Pearson,2004.

Online Resources:

1. https://www.latex-project.org/help/documentation/
2. https://spoken-tutorial.org/tutorial ef,search?search_foss=LaTeX& search_language=English

22CSV019

ENGINEERING LEADERSHIP

Instruction	1T Hour per week
CIE	50 Marks
Credits	1

Course Objectives: This course aims to:

1. Prepare students to assume engineer-leader roles in their professional careers, whether in the private,academic, public, or non-profit sectors.
2. Assist students in describing and applying the foundations of leadership to their individual leadershipframework, with linkage to vision, high ethical standards and professionalism.
3. Assist students in developing their effective communications and presentation skills.
4. Provide students with a background in applying concepts to manage collaborative team dynamics, drivechange, and manage conflicts and crises.

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

1. Understand engineer-leader roles to be played in professional careers.
2. Acquire leader skills that are required for professional career.
3. Use assessment tools to identify the strengths and weaknesses and analyze the impact on leadership style.
4. Develop stress management skills to improve leadership styles.
5. Develop the attitude of creativity in problem solving.

CO-PO Articulation Matrix

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

UNIT-I

Introduction to Leadership: Functions, leadership roles, leadership skills and styles, leadership competencyframework, methodology for assessing skill levels.

UNIT-II

Engineering Profession: Engineering challenges, Time management strategies and toolboxes.

UNIT-III

Self-Awareness: An introduction to self-assessment tools that allow identifying strengths and weaknesses andimpact analysis on leadership style.

UNIT-IV

Stress Management: Strategies to limit or leverage stress to improve leadership style, tools for effective stressmanagement.

UNIT-V

Creative Problem Solving: Differences between analytical and creative problem solving. Techniques forencouraging creativity in solving problems while recognizing and overcoming conceptual blocks.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_mg34/preview

2. https://www.coursera.org/learn/self-awareness#syllabus

22CSI01

INTERNSHIP-I
(MOOCs/Training/Internship)

Instruction	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 realtime 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
5. Opportunity to interact with the people of industry/society to understand the real conditions.

Course Outcomes: Upon 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	PSO 1	PSO 2	PSO 3
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	1	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 instituteby filling the application form IAP-101.
2. Industry shall scrutinize the students based on their criteria and communicate a provisionaloffer 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 eitherby 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 andsafety precautions during internship.

Student shall maintain diary during the internship and submit the internship report at the end of the internship. Thereport 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(**15 marks**)
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 16onwards 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)

BE (Computer Science and Engineering)

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.	22CSC10	Computer Organization and Architecture	3	1	-	3	40	60	4
2.	22CSC11	Database Management Systems	3	0	-	3	40	60	3
3.	22CSC12	Formal Language and Automata Theory	2	1	-	3	40	60	3
4.	22MTC12	Probability and Statistics	3	1	-	3	40	60	4
5.	22ITC17	Web Technologies	2	1	-	3	40	60	3
6.	22ECC39	Systems and Signal Processing	2	1	-	3	40	60	3
PRACTICALS									
7.	22ITC18	Web Technologies Lab	-	-	3	3	50	50	1.5
8.	22CSC13	Database Systems Lab	-	-	3	3	50	50	1.5
9.		Extra Academic Activities (EEA)-4	-	-	3	-	*APts	-	-
Total			**15**	**5**	**9**	**-**	**340**	**460**	**23**
Clock Hours Per Week: 29									

L: Lecture **D: Drawing** **CIE: CIE**
T: Tutorial **P: Practical/Project** **SEE: Semester End Examination**
Seminar/Dissertation

*** Activity points as per institutional guidelines**

22CSC10

COMPUTER ORGANIZATION AND ARCHITECTURE

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

Pre-Requisites: Digital Logic Design

Course Objectives: This course aims to:
1. The course aims to introduce principles of computer organization and basic architectural concepts.
2. It begins with the basic organization, design, and programming of a simple digital computer and introducessimple register transfer language to specify various computer operations.
3. Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining andI/O systems, and multiprocessors.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the basics of instructions sets and their impact on processor design.
2. Demonstrate an understanding of the design of the functional units of a digital computer system.
3. Evaluate cost performance and design trade-offs in designing and constructing a computer processor.
4. Design a pipeline for consistent execution of instructions with minimum hazards.
5. Understand how to perform computer arithmetic operations, pipeline procedures, and multiprocessors.

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

UNIT–I

Introduction to Computer Architecture: Introduction to Computer Architecture, Flynn's Classification of Computers, Performance Metrics (like Latency, throughput), Fundamental Blocks of Computer (like CPU, I/O subsystems, memory, control unit).

UNIT–II

Instruction Set Architecture (ISA): Introduction to Instruction Set Types of ISA; RISC, CISC., Registers, Common bus structure, Instruction Execution Cycle, Addressing Modes, Register Transfer Language (RTL), 8086Architecture, ARM Architecture.

UNIT–III

Data Representation: Data Type Representation, Floating-point Addition, Multiplication, Division.

UNIT–IV

Pipelining: Pipelining (Basics, Types, stalling, and forwarding), Throughput and Speedup of Pipelining, Pipelining Hazards.

UNIT–V

Data Level parallelism: Data Level Parallelism (DLP) (Introduction, Loop Level Parallelism), Vector Architecture, SIMD Instruction Set: Used for Multimedia, Graphics Processing Unit (GPU) (Introduction, GPU Memory Hierarchy), CUDA Programming (Introduction, Code samples of PDA and FPGA).

Text Books:

1. J.L. Hennessy and D.A. Patterson, "Computer Architecture: A Quantitative Approach", 5th edition, MorganKauffmann Publishers, 2012.
2. M. Morris Mano, "Computer System Architecture", Pearson Publication, 3rd edition, 2017.
3. Jon Stokes, "Inside the Machine: An Illustrated Introduction to Microprocessors and Computer

Architecture", No Starch Press, 1st edition, 2015.

4. Noam Nisan and Shimon Schocken, "The Elements of Computing Systems: Building a Modern Computer

from First Principles", The MIT Press, 2nd edition, 2021.

Suggested Reading:

1. Car Hamacher, Zvonks Vranesic, Safea Zaky, "Computer Organization", McGraw Hill, 5th Edition, 2011.
2. William Stallings, "Computer Organization and Architecture", Pearson/PHI, 6th Edition, 2007.
3. Andrew S. Tanenbaum, "Structured Computer Organization", PHI/Pearson, 6th Edition, 2013.

Online Resources:

1. http://www.geeksforgeeks.org/computer-organization-and-architecture-gq/
2. https://www.cs.virginia.edu/c++programdesign/slides/pdf/bw01.pdf
3. ttps://www.tutorialspoint.com/computer_organization/index.asp
4. https://sites.google.com/site/uopcog/

22CSC11

DATA BASE MANAGEMENT SYSTEMS
(Common to CSE, CSM, AIML, CET, IT, AIDS)

Instruction	3L 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 ofdatabase 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: Upon 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, transactionprocessing, and concurrency control and recovery mechanisms.
5. Analyze 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	2	2	3
CO 2	2	3	2	2	3	-	-	-	-	-	-	1	2	2	2
CO 3	2	1	2	1	3	-	-	-	-	-	-	-	2	3	2
CO 4	2	1	1	-	-	-	-	-	-	-	-	-	3	3	3
CO 5	2	1	-	1	-	-	-	-	-	-	-	-	3	3	2

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 interfacingwith 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;

Concurrency 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, 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) 1stEdition.

Online Resources:

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

22CSC12

FORMAL LANGUAGE AND AUTOMATA THEORY

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

Pre-Requisites: Discrete Mathematics, Data Structures, Design and Analysis of Algorithms

Course Objectives: This course aims to:

1. Identify the hierarchy of formal languages, grammars, and design finite automata to accept a set of strings ofa language.
2. Examine regular expressions, context free grammars and normal forms.
3. Study equivalence of languages accepted by Push down Automata and distinguishes between ComputabilityVs Non-computability and Decidability Vs Undecidability.

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

1. Describe language basics like Alphabet, strings, grammars, productions, derivations, and Chomsky hierarchy.
2. Recognize regular expressions, formulate, and build equivalent finite automata for various languages.
3. Identify closure, decision properties of the languages and prove the membership.
4. Demonstrate context-free grammars, check the ambiguity of the grammars and design equivalent PDA toaccept.
5. Use mathematical tools, abstract machine models to solve complex problems and distinguish decidable andundecidability of a problem.

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

UNIT–I

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Finite automata: Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA) and equivalence with DFA, Equivalence and Minimization of Automata, Introduction to Mealy and Moore machine.

UNIT–II

Regular Expressions, Languages and Finite Automata: Converting DFA's to Regular Expressions by eliminating states, Converting Regular Expressions to Automata, Applications of Regular Expressions, Algebraic Laws for Regular Expressions. **Properties of Regular Languages:** The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties and Decision Properties of Regular Languages.

UNIT–III

Context-free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

UNIT–IV

Context-sensitive Languages: Context-sensitive grammars (CSG), linear bounded automata and equivalence with CSG. **Turing Machines:** The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines,nondeterministic TMs and equivalence with deterministic TMs.

UNIT–V

Unrestricted grammars and equivalence with Turing machines, TMs as enumerators.
Undecidability: Universal Turing machine, Diagonalization Languages, reduction between languages and Rice stheorem, PCP and Modified PCP, Various translators.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages andComputation", Pearson Education, 3rd edition, 2012.
2. Michael Sipser, "Introduction to the Theory of Computation", PWS Publishing, 3rd edition, 2012

Suggested Reading:

1. Harry R. Lewis and Christos H. Papadimitriou, "Elements of the Theory of Computation", Pearson Education Asia. 2003.
2. John C Martin. "Introduction to Language and Theory of Computation", TMH, 3rd edition, 2007.
3. Daniel Cohen, "Introduction to Computer Theory", Wiley Publications, 2nd edition, 2007.
4. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", Prentice Hall of India, 3rd edition, 2008.
5. Shyamalendra Kandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson,1st edition, 2013.
6. Kamala Krithivasan, Rama R. "Introduction to Automata Theory, and Computation", Pearson, 1st edition, 2009.

Online Resources:

1. http://courses.cs.vt.edu/cs4114/spring2012/index.php
2. www.pearsoned.co.in/KamalaKrithivasan

22MTC12

PROBABILITY AND STATISTICS

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

Course Objectives: This course aims to
1. Able to learn and Analyzing data in Linear and Non-Linear form.
2. Able to learn methods to solve bivariate probability functions.
3. To explain hypothetical data using probability distribution
4. To discuss the testing of hypothesis of sample data.
5. Able to formulate and get the solution of real world problem.

Course Outcomes: Upon completion of this course, students will be able to:
1. Analyze the coefficient of skewness and fitting of the data by various methods
2. Estimate the marginal probabilities of statistical averages.
3. Use the basic probability for fitting the Random phenomenon.
4. Apply various tests for testing the significance of sample data.
5. Analyse the random phenomena of real world data.

CO-PO Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	-	-	-	-	-	-	-	2	2	1	-
CO 2	3	3	2	3	-	-	-	-	-	-	-	2	2	1	-
CO 3	3	3	2	3	-	-	-	-	-	-	-	2	2	1	-
CO 4	3	3	3	3	-	-	-	-	-	-	-	2	2	1	-
CO 5	3	3	2	3	-	-	-	-	-	-	-	2	2	1	-

UNIT-I

Basic Statistics: Measures of Central Tendency, Measures of Dispersion, Moments (Moments about the mean andmoments about a point), Skewness, Karl Pearson's coefficient of skewness and Bowley's coefficient of skewnessfor 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 line and Exponential curve.

UNIT-II

Univariate and Bivariate 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 and co-variance. Two-dimensional orJoint Probability Mass Function, Two-dimensional Distribution Function, , Joint Density Function, Marginal Density Function, The Conditional Distribution Function, and Conditional Probability Density Function, Stochastic Independence.

UNIT-III

Probability Distributions: Discrete probability distribution: Poisson distribution, Mean, Variance, MGF, CGF, fitting of Poisson distribution. Continuous probability distributions: Normal distribution, Standard Normal randomvariable, Expectation, Variance, MGF (with out proof), CGF, Properties of Normal Curve and Areas under Normalcurve. Exponential distribution, Expectation, Variance, MGF, CGF.

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 oftwo population variances. Chi-Square test.

UNIT-V

Analysis of Variance and Time Series: One way classification-Assumptions for ANOVA Test-ANOVA for fixedeffect model-Two way classification-ANOVA for fixed effect model-Components of Time series-Measurement of Trend- Method of semi Averages- Moving Averages Method.

Text Books:

1. S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. Sheldon Ross, "A First Course in Probability", Pearson publications, 9th Edition, 2014.

Suggested Reading:

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 3rd Ed., 1968.
2. S.C.Gupta, V.K.Kapoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, 2014.

22ITC17

WEB TECHNOLOGIES
(Common to CSE, AI&DS and CET branches)

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. Understand how HTML, CSS, javascript and Bootstrap work together.
2. Explore various features of JS and its functionality.
3. Understand the basics of mongodb and its Data Model.
4. Comprehend the new features of JS, role of React JS in responsive web application development.
5. Familiarize with configuration of NPM and backend integration with NODE JS and Express JS.

Course Outcomes: Upon completion of this course, students will be able to:
1. Create web pages with good aesthetic sense of design using HTML CSS3, Bootstrap and popular themes.
2. Use JS in Validations and DOM manipulation.
3. Design Schema and perform CRUD operations from UI components.
4. Become an agile practitioner with the ability to quickly complete projects using ReactJS.
5. Build an end-to-end application from scratch using React JS, NODE JS, Express JS and Mongo DB.

CO-PO Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	1	1	-	-	-	1	1	1	1	3	-	3
CO 2	2	1	2	1	2	-	-	-	-	-	1	-	2	-	3
CO 3	2	1	2	2	1	-	-	-	-	-	-	-	3	-	3
CO 4	2	1	1	1	1	-	-	-	-	-	-	1	1	-	3
CO 5	2	1	1	1	1	-	-	-	-	-	-	1	1	-	3

UNIT-I

Introduction: Web Fundamentals, **HTML 5.0:** basic tags, Images, Tables, Lists, Forms, Layout, Graphics, spanand div tags. Grid, **Introduction to Cascading Style Sheets:** Types of CSS**,** text and font, color**,** CSS Selectors, CSS BOX Model, CSS Positioning, and CSS floating.

Bootstrap: Introduction of Bootstrap, Container and Container-fluid, Jumbotron, Grid, Table, Form, Alert,Navbar, Modals.

UNIT-II

Java Script: Introduction, data types, control structures, functions, arrays, objects, regular expressions, working with events, form validation, DOM Elements, Accessing and modifying Elements using DOM, Dynamic documentwith Java script.

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UNIT-III

MongoDB: Introduction, Importance of NoSQL databases, Data types, Documents, nested Documents, CRUD Operations, Basic cursor methods: map, to Array, pretty, for Each, limit, count, sort, Columnar Databases, Indexing and Aggregation, MongoDB Node JS Drivers and CAP theorem.

UNIT-IV

ReactJS: ES5 vs Es6, Scoping - var vs let vs const, Arrow functions, Use of this keyword (lexical scoping), Spread& rest parameter, Array & object destructure, module import and export, State, Props,

Components, Lifecycle, Stateful and stateless components, Events, Router, Forms, Tables, Portals, CSS, Hook and new Features added inrecent versions.

UNIT-V

NodeJS: Creating Web Server, Functions, Buffer, Node Modules, Creating Web Server, Handling HTTP requests;**ExpressJS:** API methods - GET, POST, PUT, DELETE, Request & response objects, URL and Query parameters,Routing, Templates, middleware and the model-view-controller pattern.

Text Books:

1. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React,and Node", second Edition, Apress Publications, 2019.
2. David Hows, Peter Membrey, EelcoPlugge – "MongoDB Basics", Apress, 2014.

Suggested Reading:

1. Ethan Brown, "Web Development with Node and Express", Oreilly Publishers, First Edition, 2014.
2. Shelly Powers, "Learning Node: Moving to the Server-Side", 2nd Edition, O"REILLY, 2016.
3. Simon D. Holmes and Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Second

Edition, Manning Publications, 2019

4. Brad Dayley, "Node.js, MongoDB and Angular Web Development", 2nd Edition, Addison-WesleyProfessional, 2017.

Online Resources:

1. https://web.stanford.edu/class/cs142/index.html
2. https://nodejs.org/en/docs/
3. https://www.mongodb.com/
4. https://reactjs.org/
5. https://getbootstrap.com/docs/5.0/utilities/api/
6. https://edu.anarchocopy.org/Programming%20Languages/Node/Pro%20MERN%20Stack,%202nd%20 Edition.pdf

22ECC39

SYSTEMS AND SIGNAL PROCESSING
(Common to CSE, AI&DS, AIML)

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

Prerequisite: Knowledge of Differential and Integral Calculus.

Course Objectives: This course aims to:

1. Know Signals and systems representation/classification and also the time and frequency domain analysisof continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. Understand Sampling, time and frequency domain analysis of discrete time signals with DTFT, DFT andZ-Transforms.
3. Understand concepts of convolution integrals.

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

1. Classify signals, analyse the signals using Transform techniques.
2. Evaluate signal characteristics in frequency domain.
3. Assess the system stability and causality using ROC and Pole-Zero Plot.
4. Classify systems and analyse the signals using Transform techniques.
5. Describe and analyse the DT Signal/systems using DFT, DCT, DWT, FFT and Z-Transform.

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

UNIT-I

Continuous Time Signals: Introduction to signals, signal representations and classification.

Fourier Series: Exponential Fourier series, Amplitude and Phase spectra. Power Spectral Density.

UNIT-II

Fourier Transforms: Direct Fourier transforms, Inverse Fourier transforms, Existence, Frequency spectrum andproperties of Fourier Transforms, FT of basic signals, Energy Spectral Density.

UNIT-III

Laplace Transforms: Laplace transforms. Region of convergence and its properties. Properties of Laplacetransform, Inverse Laplace transform, Laplace transform of periodic signals.

UNIT-IV

Z–Transform: Direct Z-Transform, Region of convergence and its properties. Z–Transform properties. InverseZ–Transform, Discrete Fourier Transform, Properties of Discrete Fourier Transform, FFT, DCT and DWT.

UNIT-V

Continuous & Discrete Systems: Introduction to systems, System classifications-Linear, Causal, Stable, Time-invariant, Impulse response, System transfer function, Distortion less system, Non-linear systems- Filters.

Text Books:

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. Simon Haykin, "Signals and Systems", Wiley India, 5th Edition, 2009.

Suggested Reading:

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawad, "Signals and Systems", PHI 2nd Edition, 2015.
2. M. J. Robert, "Fundamentals of signals and systems", McGraw Hill, 2008.

22ITC18

WEB TECHNOLOGIES LAB
(Common to CSE, AI&DS and CET branches)

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

Course Objectives: This course aims to:
1. To build Strong expertise to develop front end application using HTML5 and CSS3.
2. To become proficient in Bootstrap concepts.
3. To comprehend NoSQL Databases and MongoDB.
4. To understand core features of JavaScript and React JS.
5. To learn Express JS and Node JS frameworks to develop responsive web applications.

Course Outcomes: Upon completion of this course, students will be able to:
1. Build interactive and user-friendly static frontend UI applications using HTML, CSS and JavaScript.
2. Develop a web page based on Bootstrap.
3. Use MongoDB concepts in Web Application Development using React JS.
4. Create Single Page and multi-page Applications using React, Node JS, Express JS and MongoDB.
5. Implement MVC and responsive design to scale well across PC, tablet and Mobile Phone.

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

List of Experiments:

(Note: Setup a Node JS server in Visual Studio to run the following experiments applications)
1. Build a basic static website using HTML5, CSS3 and bootstrap components.
2. Navigate to a particular element using DOM (Document Object Model) and modify it. Also understand thedifference between a real DOM and Virtual DOM.
3. Explore the new features introduced in ES5 to recent.
4. Write React Class and functional Components and pass props.
5. Design a college admission enquiry form and store details in mongoDB using states and events as a ReactFunctional Component.
6. Write code to illustrate the lifecycle of React JS.
7. Write code to understand different hooks in React JS.
8. Implement Routing in React JS.
9. Develop a CRUD Application using MERN.
10. Develop an Attendance Management Module for student attendance entry and Verifying attendance bystudents using MongoDB, Express JS, React JS and Node JS (MERN).

Text Books:
1. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and React JS Web Development", 2nd edition, Perason Education, 2018.

2. Alex Banks, Eve Porcello, “Learning React Modern Patterns for Developing React Apps”, 2nd Edition,Oreilly Media Inc, 2020.

Suggested Reading:

1. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React,and Node", second Edition, Apress Publications, 2019.

Online Resources:

1. https://github.com/eggheadio/illustrated-dev/blob/master/content/explainers/react-vdom/index.mdx
2. https://legacy.reactjs.org/docs/jsx-in-depth.html#props-default-to-true
3. https://react.dev/learn/tutorial-tic-tac-toe

22CSC13

DATABASE SYSTEMS LAB

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

Course Objectives: This course aims to:
1. Become familiar with the features of MySQL / PostgreSQL / MongoDB /Oracle.
2. Explore ER tools for MongoDB.
3. Understand about data storage techniques and indexing.

Course Outcomes: Upon completion of this course, students will be able to:
1. Design database schema for an application using MYSQL.
2. Write SQL queries for tasks of various complexities.
3. Create indices for query optimization.
4. Evaluate various database management systems.
5. Design and develop applications to solve real time problems.

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

LIST OF EXPERIMENTS:
1. Exploring the features of MySQL / PostgreSQL / MongoDB /Oracle.
2. Installation of Mongo DB
3. Tutorial on PostgreSQL / MySQL / SQLite in W3Schools or any other platform (2 Weeks)
4. Exercises on SQL queries for various tasks.(2-3 Weeks).
5. Exercises on triggers and cursors
6. Practice interfacing with a database from a program using connectors like JDBC/ODBC.
7. Small exercises on MongoDB
8. Exercise in ER design for an application starting with natural language description
9. Convert ER design to tables
10. Visualization of B+ tree using any simulation code.
11. Sample Queries to explain the benefits of indexing.
12. Case study on development of applications to solve real time problems.

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

Suggested Reading:
1. "The Language of SQL (Learning)" by Larry Rockoff
2. MongoDB Fundamentals: A hands-on guide to using MongoDB and Atlas in the real world

Online Resources:
1. https://www.mongodb.com/docs/manual/tutorial/query-documents/
https://www.cs.usfca.edu/~galles/visualization/BPlusTree.html

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTIONS AND EXAMINATION

(Inline with AICTE Model Curriculum with effect from AY 2024-25)
(R22 Regulation)

B.E. (Computer Science and Engineering)

SEMESTER - V

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.	22ITC10	Computer Networks	3	-	-	3	40	60	3
2.	22CSC15N	Operating Systems	3	-	-	3	40	60	3
3.	22CSC21	Software Engineering	3	-	-	3	40	60	3
4.	22CSC14N	Design and Analysis of Algorithms	3	-	-	3	40	60	3
5.	22CSEXX	Professional Elective Course-I	3	-	-	3	40	60	3
6.	22XXXXX	Open Elective Course - I	3	-	-	3	40	60	3
PRACTICAL									
7.	22ITC11	Computer Networks Lab	-	-	2	3	50	50	1
8.	22CSC18N	Operating Systems Lab	-	-	2	3	50	50	1
9.	22CSC23	Case Tools Lab	-	-	2	3	50	50	1
10.	22CSI02	Industrial / Rural Internship	3 to 4 weeks / 90 Hours			-	50	-	2
Total			**18**	**-**	**6**	**-**	**440**	**510**	**23**

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

Professional Elective – I	
22ADE12	Big Data Analytics
22CAE17	Image Processing
22CSE01	Computer Graphics and Multimedia
22CSE02	Microprocessors and Microcontrollers
22CSE03	Optimization Techniques

Open Elective - I	
22CEO02	Disaster Risk Reduction and Management
22MEO06	Principles of Entrepreneurship and Startups
22ECO05	Principles of Embedded Systems
22BTO01	Biology For Engineers
22CHO04	Environmental and Sustainable Development

22ITC10

COMPUTER NETWORKS

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. To understand the basics of Layering Concepts, Physical layer, data transmission, transmission media.
2. To demonstrate the state-of-the-art knowledge on Data Link Layer Concepts.
3. To distinguish the different types of networks and Network Layer in the Internet.
4. To introduce Transport Layer basics, UDP and TCP Protocols.
5. To know the concepts of Application Layer Protocols.

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

1. Illustrate the functions of each layer in the OSI and TCP/IP reference models and demonstrate the concepts of Physical Layer.
2. Analyze the Data Link Layer protocols and MAC mechanisms.
3. Evaluate the Network Layer Issues and to avoid Congestion in Networks.
4. Exemplify the functions and performance of Internet Transport Protocols TCP and UDP.
5. Explore the various Application layer protocols.

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	1	0	0	0	0	0	0	1	-	-	-
CO 2	3	2	1	1	1	0	0	0	0	0	0	1	-	-	-
CO 3	3	2	1	1	1	0	0	0	0	0	0	1	-	-	-
CO 4	3	2	1	2	1	0	0	0	0	0	0	1	-	-	-
CO 5	2	2	1	2	1	0	0	1	0	0	0	1	-	-	-

UNIT-I

Introduction: Network Hardware, Network Topologies, Reference models- The OSI Reference Model- the TCP/IP Reference Model – A Comparison of the OSI and TCP/IP Reference, Basics of Packet Switching, Circuit Switching and Virtual Circuit switching, Models. **Physical Layer:** Guided Transmission media, Twisted Pairs, Coaxial Cable, Fiber Optics, Wireless transmission.

UNIT-II

Data Link Layer: Design issues, Framing, Error detection and correction, Elementary data link protocols: simplex protocol, A Simplex Stop and Wait Protocol for an Error-free channel, A Simplex Stop and Wait Protocol for Noisy Channel, Sliding Window protocols: A One-Bit Sliding Window Protocol, A protocol using Go-Back-N, A Protocol using Selective Repeat, Example data link protocols, Medium Access Sub Layer: The Channel allocation problem, Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols, Collision Free Protocols, Ethernet.

UNIT-III

Network Layer: Design Issues, Routing algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, OSPF, BGP, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the Internet- The IP Version 4 Protocol, Fragmentation and IP Addresses, CIDR Notation, IP Version 6, Internet Control Protocols, Basics of IP Support Protocols (ARP, RARP, DHCP, ICMP), Network Address Translation (NAT).

UNIT-IV

Transport Layer: Transport Service, Transport Service Primitives, Berkeley Sockets, TCP/ UDP Sockets, Elements of Transport protocols, The Internet Transport Protocols: UDP, TCP - Introduction to UDP, Real Time Transport Protocols, Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, The TCP Connection Establishment, TCP Connection Release, TCP Sliding Window, TCP Timer Management, TCP Flow Control, Congestion Control.

UNIT-V

Application Layer: DNS, The Domain Name System, The DNS Name Space, Domain Resource Records, Name Servers. **Electronic MAIL:** Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery. **The World Wide Web** - Architectural Overview, Streaming Audio and Video: Streaming Stored Media, Streaming Live Media, Content Delivery.

Text Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2014.

Suggested Reading:

1. Chwan-Hwa (John) Wu, J. David Irwin, "Introduction to Computer Networks and Cyber Security", CRC Press, 2013.
2. W. Richard Stevens, "Unix Network Programming", Prentice Hall/Pearson Education, 2009.
3. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 5th Edition, Addison-Wesley, 2012.
4. Larry L. Peterson and Bruce S. Davie "Computer Networks: A Systems Approach", 5e, 2018.
5. Behrouz A. Forouzan "Data Communications and Networking", Fourth Edition, 2007.

Online Resources:

1. https://nptel.ac.in/courses/117105148
2. https://www.ibm.com/docs/en/i/7.1?topic=communications-socket-programming
3. Web Resources for Computer Networks, 5 (vu.nl)

22CSC15N

OPERATING SYSTEMS

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

Prerequisite: 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: Upon 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 security as well as recovery features in the designing Operating system.

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

UNIT – I

Introduction to Operating Systems: Computer System overview, Components of a computer system, functions of OS, Examples and 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 and 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.

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 and Case Studies: Types of threats in OS, basic security mechanisms, malware taxonomy, viruses, worms, and rootkits;

Defense: Overview, logging, auditing, and recovery, OS-level memory protection. Linux/Unix OS Design and architecture, Unix Shell.

Text Books:

1. Galvin, Silberschatz, "Operating system Concepts", 10th Edition, John Wiley & Sons, 2018.
2. William Stallings, "Operating Systems Internals and Design Principles" Pearson Edition, 2012.
3. Ekta Walia Khanna, "Operating System Concepts", 2nd Edition, Publishing House, 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", 3rd Edition, Pearson Education India; 2013.
2. Maurice J. Bach, "Design of the UNIX Operating System", 1st Edition, Pearson Education India, 2015.

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).

22CSC21

SOFTWARE ENGINEERING

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

Pre-requisites: Object-oriented programming, Programming for problem-solving, database management systems.

Course Objectives: This course aims to:
1. Understand the Software Engineering Practice and Process Models.
2. Understand Design Engineering and Project Management in Software Development.
3. Understand the importance of testing in software development and study various testing strategies and software quality metrics.

Course Outcomes: Upon completion of this course, students will be able to:
1. Acquire a working knowledge of software processes and models for each phase of software development.
2. Understand the agile Software process models and demonstrate the skills necessary to specify the requirements.
3. Recall the modelling concepts and estimate the cost of software using empirical models.
4. Enlist the design principles and construct a product using coding principles and standards.
5. Develop test cases and acquire skills necessary for independently developing a complete software project and estimate software quality.

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

UNIT - I

Introduction to Software Engineering: Software Engineering Practice, The Software Process, Software **Engineering Practice Process Models:** A Generic Process Model, Process assessment and Improvement, **Prescriptive Process Models:** Waterfall Model, Incremental Process Models, RAD Model, Evolutionary Process Models - Prototyping, The Spiral Model, Specialized Process Models.

UNIT - II

An Agile Development: Agility, Agile Process, and Agile Process Models, Extreme Programming (XP), Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Feature Driven Development (FDD), Agile Modelling (AM), Requirement Engineering, Establishing the groundwork, Eliciting Requirements, Negotiating Requirements, and Validating Requirements. Software Requirements Analysis and Specification: Value of a Good SRS, Problem Analysis, Requirements Specification.

UNIT - III

Planning a software Project: Effort Estimation, Project Schedule and Staffing, Quality Planning, Risk Management.

Estimation for Software Projects: Decomposition Techniques - Software Sizing, Problem-Based Estimation, an Example of LOC-Based Estimation, an Example of FP-Based Estimation, COCOMO Model

UNIT - IV

Design Concepts: Flow-oriented modelling (DFDs), Coupling, Cohesion, Function-Oriented Design - Structure Charts, Structured Design Methodology, An Example, Software Architecture, a Brief Taxonomy of Architectural Styles. Component-Level Design: Definition, Basic Design Principles, Design Guidelines, Designing Traditional Components, Coding Principles and guidelines, Incremental Development of Code, Code Inspection – Planning.

UNIT - V

Testing: Testing Concepts, Testing Process, Testing Strategies: A Strategic approach to software testing, strategic issues, test strategies for Conventional Software, Validation Testing, System Testing, White Box Testing, Black Box. Automatic vs. Manual Testing, Software Review Techniques - Informal Reviews Formal Technical Reviews, Quality Concepts - What is Quality, Software Quality, Objectives, Software Quality Attributes (McCall's,HP)Deployment overview, Deployment planning, Deployment Rollback.

Text Books:

1. Roger S. Pressman "Software Engineering: A practitioner's approach", McGraw Hill, 7th Edition, 2010.
2. Pankaj Jalote, "Software Engineering Precise Approach", Wiley Publishers, 2012

Suggested Reading:

1. Sommerville "Software Engineering", 10th Edition, Pearson, 2016.
2. Rajib Mal "Fundamental of Software Engineering", 4th Edition, PHI Learning, 2014.
3. Software Engineering Fundamentals - Hardcover - Ali Behforooz; Frederick J. Hudson

Online Resources:

1. https://nptel.ac.in/courses/106101061/
2. Udemy:https://www.udemy.com/share/101BHy3@YYJn8BxwvS6cGfnCsiIlxyA-lUjwZmA2xN5WmMbd8hlGxwhc4N0DF7KaEOaz4eDnMg==/

22CSC14N

DESIGN AND ANALYSIS OF ALGORITHMS

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

Pre-requisites: Basics of Data structures and algorithms.

Course Objectives: This course aims to:
1. To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms.
2. To introduce the different algorithmic approaches for problem solving through numerous example problems.
3. To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

Course Outcomes: Upon completion of this course, students will be able to:
1. Identify and apply asymptotic notations to measure the performance of algorithms.
2. Describe the algorithmic design techniques of divide and conquer, greedy, dynamic programming, backtracking and branch and bound to solve problems.
3. Apply suitable algorithmic design techniques to solve problems to get optimal solution.
4. Analyze the performance of algorithmic design techniques.
5. Evaluate the efficiency of alternative solutions derived for a problem by applying various algorithmic design techniques.
6. Formulate approximate solutions to NP problem.

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	1	1	-	-	-	-	-	-	-	-	-	2	1	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	-	2	1	-
CO 3	2	2	2	-	-	-	-	-	-	-	-	-	2	1	-
CO 4	2	2	1	-	-	-	-	-	-	-	-	-	2	1	-
CO 5	2	2	1	-	-	-	-	-	-	-	-	-	2	1	-
CO 6	2	3	1	-	-	-	-	-	-	-	-	-	2	1	-

UNIT - I

Introduction: Characteristics of algorithm. **Analysis of algorithm:** Asymptotic analysis of complexity bounds – best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs. **Divide and Conquer:** The general method, Minimum and Maximum Problem, Strassen's algorithm for matrix multiplication.

Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT - II

Greedy Algorithms: The general method, Knapsack Problem, Huffman Codes, Job scheduling with deadlines. **Dynamic Programming**: The general method, 0/1 Knapsack, Travelling Salesman Problem, Matrix chain multiplication, Longest Common subsequence, Optimal Binary search tree.

UNIT - III

Backtracking: The general Method, 8-Queens Problem, Graph Coloring, and Hamiltonian Cycle.

Branch-and-Bound: The general method, FIFO branch and bound, LC branch and bound, 0/1 Knapsack Problem, Travelling Salesperson problem.

UNIT - IV

Graph Algorithms: Applications of DFS: Bi-Connected components, strongly connected components, topological sorting.

Shortest Path Algorithms: Dijkstra's, Bellman-Ford, Floyd-Warshall and Johnson's algorithms.

UNIT - V

Theory of NP-Completeness: Polynomial time, Polynomial time verification, P, NP, NP-hard and NP-Complete classes, NP-Completeness and Reducibility.

Standard NP-Complete Problems and Reduction Techniques: The Clique Problem, vertex-cover and Subset Sum Problem.

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", 4th Edition, MIT Press/McGraw-Hill, 2022.
2. E. Horowitz, sartaj sahni and sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press, 2008.

Suggested Reading:

1. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis", and Internet Examples, Wiley Second Edition.

Online Resources:

1. https://nptel.ac.in/courses/106101060/

22ADE12

BIG DATA ANALYTICS
(Professional Elective-I)

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 the importance of big data and role of Hadoop framework in analyzing large datasets by writing mapper and reducer for a given problem.
2. Familiarize writing queries in Pig and Hive to process big data
3. Present the latest big data frameworks and applications using Spark and Scala.
4. Discuss the concept and writing applications using SparkSQL.
5. Investigate the integration of Kafka with other streaming frameworks like Apache Spark and Apache Flink.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the processing of large datasets in Hadoop framework and Apply MapReduce architecture to solve real world problems.
2. Develop scripts using Pig over large datasets and query using Hive.
3. Understand the Implementation of Spark and the Scala programming.
4. Expertise in using Resilient Distributed Datasets (RDD) for creating applications in Spark and query \using SparkSQL.
5. Apply streaming technologies in real-time data processing.

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	3	3	3	1	0	0	0	0	2	0	3	1	-	1
CO 2	2	3	2	3	1	3	0	0	0	2	0	3	2	2	2
CO 3	2	3	2	3	3	3	3	3	0	2	3	3	1	-	1
CO 4	2	3	2	3	3	3	3	3	0	2	3	3	2	1	2
CO 5	2	3	2	3	3	3	3	3	0	2	3	3	2	2	2

UNIT-I

Introduction to Big Data: Introduction, Big Data Enabling Technologies, Hadoop Stack for Big Data. **The Hadoop Distributed Files system:** Overview, The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop File systems. **MapReduce:** Overview, Developing a MapReduce Application, How MapReduce works, MapReduce Types and Formats, MapReduce Features, MapReduce Examples.

UNIT-II

Pig: Generating Examples, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators, Pig in Practice. **Hive:** Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function.

UNIT-III

Parallel programming with Spark: Overview of Spark, Fundamentals of Scala and functional programming, Spark concepts - Resilient Distributed Datasets (RDD), creating RDDs, Basic Transformations, Basic Actions, Word Count example; Spark operations, Job execution, Spark Applications : Cluster computing with working sets. **Spark SQL:** What is SQL, Big Data and SQL: Spark SQL, Creating DataFrames, Dataframes Operations, How to Run Spark SQL Queries, Tables, Views, Databases, Select Statements.

UNIT-IV

Machine Learning with Spark: Designing a Machine Learning System, Obtaining, Processing and Preparing Data with Spark, Building a Recommendation Engine with Spark, Building a Classification Model with Spark, Building a Regression Model with Spark and Building a Clustering Model with Spark. **Spark GraphX & Graph Analytics**: *GraphX* : Introduction, Graphs in Machine Learning Landscape, Graph-structured data, PageRank, *Graph Analytics*: Property Graphs, Graph Operators, Distributed Graphs, GraphX Unified Analytics; *Case Study*: Flight Data Analysis using Spark GraphX.

UNIT-V

Streaming: Introduction to Stream Processing, Batch processing vs. stream processing, Spark structured streaming API, use case using Spark streaming. **Apache Kafka Fundamentals:** Architecture, Brokers, Topics, Partitions, Producers, Consumers, Kafka Connect and Kafka Streams. **Advanced Kafka Features:** xactly-Once Semantics, Kafka Transactions, Tiered Storage, Integrating Kafka with Apache Spark and Apache Flink, Integrating Kafka with Spark Streaming, Real-time Analytics Use Cases with Kafka such as Fraud Detection, Clickstream Analysis, Real-time Monitoring.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2015.
2. Bill Chambers, Matei Zaharia, “Spark: The Definitive Guide”, 4th Edition, O'Reilly Media Inc, 2018.
3. Anand Rajaraman and Jeffrey David Ullman,”Mining of Massive Datasets”, 2nd Edition, Cambridge University Press, 2014.
4. Neha Narkhede, Gwen Shapira, Todd Palino, "Kafka: The Definitive Guide", 2nd Edition, O'Reilly Media, 2017
5. Viktor Gamov, "Kafka Streams in Action", 1st Edition, Manning Publications, 2018

Suggested Reading:

1. Thilinagunarathne Hadoop MapReduce v2 Cookbook – 2nd Edition, Packet Publishing, 2015.
2. Chuck Lam, Mark Davis, Ajit Gaddam, “Hadoop in Action”, Manning Publications Company, 2016.
3. Alex Holmes,” Hadoop in Practice”, Manning Publications Company, 2012.
4. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.
5. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Media Inc, October 2012.

Online Resources:

1. http://www.planetcassandra.org/what-is-nosql
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

22CAE17

IMAGE PROCESSING
(Professional Elective-I)

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

Pre-requisites: Signal Processing.

Course Objectives: This course aims to:
1. To introduce basics of visual perception, sampling, quantization and representation of Digital images.
2. To introduce spatial domain and frequency domain filtering techniques necessary for Image processing operations.
3. To learn advanced image analysis techniques such as image restoration, image Compression, image segmentation.
4. To learn techniques of multi resolution methods, wavelets and morphological Processing.
5. To understand the applications of image processing

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the basic image enhancement techniques in spatial & frequency domains.
2. Understand the basics of multi-resolution techniques.
3. Understand the basics of segmentation methods.
4. Apply this concept for image handling in various fields.
5. Knowledge about Morphological operations.

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

UNIT-I

Fundamentals of Image Processing: Introduction, examples, fundamental steps, components, elements of visual perception, light and electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, basic relationships between pixels. **Intensity Transformations and Spatial Filtering**: Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods.

UNIT-II

Filtering in the Frequency Domain: Background, preliminary concepts, sampling and Fourier transform of sampled functions, discrete Fourier transform (DFT) of one variable, extension to functions of two variables, some properties of the 2-D discrete Fourier transform, basics of filtering in the frequency domain, image smoothing, image sharpening, homo- morphic filtering.

UNIT-III

Image Restoration: Noise models, restoration in the presence of noise only-spatial filtering,periodic noise reduction by frequency domain filtering, linear degradation, position-invariant degradation, estimating the degradation function, inverse filtering, minimum mean square error filtering, constrained least squares filtering, geometric mean filter.

UNIT-IV

Wavelets and Multi Resolution Processing: Background, multi-resolution expansions, wavelet transforms in one dimension, the fast wavelet transform, wavelet transforms in two dimensions, wavelet packets**. Image Compression**: Fundamentals, image compression models, elements of information theory, error free compression, lossy compression, image compression standards.

UNIT-V

Image Segmentation: Fundamentals, point, line and edge detection, thresholding, region-based segmentation, segmentation using morphological watersheds, the use of motion in segmentation. **Morphological Image Processing**: Preliminaries, erosion and dilation, opening and closing, the Hit-or-Miss transformation, some basic morphological algorithms, some basic gray-scale morphological algorithms.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, PHI Learning Pvt. Limited, 3rd Edition, 2008.
2. Rafael C.Gonzalez, Richard E.Woods and Steven L.Eddins, Digital Image Processing Using MATLAB,2nd Edition, McGraw Hill, 2010.

Suggested Reading:

1. AL. Bovik, The Essential Guide to Image processing, 2nd Edition, Elsevier, 2009.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", PHI, 2006.
3. William K. Pratt, Digital Image Processing, John Wiley & Sons, Inc., 3rd Edition, 2001

Online Resources:

1. https://www.youtube.com/watch?v=DSGHkvQBMbs&list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8
2. https://archive.nptel.ac.in/courses/117/105/117105135/

22CSE01

COMPUTER GRAPHICS AND MULTIMEDIA
(Professional Elective-I)

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

Prerequisite: Basic knowledge of Mathematics.

Course Objectives:This course aims to:
1. Familiarize the students with fundamental algorithms that are used in interactive graphics systems.
2. Learn algorithms and techniques of fundamental 3D computer graphics and understand the relationship between the 2D and 3D versions of such algorithms.
3. Apply these algorithms and techniques in upcoming real world scenarios.

Course Outcomes: Upon completion of this course, students will be able to:
1. Illustrate the algorithm for drawing 2D Primitives.
2. Implement 2D transformations for an object.
3. Identify the visible and invisible surfaces of 3D objects by using surface detection algorithm.
4. Summarize various compression techniques and color models in multimedia.
5. Develop animation for graphics design problems.

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

UNIT – I
2D PRIMITIVES: Graphics systems, Algorithms for drawing 2D primitives-Line, Circle and Ellipse, Attributes of Output primitives, Applications of computer graphics.

UNIT - II
2D GRAPHICS: Two Dimensional Geometric Transformations, 2D Viewing, 2D Line Clipping, 2D Graphics design software-Inkscape, GIMP, Software.

UNIT – III
3D GRAPHICS: 3D concepts, Object representations, 3D geometric and modeling transformations, 3D Viewing, Visible Surface detection methods.

UNIT – IV
MULTIMEDIA: Multimedia Objects, Graphics and image data representations, Color Models, Compression techniques and standards, Storage and Retrieval technologies, Hypermedia.

UNIT – V
ANIMATION: Animation and Modelling techniques in multimedia, Texture and Shading, Tweening and
Morphing, Lightening and Rendering, Image editing and Manipulation, Interactive animation using authorized tools-Blender, Synfig, Adobe Animate.

Text Books:

1. Donald Hearn and Pauline Baker M, Computer Graphics, Pearson Education, 2014.
2. Andleigh, P. K and Kiran Thakrar, Multimedia Systems and Design, PHI, 1st Edition 2015.

Suggested Reading:

1. Judith Jeffcoate, Multimedia in practice: Technology and Applications, PHI, 2006.
2. Foley, Vandam, Feiner and Hughes, Computer Graphics: Principles and Practice, 2nd Edition, Addison wesley, 2013.
3. Jeffrey McConnel, Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, 2006.
4. William M. Newman and Robert F.Sproul, Principles of Interactive Computer Graphics, Mc Graw Hill 2001.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs115/preview
2. https://nptel.ac.in/courses/106106090

22CSE02

MICROPROCESSORS AND MICROCONTROLLERS
(Professional Elective-I)

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. Learn the architecture and addressing modes of 8086 processor.
2. Understand instruction set of 8086 and learn programming in 8086.
3. Study how interfacing is done with various peripherals and I/O devices.
4. Work on timers and communication interfaces.
5. Understand the microcontrollers, their addressing modes and interfacing with mechanical and electronic Systems.

Course Outcomes: Upon completion of this course, students will be able to:
1. Identify the basic elements and functions of 8086 microprocessors.
2. Write programs in Assembly language and manipulate data.
3. Demonstrate fundamental understanding on the operation between the microprocessor and its interfacing devices.
4. Ability to write complex programs involving interface with various peripheral devices.
5. Demonstrate knowledge in microcontrollers and their usage in dealing with various electromechanical devices.

CO-PO Articulation Matrix

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

UNIT-I

8086 Architecture: Pin Diagram, Architecture, Internal operation, Machine language instructions, Addressing modes, Instruction formats, Instruction execution timing.

Modular Programming: Macros, Directives and Operators, Linking and Relocation.

UNIT-II

Assembler Language Programming: Branch instructions, Loop instructions, NOP and HLT, Flag manipulation instructions, Logical instructions, Shift and Rotate instructions.

Byte and String Manipulation: String instructions, REP prefix.

UNIT-III

Stacks and subroutines, interfacing peripherals - Basic interfacing concepts, interfacing output displays, interfacing input keyboards. Interrupts, Programmable Interrupt Controller (8259A), Direct Memory Access (DMA), DMA Controller (Intel 8257).

UNIT-IV

Interfaces: Programmable Peripheral Interface (Intel 8255 A), Programmable communication interface (Intel 8251), Programmable Interval Timer (Intel 8253 and 8254), Programmable Keyboard / Display controller (Intel 8279).

UNIT-V

Introduction to microcontrollers, 8051 architecture, Instruction set, Addressing modes, programming techniques. Interfacing of LCD, Stepper motor, ADC and DAC.

Text Books:

1. Liu, Gibson. "Microcomputer Systems: The 8086/88 family", 2nd Edition, 2005.
2. Kenneth Ayala "The 8051 Microcontroller: 3rd Edition, Cengage Learning, 2004.
3. 1993Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata Mc Graw Hill, Revised 2nd Edition, 2007.

Suggested Reading:

1. Brey B.Brey, The Intel Microprocessor, 8086/8088,80186/80188,80286,80386,80486, Pentium and Pentium Pro-Processors-Architecture, Programming and interfacing 4th Edition, Prentice Hall.
2. Myke Predko, Programming and customizing the 8051 Microcontroller, Tata McGraw –Hill , 1994.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105102/

22CSE03

OPTIMIZATION TECHNIQUES
(Professional Elective - I)

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

Pre-requisites: Mathematical Foundation for Data Science and Security.

Course Objectives: This course aims to:
1. Identify and develop optimization techniques from the verbal description of real system.
2. Learn different techniques to get optimum solution for a given LPP.
3. Understand the Mathematical representations that are needed to solve the problems.
4. Analyze the results of the different real-world problems.
5. Construct network and find critical path using network scheduling technique

Course Outcomes: Upon completion of this course, students will be able to:
1. Identify the optimum values for given objective function of LPP using Graphical and Simplex approaches.
2. Solve the transportation problem using uv and steppingstone methods for maximize the profit with minimum resources.
3. Determine the optimum feasible solution for assignment and travelling salesman problems and computing the optimal solution for Job sequencing models.
4. Compute the optimum values for given objective function by IPP and optimal strategy for games.
5. Construct a network diagram and Identify critical path using network scheduling by CPM/PERT.

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

UNIT - I

Introduction to Operations Research: Basics definitions, objectives, models, application and limitations. Linear Programming (LP) - Mathematical Formulation of LP Problem (LPP), Graphical Method, Some Exceptional Cases, Simplex Method - Introduction, computational procedure, artificial variables technique - 2-phase method.

UNIT - II

Linear Programming and Transportation Problem: Introduction, Mathematical Formulation of transportation Problem, Balanced / Unbalanced, Minimization / Maximization, Determination of the initial basic feasible solution using North-West Corner Rule, Least cost method and Vogel's approximation method for balanced and unbalanced transportation problems. Optimality Test and obtaining of optimal solution using uv method, Steppingstone method.

UNIT - III

Assignment And Sequencing Problem : Introduction, Mathematical Formulation of Assignment Problem, Hungarian method for optimal solution, solving unbalanced problem, Traveling salesman problem, Sequencing models, Solution of Sequencing Problem, Processing n Jobs through 2 Persons/Machines, Processing n Jobs through 3 Persons/Machines, Processing 2 Jobs through m Persons /machines, Processing n Jobs through m Persons /Machines.

UNIT - IV

Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique. Game and strategies: Introduction, Game with maximin-minimax principle (Pure Strategies), Game with Mixed Strategies, Dominance Property, Linear Programming Approach for Game Theory.

UNIT - V

Construction of Network, Rules & Precautions, C.P.M. & P.E.R.T. Networks, Obtaining of Critical Path, Time estimates for activities, Probability of completion of project, Determination of floats.

Text Books:

1. Kanti Swarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand Publications, 20th Revised Edition.
2. Dr S P Gupta, Dr P K Gupta, 'Quantitative Techniques and Operations Research', Sultan Chand & Sons, 2022.
3. R. Pannerselvam, "Operations Research", PHI, 2nd Edition, 2016.

Suggested Reading:

1. Deb K. "Optimization for Engineering Design Algorithms and Examples", PHI, 2000.
2. Saravanan R. "Manufacturing Optimization through Intelligent Techniques", Taylor & Francis (CRC Press), 2006.
3. Hardley G. "Linear Programming", Narosa Book Distributors Private Ltd., 2002.

Online Resources:

1. https://nptel.ac.in/courses/111105039.
2. https://nptel.ac.in/courses/105108127.

22CEO02

DISASTER RISK REDUCTION AND MANAGEMENT
(Open Elective-I)

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

Course Outcomes: Upon completion of this course, students will be able to:
1. Explain the fundamental concepts of disaster management.
2. Demonstrate the principles and practices of disaster risk reduction management.
3. Identify stress and its management during disaster.
4. Outline institutional frame work at different levels of administration.
5. Evaluate disaster management study including data search, analysis and presentation as a case study.

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

UNIT-I

Fundamental concepts in disaster management: Hazard and disaster-concepts, vulnerability and risk, Hazardand disaster type – Natural, Water- related, pandemic and Human induced hazards disasters. Causes and Impactsof disasters – Impacts on natural eco systems: physical, psychological and social impact. Disaster and financial resilience. Disaster vulnerability profile of India –Specific to geographical regions and states (as per regional significance)

UNIT-II

Disaster Management Cycle: Rescue, Relief, Rehabilitation, Prevention, Mitigation and Preparedness. Disaster risk reduction (DRR). Community based DRR, institutions concerned with safety, disaster mitigation and construction techniques as per Indian standards and Early warning systems

UNIT-III

Disaster Impacts Management: Trauma and stress management, First aid and emergency procedures Awareness generation strategies for the community on safe practices in disaster (as per regional significance)

UNIT-IV

Institutional framework of disaster management in India: NDMA-SDMA, NDRF, civic volunteers, and NIDM. Phases of disaster/risk management and post-disaster responses. Compensation and insurance Applications of remote sensing & GIS in disaster management. Components of disaster management. Preparedness of rescue and relief, mitigation, rehabilitation & reconstruction. Institutional frame work of disaster management in India

UNIT-V

Capacity building for disaster/damage mitigation: Structural and Nonstructural measures forcapacity building for disaster/damage mitigation. Disaster risk reduction strategies and national disaster management guidelines. Disaster management Act -2005. Regional issues as per regional requirement/university can take minimum two topics as per high powered committee

Text Books:

1. Singh, R. (2017), "Disaster management Guidelines for Earth quakes, Landslides, Avalanches andTsunami". Horizon Press publications.
2. Taimpo (2016), "Disaster management and preparedness". CRC Press Publications

Suggested Reading:

1. Nidhi, G.D. (2014), "Disaster management preparedness" .CBS Publications Pvt. Ltd.
2. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S. (2013), "Flood Disaster Risk Management-CBS Publications Pvt Ltd.
3. Singh, R. (2016), "Disaster management Guidelines for Natural Disasters" Oxford University PressPvt. Ltd

Online Resources:

1. https://nptel.ac.in/courses/124107010
2. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

22MEO06

PRINCIPLES OF ENTREPRENEURSHIP AND STARTUPS
(Open Elective-I)

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

Prerequisite: Nil

Course Objectives: This course aims to:
1. Impart basic concepts and procedure of idea generation.
2. Familiarize the nature of industry and related opportunities and challenges.
3. Familiarize with elements of business plan and its procedure.
4. Learn the project management and its techniques.
5. Know the behavioral issues and time management.

Course Outcomes: Upon completion of this course, the students will be able to:
1. Understand the concept and essence of entrepreneurship.
2. Identify business opportunities and nature of enterprise.
3. Analyze the feasibility of new business plan.
4. Apply project management techniques like PERT and CPM for effective planning and execution of projects.
5. Use behavioral, leadership and time management aspects in entrepreneurial journey.

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

UNIT - I

Entrepreneurship: Definition, Characteristics of an Entrepreneur, Functions of Entrepreneurs, Entrepreneur vs. Intrapreneur, First Generation Entrepreneur, Women Entrepreneurship, Ideas and their Sources, Conception and Evaluation of Ideas.

Behavioral Aspects of Entrepreneurs: Personality: Determinants, Attributes and Models, Leadership: Concepts and Models, Values and Attitudes, Motivation Aspects.

UNIT - II

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic Growth, Small Scale Industry in India, objectives, Linkage among Small, Medium and Heavy Industries, Types of Enterprises, Corporate Social Responsibility.

UNIT - III

Business Plan: Introduction, Elements of Business Plan and its salient features, Business Model Canvas, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility Studies, Executive Summary.

UNIT - IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, human aspects of project management.

Time Management: Approaches of Time Management, their strengths and weaknesses. Time Management Matrix, Urgency Addiction.

UNIT - V

Startup: Definition, Startup Ecosystem, Startup Incubator, Need and Importance of Startups and Incubation Centers. Sources of Finance and Incentives for Startups. Innovation, Creativity, Intellectual Property in Entrepreneurial Journey. Business firm Registration Process in INDIA.

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw- Hill Publishing Company Ltd, 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi, 2015.

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5th edition, Tata Mc Graw Hill Publishing Company. Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.

22ECO05

PRINCIPLES OF EMBEDDED SYSTEMS
(Open Elective-I)

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

Prerequisite: Knowledge about computer Architectures, Microprocessors and Microcontrollers.

Course Objectives: This course aims to:
1. Learn the fundamentals of the embedded system design.
2. Learn architecture details of embedded processors
3. Analyze various embedded applications and debugging tools.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand hardware and software details of embedded system.
2. Analyze the architecture and instruction set of embedded processors.
3. Develop the embedded system design cycle
4. Apply various debugging tools for embedded system applications.
5. Design different case studies for embedded applications

CO-PO Articulation Matrix

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

UNIT I

Embedded systems: Embedded systems vs General computing systems, Classifications, Applications areas, Processor embedded into a system, Processor selection for embedded system, embedded hardware units and devices in a system, Design metrics and Challenges in embedded system design.

UNIT II

Embedded Processors: PIC 18 Family Overview, Architecture, Instruction Set, Addressing modes, Timers and Interrupts of PIC 18. Capture/Compare and PWM modules of PIC 18.

UNIT III

Introduction to advanced processor architectures: ARM design philosophy. ARM data flow model, Register organization, Program Status Register, Pipeline, Introduction to exceptions. ARM instruction set, Introduction ARM cortex series, salient features.

UNIT IV

Embedded System Design Cycle: Embedded system design and co-design issues in system development process, Design cycle in the development phase for an embedded system. Embedded software development tools: Host and Target machines, Linker/Locators for embedded software, embedded software into the target system.

UNIT V

Debugging tools and Applications: Integration and testing of embedded hardware, testing methods, Debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, Simulator, Emulator and In-Circuit Emulator, IDE.

Case Studies: Design of Embedded Systems using Microcontrollers – for applications in the area of communications and automotives. (GSM/GPRS, CAN, Zigbee).

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design," 3/e, Tata McGraw Hill Education, 2015.
2. Andrew N.SLOSS, DomonicSymes Chris Wright "ARM System Developers Guide- Designing and optimizing system software" ELSEVIER 1st Edition2004.
3. Mazidi, MCKinlay and Danny Causey, "PIC Microcontrollers and Embedded Systems", Pearson Education. 2008

Suggested Readings:

1. David E.Simon, "An Embedded software primer", Pearson Education,2004.
2. Steve Furber "ARM System on Chip Architecture" 2/e Pearson education, 2000.

22BTO01

BIOLOGY FOR ENGINEERS
(Open Elective-I)

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

Prerequisites: The school level basic knowledge in Fundamental science is required

Course Objectives: This course aims to:
1. Understand the milestones reached by human in the field of biology.
2. Understand the human body and its parts.
3. Understand the human anatomy and medical devices.
4. Understand types of advanced therapies.
5. Understand the treatment of toxic pollutants in the environment.
6. Understand genome sequencing and NGS.

Course Outcomes: Upon completion of this course, students will be able to:
1. Appraise the values of Biology in classical and modern time
2. Develop modern instruments related to skeletal, nervous, and circulatory system
3. Apply concept of respiratory, excretory, and assisted reproductive process for developing related instruments
4. Illustrate the modern interdisciplinary tools related to medical biotechnology and bioremediation
5. Summarize the basic knowledge about nucleic acids, proteins and their sequencing

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

UNIT-I

Introduction to Biology: Classical Vs Modern Biology; Importance of Biological Science and Historical developments; Origin of Life, Urey Miller Experiment, Spontaneous Generation Theory; Three Domains of Life; Principle and Applications of Microscope (Light and Electron Microscope), Prokaryotic and Eukaryotic Cell- Structure and their differences.

UNIT-II

Human Anatomy and Functions-I: Human organ systems and their functions; Skeletal System- Bones, Tendon, Ligaments, principle and applications in knee replacement; Nervous System - Structure of Brain, Spinal Cord, Neuron, Neurotransmitters, Synapse, Alzheimer's - a case study, principle and applications of Imaging Techniques (CT & MRI scans); Circulatory System - Heart structure and functions, principle and applications of cardiac devices (Stent and Pacemaker), Artificial heart, blood components and typing, haemocytometer.

UNIT-III

Human Anatomy and Functions-II: Respiratory Systems - Lung structure and function, principle and applications of Peak Flow Meter, ECMO (Extra Corporeal Membrane Oxygenation); Excretory Systems-Kidney structure and function, principle and applications of Dialysis; Prenatal diagnosis; Assisted reproductive techniques- IVF, Surrogacy.

UNIT-IV

Medical Biotechnology and Bioremediation: Cells of Immune System, Etiology of cancer, Cancer treatment (Radiation Therapy); Stem Cells and its Clinical applications; Scaffolds and 3D printing of organs; Bio sensors and their applications; Parts of bioreactor and its types; Bioremediation.

UNIT - V

Bioinformatics: Nucleic acid composition, Genetic Code, Amino acid, Polypeptide, Levels of protein structure, Homolog, Ortholog and Paralog, Phylogenetics, Genome Sequencing, Human Genome Project, Next generation sequencing.

Text Books:

1. Champbell, N.A., Reece, J.B., Urry, Lisa, Cain, M,L., Wasserman, S.A., Minorsky, P.V., Jackson, R.B., “Biology: A global approach”, Pearson Education Ltd, Edition 11, 2017.
2. Shier, David, Butler, Jackie, Lewis, Ricki., “Hole's Human Anatomy & Physiology”., McGraw Hill 2012.

Suggested Reading:

1. Bernard R. Glick, T. L. Delovitch, Cheryl L. Patten, “Medical Biotechnology”, ASM Press, 2014.

22CHO04

ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT
(Open Elective-I)

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. Have an increased awareness on issues in areas of sustainability
2. Understand the role of engineering & technology within sustainable development
3. Know the methods, tools and incentives for sustainable product service system development
4. Establish a clear understanding of the role and impact of various aspects of engineering decisions on environmental, societal and economic problems.
5. Communicate results related to their research on sustainable engineering

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the concept of sustainable engineering and its significance in addressing contemporary environmental challenges.
2. Explore the 4R concept of solid waste management and examine various tools and methodologies to assess and mitigate the environmental impacts of engineering activities.
3. To be aware of the principles and requirements of environmental management standards and their application in promoting environmental sustainability.
4. Analyze the challenges and opportunities associated with promoting sustainable habitats such as sustainable cities, sustainable transport, sustainable sources of energy conventional and sustainable materials for green buildings
5. Understand and evaluate the industrial processes through the principles of industrial ecology and industrial symbiosis.

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

UNIT I

Introduction of sustainability- Need and concept of Sustainable Engineering, Social-environmental and economic sustainability concepts, Sustainable development and challenges, Sustainable Development Goals, Environmental acts and protocols – Clean Development Mechanism (CDM).

UNIT II

Economic and social factors affecting sustainability, Effects of pollution from natural sources, Solid waste-sources, impacts, 4R (Reduce, Reuse, Recycling, Recover) concept, Ozone layer depletion, Global warming, Tools used to ensure sustainability in engineering activities such as environmental management systems and environmental impact assessment studies.

UNIT III

Global, Regional and Local environmental issues, Carbon credits and Carbon trading, Carbon foot print, Environmental management standards, ISO 14000 series, Life cycle Analysis (LCA)-scope and goal, Procedures of EIA (Environment Impact Assessment) in India.

UNIT IV

Basic concept of sustainable habitat-Sustainable cities, Sustainable transport, Sustainable sources of energy conventional and renewable sources, Green Engineering: Green buildings, Green materials for sustainable design, Methods for increasing energy efficiencies of buildings**.**

UNIT V

Technology and sustainable development, Sustainable urbanization, Industrialization and poverty reduction, Social and Technological change, Industrial processes-material selection, Pollution prevention, Industrial ecology, Industrial symbiosis.

Text book:

1. Rag R. L., Introduction to Sustainable Engineering, 2nd Ed, PHI Learning Pvt Ltd, 2016.
2. Allen D. T and Shonnard D. R., Sustainability Engineering Concepts, Design and Case Studies, 1st Ed, Prentice Hall, 2011.

Suggested Reading

1. Bradley A. S, Adebayo A. O and Maria. P., Engineering Applications in Sustainable Design and Development, 1st Ed, Cengage Learning, 2016.
2. Krishna R. Reddy, Claudio Cameselle, Jeffrey A. Adams., Sustainable Engineering,1st Ed, Wiley, 2019.

22ITC11

COMPUTER NETWORKS LAB

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

Course Objectives: This course aims to:

1 To know about the fundamentals of peer to peer networks.
2 To familiarize with the installation and configuration of Physical systems and network connections.
3 To learn the implementation methodologies of Wire shark software packages.
4 To explore the concepts of simulations.
5 To acquire knowledge on Socket Programming and SMTP Protocol.

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

1. Describe the concepts of Peer to Peer Networks.
2. Implement the configuration of Physical hosts and sharing the network devices.
3. Analyze the network issues by using Wireshark Software.
4. Solve the Network Problems by using Simulators.
5. Implement Socket Programming and SMTP protocol.

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	1	0	0	0	0	0	0	0	0	0	0	-	-	-
CO 2	3	2	1	1	0	0	0	0	0	0	0	0	-	-	-
CO 3	3	2	1	1	1	0	0	0	1	0	0	0	-	-	-
CO 4	2	2	1	1	1	0	0	0	0	0	0	2	-	-	-
CO 5	2	2	1	3	1	3	0	2	0	0	0	2	-	-	-

List of Experiments:

1. Configure Peer to Peer Network with at least three hosts.
2. Share Files/Folder, Devices and Printer in the Network and access the shared resources from the other node
3. Use Wireshark Packet sniffer software and capture TCP, UDP, IP, ARP, ICMP, Telnet, FTP packets
4. Write and analyze the output of various Network commands such as ping, ipconfig, arp, netstat, tracert, nslookup, hostname, system info etc.,
5. Installation setup of Network simulator software (NS2/NS3/ NetSim /OPNET/ QualNet/ OMNet++ / J-Sim and Cisco Packet Tracer).
6. Simulation of Star topology.
7. Simulation of Stop and Wait Protocol
8. Simulation of Sliding Window Protocol
9. Simulation of the Routing algorithms (Link State Routing/Distance Vector Routing)
10. Implement Socket Programming.
11. Implement SMTP protocol.

Text Books:

1. Andrew S. Tanenbaum, Computer Networks, Pearson Education, 6th Edition, 2021.
2. Michael Gregg, "Build Your Own Security Lab", Wiley Publishing, Inc., 2008.
3. Michael E.whitman, Herbert J.Mattord, Andrew Green ,"Hands on Information Security lab manual",Cengage Learning, Fourth edition, December 27, 2013.

Suggested Reading:

1. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", 8th Edition, Pearson Education, 2022.

Online Resources:

1. https://nmap.org
2. https://www.snort.org
3. https://www.wireshark.org
4. NS2 Projects Tutorials | How to install NS2 Software | Network Simulation Tools
5. Network Simulator 2 (NS2) : Steps For Installing NS2 (tutorialsweb.com)
6. The Network Simulator ns-2: Documentation (isi.edu)
7. Language (tcl.tk)

22CSC18N

OPERATING SYSTEMS LAB

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

Pre-requisites: Operating systems, Programming for problem solving.

Course Objectives: This course aims to:
1. Explore Unix/Linux operating system.
2. Analyze various system calls available in Linux/Unix.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand Linux/Unix environment.
2. Identify and interpret various system programs.
3. Understand and implement shell programming.
4. Simulate memory management, file allocation techniques and process schedules.
5. Analyze process and file management system calls by creating and/or modifying concurrent programs.

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

List of Experiments:
1. Demonstration of Linux/Unix file related system calls: mkdir, link, unlink, mount, unmount, users+, chown, chmod, open, close, read, write, lseek, stat, sync.
2. Demonstration of Linux/Unix process related system calls: fork, wait, exec, exit, getpid, getuid, setuid brk, nice, sleep.
3. Shell programming.
4. Implement CPU scheduling algorithms (a) Round Robin (b) SJF (c) FCFS.
5. Implement page replacement algorithms (a) FIFO (b) LRU.
6. Programs to illustrate threads.
7. Demonstration of GNU/Linux IPC mechanisms- Pipes, Semaphores, Shared memory.
8. Implementation of Classical Problems for synchronization (Dining philosopher problem and Producer- Consumer problem).
9. Implementation of Bankers algorithm for Deadlock detection and avoidance.
10. Implementation of Linked, Indexed and Contiguous file allocation methods.
11. 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.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs88/preview
2. https://onlinecourses.swayam2.ac.in/aic20_sp05/preview

22CSC23

CASE TOOLS LAB

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

Prerequisites: Object Oriented Programming, Software Engineering.

Course Objectives: This course aims to:

1. Identify Project Scope, Objectives and infrastructure.
2. Understand Software Engineering methodologies for project development
3. Gain knowledge about Computer Aided Software Engineering (CASE) tools.
4. Use effective communication and technical skills for building quality software.

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

1. Identify the problem scope and constraints in the problem.
2. Prepare software requirements specifications (SRS) for the system according to standards.
3. Apply the design notations of a structured approach to develop Data Flow Diagrams.
4. Apply/Use the design notations of UML diagrams.
5. Analyze and prepare the documentation for the proposed system.

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

List of Experiments:

Select one large Information System/Approach per each team and device the following:

1. Preparation of Software Requirement Specification Document for a given Case Study.
2. Data Flow Diagrams.
3. Use Case Diagrams.
4. Class Diagrams.
5. Sequence Diagrams.
6. Activity Diagrams.
7. State Chart Diagrams.
8. Component Diagrams.
9. Deployment Diagrams.
10. Given a code snippet representing a simple banking system, reverse engineer a class diagram depicting the classes, attributes, methods, and relationships.
11. Demonstrate software testing techniques using any testing tool.

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: "The Unified Modeling Language User Guide", Pearson Education, 2007.
2. Roger S. Pressman, "Software Engineering - A Practitioners Approach", 7th Edition, Pearson Education, India, 2010.

Online Resources:

1. https://archive.nptel.ac.in/courses/106/105/106105087/

22CSI02

INDUSTRIAL / RURAL INTERNSHIP

Instruction	3 to 4 Weeks / 90 Hours
Duration of SEE	-
SEE	-
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.
5. Opportunity to interact with the people of industry/society to understand the real conditions.

Course Outcomes: Upon completion of this course, student 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	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	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	1	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

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 (**15** marks)
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)
SCHEME OF INSTRUCTIONS AND EXAMINATION

(Inline with AICTE Model Curriculum with effect from AY 2024-25)
(R22 Regulation)

B.E. (Computer Science and Engineering)

SEMESTER – VI

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.	22CSC24	Compiler Design	3	-	-	3	40	60	3
2.	22CAC13	Artificial Intelligence and Machine Learning	3	1	-	3	40	60	4
3.	22MEC36	Fundamentals of Design Thinking	2	-	-	3	40	60	2
4.	22CSEXX	Professional Elective Course-II	3	-	-	3	40	60	3
5.	22CSEXX	Professional Elective Course-III	3	-	-	3	40	60	3
6.	22MBC01	Engineering Economics and Accountancy	3	-	-	3	40	60	3
PRACTICAL									
7.	22CSC25	Compiler Design Lab	-	-	2	3	50	50	1
8.	22CAC14	Artificial Intelligence & Machine Learning Lab	-	-	2	3	50	50	1
9.	22CSC26	Mini Project	-	-	4	-	50	-	2
10.	22CSV02	Product Management Essentials	-	1	-	-	50	-	0.5
11.	22CSU02	Upskill Certification Course-II	-			-	25	-	0.5
TOTAL			**17**	**2**	**8**	**-**	**465**	**460**	**23**

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

Professional Elective-II	
22CSE04	Concurrent Programming
22CSE05	Advanced Database Management Systems
22CSE06	Algorithmic Game Theory
22CIE51	Industrial Internet of Things Systems
22CSE07	Nature Inspired Algorithms

Professional Elective-III	
22ADE06	Explanatory Data Analysis and Visualization
22ITE04	Mobile Application Development
22CSE08	User Interface and User Experience Design
22CIE15	Extended Reality
22CSE09	High Performance Computing

22CSC24

COMPILER DESIGN

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

Pre-requisites: Formal Language and Automata Theory, Data Structures.

Course Objectives: This course aims to:

1. Understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis and design top-down and bottom-up parsers.
3. Implement syntax directed translation schemes and develop algorithms to generate code for a target machine and advance topics of compilers.

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

1. Identify the concepts related to translator, tokens, bootstrapping, porting and phases of the compiler.
2. Use grammar specifications and implement lexical analyzer by the help of compiler tools.
3. Explore the techniques of Top down, Bottom up Parsers and apply parsing methods for various grammars.
4. Implement syntax directed translation schemes and relate Symbol Table organization.
5. Analyze the concepts involved in Intermediate, Code Generation and Code Optimization process and understand error recovery strategies and advance topics in compilers.

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

UNIT - I

Introduction to Compilers: Structure of a compiler, Phases of a compiler, Grouping of phases, Compiler writing tools, Bootstrapping, Data structures.

Lexical Analysis: The role of Lexical Analyzer, Input Buffering, Specification of Tokens using RegularExpressions, Review of Finite Automata, Recognition of Tokens, Design of Lexical Analyzer Generator (lex, flex).

UNIT - II

Syntax Analysis: Top-Down Parsing: Recursive descent parsing, Predictive parsing, LL (1) Grammars.

Bottom-Up Parsing: Shift Reduce parsing, Operator precedence parsing (Concepts only).

LR parsing: Constructing SLR parsing tables, Constructing Canonical LR parsing tables and Constructing LALR parsing tables. Parser generator (YACC, BISON).

UNIT - III

Syntax directed translation: Syntax directed definitions, Bottom- up evaluation of S-attributed definitions, L-attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.

Type Checking: Type systems, Specification of a simple type checker, Overview of Symbol Table.

Runtime Time Environments: Storage Organizations, Stack, Heap organizations.

UNIT - IV

Intermediate Code Generation: Intermediate languages, Graphical representations, Three Address code, Quadruples, Triples.

Code Optimization: Principal sources of optimization, Optimization of basic blocks.

UNIT - V

Code generation: Issues in the Design of a Code Generator. The Target Machine, Basic Blocks and Flow Graphs, a simple Code Generator, Peephole optimization.

Machine independent optimization: Data Flow Analysis, Constant Propagation, Live Variable Analysis, Loops. Error recovery in various phases.

Advanced topics: Review of Compiler Structure, Advanced elementary topics, Structure of optimizing compilers.

Text Books:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, "Compilers: Principles Techniques &Tools", Pearson Education, 2nd Edition, 2013.
2. Steven Muchnik, "Advanced Compiler Design and Implementation", Kauffman, 1998.

Suggested Reading:

1. Kenneth C Louden, "Compiler Construction: Principles and Practice", Cengage Learning, 2005.
2. Keith D Cooper & Linda Tarezon, "Engineering a Compiler", Morgan Kafman, 2nd Edition, 2004.
3. John R Levine, Tony Mason, Doug Brown, "Lex &Yacc", 3rd Edition, Shroff Publisher, 2007.

Online Resources:

1. http://www.nptel.ac.in/courses/106108052.
2. https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/.
3. http://en.wikibooks.org/wiki/Compiler_Construction.
4. http://dinosaur.compilertools.net/.
5. http://epaperpress.com/lexandyacc/.

22CAC13

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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

Prerequisite: Knowledge on linear algebra, algorithms.

Course Objectives:**This course aims to:**
1. To get the students acquainted with the concepts of different searching techniques of AI systems.
2. To understand the various Machine Learning Algorithms.
3. To familiarize various Classification and Regression techniques.

Course Outcomes: Upon completion of this course, students will be able to:
1. Define the concept of Artificial Intelligence.
2. Apply real life problems in a state space representation so as to solve them.
3. Understand the features of machine learning to apply on real world problems.
4. Compare and contrast Classification and Regression problems.
5. Apply unsupervised learning algorithms to solve real world problems.

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	2	2	-	-	-	-	-	-	-	3	-	-	-
CO 2	3	3	2	1	-	-	-	-	-	-	-	3	2	1	2
CO 3	3	3	3	1	-	-	-	-	-	-	-	3	1	-	1
CO 4	3	3	2	1	-	-	-	-	-	-	-	3	1	-	1
CO 5	3	2	3	1	-	-	-	-	-	-	-	3	2	2	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: Breadth-first search, Uniform cost search, Depth- first search, Iterative deepening Depth-first search, Bidirectional search.
Informed (Heuristic) Search Strategies: Heuristic Functions, Hill- climbing, Greedy best-first search, A* search,
Adversarial Search: Game Theory, Alpha–Beta Pruning, Constraint Satisfaction Problems.

UNIT - III

Machine Learning: What is Machine Learning, Types of Machine Learning Algorithms- Supervised, Unsupervised and Reinforcement Learning.
Feature Selection and Feature Engineering: Data sets, Creating training and test sets, managing categorical data, missing features, data scaling and normalization, Whitening, Feature selection and filtering, PCA, Visualization of high-dimensional datasets;
Regression Algorithms: Linear models for regression, Regression types, Evaluation Metrics, Hyper parameter tuning, Grid and Random search.

UNIT - IV

Linear Classification Algorithms: KNN, logistic regression, classification metrics, ROC curve.
Naïve Bayes: Bayes theorem, Naïve Bayes classifiers- Multinomial, Bernoulli and Gaussian.
Support Vector Machines: Linear SVM, Kernel-based classification.
Decision Trees and Ensemble Learning: Binary Decision trees, Introduction to Ensemble Learning-Bagging, Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier.

UNIT – V

Clustering Fundamentals: Basics, Gaussian mixture, K-means, Evaluation methods, DBSCAN, Spectral Clustering, Hierarchical Clustering.
Introduction to Neural Networks: Introduction to deep learning, MLPs with Keras, deep learning model layers, introduction to Tensorflow.

Text Books:

1. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Ed., 2015.
2. Giuseppe Bonaccorso, "Machine Learning Algorithms", 2nd Edition, Packt, 2018

Suggested Reading:

1. Tom M. Mitchell, "Machine Learning", 4th Ed., McGraw Hill, 2017.
2. Rich, Knight, Nair, "Artificial Intelligence", 3rd Ed., Tata McGraw Hill, 2017.
3. Puneet Mathur, "Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance", 1st Ed., Apress, 2019.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Ed., CRC Press, 2014.
5. Saroj Kaushik, "Artificial Intelligence", 1st Ed., Cengage Learning India, 2011.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc24_cs88/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs81/preview
3. https://onlinecourses.nptel.ac.in/noc24_cs51/preview
4. https://www.holehouse.org/mlclass
5. https://www.geeksforgeeks.org/machine-learning/

22MEC36

FUNDAMENTALS OF DESIGN THINKING

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

Prerequisite: Nil

Course Objectives: This course aims to
1. 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: Upon completion of this course, the students are able to
1. Understand design thinking and its phases as a tool of innovation
2. Empathize on the needs of the users
3. Define the problems for stimulating ideation
4. Ideate on problems to propose solutions by working as a design thinking team
5. Prototype and test the proposed solutions focusing on local or global societal problems

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

UNIT – I

Introduction to Engineering & Thinking: Impact of science/engineering. Thinking and behaviour; Types of thinking – Linear thinking, lateral 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.

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.

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; use of doodling in expressing creative ideas.

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; guidelines to write value proposition.

Testing phase: Necessity to test, user feedback, conducting a user 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-solv ing, 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.

22CSE04

CONCURRENT PROGRAMMING
(Professional Elective-II)

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

Prerequisite: Operating Systems, Basics of Object-Oriented Programming

Course Objectives: This course aims to:
1. Familiarize the principles for programming secure, reliable, and robust software in a multi-threaded or multi-process environment.
2. Examine the potential run-time problems arising from the concurrent operation of many separate tasks.
3. Make understand the synchronization primitives and develop correct concurrent programs using appropriate programming models.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand and reason about concurrency and concurrent objects.
2. Analyze the concurrent programming algorithms.
3. Interpret concurrent objects for solving problems that require synchronization.
4. Implement the locking and non-blocking mechanisms.
5. Develop the mechanisms for communication and coordination among concurrent processes.

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

UNIT – I

Introduction: Introduction to concurrent programming, Overview, Importance and Benefits, Challenges, Threads, Mutual Exclusion and related algorithms.

UNIT - II

Fundamental and Building Blocks of Concurrent Programming: Concurrency and Correctness, Sequential Objects, Quiescent consistency, Sequential Consistency, Linearizability, Linearization Points, Formal Definitions Linearizability, Compositional Linearizability, Nonblocking Property,
Progress Conditions: Dependent Progress Conditions, Java Memory Model.

UNIT – III

Synchronization Operations, Consensus Numbers, Consensus Protocols, The compareAndSet() Operation, Introduction Universality, A Lock-Free Universal, Construction Wait- Free Universal Construction, Spin Locks, Test-And-Set Locks.

UNIT-IV

Synchronization and Linked Lists: Role of Locking, List-Based Sets, Concurrent Reasoning, Coarse-Grained Synchronization, Fine-Grained Synchronization, Optimistic Synchronization, Lazy Synchronization, Non-Blocking Synchronization.

UNIT – V

Concurrency and Data Structures: Introduction, Bounded Partial Queue, Unbounded Total Queue, Unbounded Lock-Free Queue, Memory Reclamation and the ABA Problem, Concurrent Stacks and Elimination, Transactional Memories.

Text Books:

1. The Art of Multiprocessor Programming., by Maurice Herlihy, Nir Shavit, Victor Luchangco, Michael Spear, Paperback 2nd Edition - September 8, 2020. ISBN: 9780124159501, eBook ISBN: 9780123914064.
2. Concurrent Programming: Algorithms, Principles, and Foundations by Michal Raynal, Springer Berlin, Heidelberg. Published 2015. ISBN 978-3-642-44615-3.

Suggested Reading:

1. Functional and Concurrent Programming: Core Concepts and Features by Michel Charpentier, 1st Edition, Addison-Wesley, November 2022.
2. The Art of Multiprocessor Programming, by Maurice Herlihy and Nir Shavit, Morgan Kaufmman Publishers, 1st Edition, Indian Reprint 2012.
3. Java Concurrency in Practice by Brian Goetz, Tim Peierls, Joshua Block, Joseph Bow beer, David Holmes and Doug Lea, 1st Edition, Addison Wesley, 2006.
4. Concurrent Programming in Java™: Design Principles and Patterns, Second Edition by Doug Lea, Publisher: Addison Wesley, Pub Date: October 01, 1999.

Online Resources:

1. Elsevier Science -The Art of Multiprocessor Programming, Morgan Kaufmann, September 8, 2020 ISBN: 9780123914064.
2. https://www.researchgate.net/publication/213876653_The_Art_of_Multiprocessor_Programming #fullTextFileContent.
3. The Art of Multiprocessor Programming DOI: 10.1145/1146381.1146382 Source DBLP, Publisher: Elsevier, Inc.
4. Concurrent Programming: Algorithms, Principles, and Foundations | SpringerLink.

22CSE05

ADVANCED DATABASE MANAGEMENT SYSTEMS
(Professional Elective-II)

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

Pre-requisites*:* Database knowledge and basic programming.

Course Objectives: This course aims to:
1. Design high-quality databases and database applications.
2. Translate complex conceptual data models into logical and physical database designs.
3. Gain an understanding of NoSql.
4. Have outline knowledge about Parallel and Distributed Databases.
5. Gain experience in Performance Tuning.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the concept of distributed database and object oriented databases.
2. Develop temporal relationships with constraints.
3. Gain the knowledge of Parallel databases.
4. Understand the design and implement Distributed Databases and NoSQL.
5. Apply the knowledge of Store and retrieve multimedia data.

CO-PO Articulation Matrix

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

UNIT - I: Object Based Database Systems:
Object Database Concepts Overview: Object Oriented Concepts and Features, Object Identity, Complex data types, Encapsulation of Operations and Object Persistence, Type Hierarchies and Inheritance.
Object Based Extensions to SQL: User-Defined Types using CREATE TYPE and Complex Objects ODMG Object Model and the Object Definition Language.

UNIT - II: Temporal Database Systems:
Temporal Data model: Conceptual Objects, Temporal Objects, temporal Constraints, Temporal and Non Temporal Attributes, Conceptual Relationships, Temporal Relationships and constraints among relationships. **The Temporal Query Language:** Temporal Projection, Temporal Selection, Temporal VersionRestriction Operators, Temporal Scope Operators.

UNIT - III: Parallel Database Systems:
I/O Parallelism: Partitioning Techniques, Managing Skew. Interquery Parallelism and Intraquery Parallelism, Intra-operator Parallelism (Parallel Sort and ParallelJoin).
Inter-operator Parallelism: Pipelined Parallelism and Independent ParallelismQuery Optimization.

UNIT IV: Distributed Database Systems:
Distributed Database Concepts. Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Concurrency Control and Recovery.
NoSQL Databases: Introduction, the CAP theorem, Document based NoSQL systems and MongoDB, NoSQL Key-Value Stores, Column Based NoSQL Systems, NoSQL Graph Databases and Neo4j.

UNIT-V: Creating Distributed Multimedia Presentations: Objects in Multimedia Presentations, Specifying Multimedia Documents with Temporal Constraints, Efficient Solution of Temporal Presentation Constraints, Spatial Constraints. Distributed Media Servers: Distributed multimedia server architecture, distributed retrieval plans, optimal distributed retrieval plans.

Text Books:
1. Advanced Database Systems by Nabil R. Adam and Bharat K . Bhargava, ISBN 3-540-57507-3 Springer-Verlag Berlin Heidelberg New York.
2. V.S. Subrahmanian, Principles of Multimedia Database Systems, Morgan Kauffman.

Suggested Reading:
1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2017
2. Advanced Database Systems by Dr.John Kandiri.
3. Abraham Silberschatz, Henry F. Korth, S.Sudarshan, "Database System Concepts", 6th Edition, 2014.
4. Multimedia Databases: An object relational approach, Lynne Dunckley, Pearson Education.
5. Multimedia Database Systems, Prabhakaran, Springer.

Online Resources:
1. https://archive.nptel.ac.in/courses/106/105/106105175/
2. https://nou.edu.ng/coursewarecontent/NATIONAL%20OPEN%20UNIVERSITY%20OF%20NIGERIA.pdf

22CSE06

ALGORITHMIC GAME THEORY
(Professional Elective – II)

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

Pre-requisites: Linear Algebra and Calculus, Data Structures.

Course Objectives: This course aims to:
1. Understand how to design systems with strategic participants that has good performance guarantees.
2. Understand the study of games from the perspective of algorithms and theoretical computer science.
3. Study the complexity-theoretic hardness of computing equilibria, focusing on Nash equilibria.
4. Study the categories of topics at a basic level: combinatorial games, zero-sum games, non-zero sum games and cooperative games.
5. Obtain familiarity how to Model and analyze conflicting situations using game theory.

Course Outcomes: Upon completion of this course, students will be able to:
1. Acquire knowledge about the real-world problems and formulate mathematical models of these problems.
2. Identifying the algorithmic Models for finding the optimal solutions for real world examples.
3. Analyze the major limitations and capabilities of game theory problems.
4. Design and analyze problems using game theory approaches.
5. Explore the real-world scenarios of economic and algorithmic interactions using game theory solutions.

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

UNIT - I
Introduction to Stable Matchings, Men-Optimality of the Men-Proposing Gale-Shapley Algorithm, GS: Cheating, Strategies for Men, GS: Cheating Strategies for Women, Problem, Popular, Strategic Behavior in Popular Matchings, Stable Roommates: Matchings in the Non-bipartite Setting.

UNIT - II
An Introduction to Voting, The Game of Trust - Nicky Case's Interactive Essay, Arrow's Theorem, Gibbard- Satterethwaite Theorem, Domain Restrictions and Multi-winner Elections, Incentive Design in Crowd sourcing Applications.

UNIT - III
Algorithmic for computing Market Equilibrium, Tournament fixing and superkings, Tournament Fixing Parameterized by FAS, Tournament Fixing with Bribery, An Introduction to Cake-Cutting, Envy-Freenes and Approximate EF, Sperner's Lemma and Applications, Cake Cutting with a Secret Agent, Fairness Notions for Indivisible Goods.

UNIT - IV

Combinatorial Games: Introduction and examples: N and P positions, Zermelo's Theorem, The game of Hex, Nim games, Sprague-Grundy Theorem, The Sylver Coinage Game, **Zero-Sum Games:** Introduction and examples, Saddle Point Equilibria & the Minimax Theorem, Zero, Mixed Strategies, Properties of Saddle Point Equilibria.

UNIT - V

Iterated elimination of strictly dominated strategies, Lemke-Howson Algorithm, , Evolutionary Stable Strategies, Fictitious Play, Brown-Von Neumann-Nash Dynamics, The Nash Bargaining Problem, Transferable Utility Games, The Core, Characterization of Games with non-empty Core, Shapley Value, The Nucleolus.

Text Books:

1. Noam Nisan, Tim Roughgarden, Eva Tardos, Vijay V. Vazirani (eds), "Algorithmic Game Theory", Cambridge University, 2007.
2. Michael Maschler, Eilon Solan, and Shmuel Zamir "Game Theory", Cambridge University Press, 2013.
3. Y. Narahari "Game Theory and Mechanism Design", World Scientific, 2015.
4. Martin Osborne, "An Introduction to Game Theory", Oxford University Press, 2003.

Suggested Reading:

1. Robert Duncan Luce "Games and Decisions: Introduction and Critical Survey" (Dover Books on Mathematics), Howard Raiffa, 1989.
2. John von Neumann, Oskar Morgenstern, "Theory of Games and Economic Behavior", Princeton Univ. Press. 2007.

Online Resources:

1. https://nptel.ac.in/courses/128106007.
2. https://nptel.ac.in/courses/110101133.
3. https://nptel.ac.in/courses/106105237.

22CIE51

INDUSTRIAL INTERNET OF THINGS SYSTEMS
(Professional Elective – II)

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

Pre-Requisites: Computer Architecture and Micro Processor, Programming for Problem Solving.

Course Objectives: This course aims to:
1. Understand the basics of IoT and IIOT.
2. Impart necessary and practical knowledge in Industrial Internet of Things.
3. Develop skills required to build real-time IIoT based projects.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand Internet of Things and IIOT basics components.
2. Illustrate working of I/O devices, sensors & communication module.
3. Analyse the use of protocols in IoT.
4. Interface I/O devices, Sensors & communication module
5. Develop real time IoT based projects.

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

UNIT – I

Internet of Things: The Third Wave? Advantages and Disadvantages of IoT.

The Industrial Internet of Things (IIoT): Definition of IIoT, IoT, and M2M, IIoT Challenges, IIoT Requirements, IIoT Benefits.

Internet of Things: More than Smart "Things": IoT key attributes, Three Major Challenges Facing IoT: Technology, Technological Challenges, Business, Categories of IoT, Architecture of IoT.

UNIT – II

IoT Implementation and Challenges: Components of IoT Implementation: Sensors, Networks, Standards, Intelligent analysis, Intelligent actions.

IoT Standardization and Implementation Challenges, Communication modules, I/O interfaces, Programming API's.

UNIT – III

Configuring Raspberry Pi, MicroPython Pyboard, and Jetson Nano for Python: Raspberry Pi Board Feature, Configuration of Raspberry Pi, Simple Applications with Raspberry Pi: OLED Display Interface, Camera Interfacing, Motor Control (DC Motor, Stepper Motor, and Servo Motor), Raspberry Pi and Mobile Interface Through Bluetooth.

UNIT – IV

IoT data protocols: MQTT, CoAP, AMQP, DDS, HTTP, WebSocket.

Network Protocols for IoT: 6LowPAN, RPL, WiFi, Bluetooth, ZigBee, Z-Wave, LoRaWan, , XMPP.

UNIT – V

IIoT Case Studies: Smart Grids for Energy Management, Connected Agriculture, Smart Buildings and Facilities Management, Supply Chain Optimization, Connected Healthcare, Smart Retail, Smart Transportation, Water Management

Text Books:

1. Ahmed Banafa, “Introduction to Internet of Things (IoT)”, River Publishers, 2023.
2. Jivan S. Parab, Madhusudan Ganuji Lanjewar, Marlon Darius Sequeira, Gourish Naik, Arman Yusuf Shaikh, “Python Programming Recipes for IoT Applications”, Springer Nature Singapore Pte Ltd. 2023.
3. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A hands on approach”, VPT publishers, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media, 2011.

Online Resources:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey”, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, “RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks”, IETF, Standards Track, Mar. 2012.
3. Z. Shelby, K. Hartke, C. Bormann, “The Constrained Application Protocol (CoAP)”, Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, “What‟s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”, Electronic Design (Online), Mar. 2013.

22CSE07

NATURE INSPIRED ALGORITHMS
(Professional Elective-II)

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

Prerequisite: Basic knowledge of Mathematics.

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

1. Understand the fundamentals of nature inspired techniques which influence computing.
2. Study the Swarm Intelligence and Immuno computing techniques.
3. Familiarize the DNA Computing.

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

1. Identify the relation between computers (computing) and natural processes.
2. Describe concepts of Evolutionary Computing like Genetic Algorithms to solve engineering Optimization Problems.
3. Apply Swarm Intelligence like ACO and PSO to Travelling Salesman Problem.
4. Explain Danger theory and its role in various Immuno Computing Models.
5. Solve the SAT problem by using DNA manipulation functions and Filtering Models.

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

UNIT - I

Introduction: From Nature-to-Nature Computing, Philosophy, Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity, Adaptation- Feedback-Self-Organization-Complexity, Emergence and, Bottom-up Vs Top-Down- Determination, Chaos and Fractals.

UNIT - II

Computing Inspired by Nature: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms, Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming.

UNIT - III

Swarm Intelligence: Introduction -Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO). The Firefly algorithm - algorithm analysis – implementation.

UNIT - IV

Immuno Computing: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation Interaction- Immune Algorithms , Introduction – Genetic algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks.

UNIT – V

Computing With New Natural Materials: DNA Computing: Motivation, DNA Molecule, Adleman's experiment, Test tube programming language, Universal DNA Computers, PAM Model, Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical to DNA Computing.

Text Books:

1. Leandro Nunes de Castro, “Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
3. Krishna Kumar Mishra, “Nature Inspired Algorithms for Engineers and Scientists”, CRC Press,2022.

Suggested Reading:

1. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
2. Marco Dorrigo, Thomas Stutzle, “Ant Colony Optimization”, PHI,2005.
3. Eiben,A.E.,Smith,James E, "Introduction to Evolutionary Computing", Springer 2015.
4. Balamurugan, Shanmugam, Anupriya Jain, Sachin Sharma, Dinesh Goyal, Sonia Duggal, and Seema Sharma, eds, “Nature-Inspired Algorithms and Applications”, John Wiley & Sons, 2021.
5. Vasuki, A, “Nature-inspired optimization algorithms”, CRC Press, 2020.

Online Resources:

1. https://nptel.ac.in/courses/106105173
2. https://nptel.ac.in/courses/127105006

22ADE06

EXPLORATORY DATA ANALYSIS AND VISUALIZATION
(Professional Elective-III)

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

Prerequisite: Python Programming

Course Objectives: This course aims to:
1. Introduce the Numpy library in Python to support storage and operations on large multi-dimensional arrays and matrices
2. Introduce large collection of mathematical functions to operate on multidimensional sequential data structures
3. Demonstrate the functionality of the Pandas library in Python for open source data analysis and manipulation
4. Demonstrate Data Aggregation, Grouping and Time Series analysis with Pandas
5. Introduce the Matplotlib library in Python for creating static, animated and interactive visualizations

Course Outcomes: Upon completion of this course, students will be able to:
1. Create, manipulate, and analyze numerical data using NumPy arrays and associated functions.
2. Perform various preprocessing operations on datasets using Pandas Series and DataFrame objects.
3. Combine and manipulating complex datasets using a variety of Pandas techniques, including concatenation, merging, grouping, aggregation, and time series analysis,
4. Apply inferential statistics to analyze data, draw valid conclusions about populations, based on hypothesis testing, confidence intervals, and correlation analysis.
5. Create and interpret different types of data visualizations using Matplotlib and Seaborn

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

UNIT - I

Introduction to Numpy: Data types in Python - Fixed type arrays, creating arrays, array indexing, array slicing, reshaping arrays, array concatenation and splitting, Universal Functions, Aggregations, Broadcasting rules, Comparisons, Boolean Arrays, Masks Fancy Indexing, Fast Sorting using np.sort and np.argsort, partial sorting Creating Structured Arrays, Compound types and Record Arrays.

UNIT - II

Introduction to Pandas: Series Object, DataFrame Object, Data Indexing and Selecting for Series and DataFrames, Universal Functions for Index Preservation, Index Alignment and Operations between Series and DataFrames, Handling missing data, operating on Null values, Hierarchical Indexing.

UNIT - III

Combining Datasets: Concat, Append, Merge and Joins, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance functions - query() and eval()

UNIT - IV

Inferential Statistics - Normal distribution, Poisson distribution, Bernoulli distribution, z-score, p-score, One- tailed and two-tailed, Type 1 and Type-2 errors, Confidence interval, Correlation, Z-test vs T-test, F- distribution, Chi-square distribution, the chi-square test of independence, ANOVA

UNIT - V

Visualization with Matplotlib : Simple Line plots, Scatter plots, Visualizing errors, Density and Contour plots, Histograms, Binnings, Multiple subplots, Three-dimensional plotting with Matplotlib, Geographic data with Basemap, Visualization with Seaborn.

Text Books:

1. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly Media, 2016.
2. Samir Madhavan, “Mastering Python for Data Science”, Packt Publishing, 2015.

Suggested Reading:

1. Wes McKinney, “Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter”, 3rd Edition, 2022

Online Resources:

1. https://numpy.org/doc/stable/user/index.html
2. https://pandas.pydata.org/
3. https://matplotlib.org/
4. https://seaborn.pydata.org/tutorial.html
5. https://www.coursera.org/learn/data-analysis-with-python

22ITE04

MOBILE APPLICATION DEVELOPMENT

(Professional Elective – III)

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. Introduce the Kotlin Programming Language for Mobile Application Development.
2. Demonstrate the development of basic mobile applications on android operating system.
3. Implement the design using specific mobile development frameworks.
4. Demonstrate the Location based services in mobile application design.
5. Demonstrate their ability to deploy the mobile applications in marketplace for distribution.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the benefits of using Kotlin for Mobile application development.
2. Design user interface for mobile applications.
3. Use Intent, Broadcast receivers and Internet services in Android App.
4. Use multimedia, camera and Location based services in Android App.
5. Apply best practices to implement database and publish apps on Playstore.

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	1	2	2	0	0	0	0	0	2	0	0	-	-	-
CO 2	2	3	3	2	3	3	3	0	0	1	0	1	-	-	-
CO 3	2	2	3	3	2	3	3	0	0	1	0	1	-	-	-
CO 4	2	2	3	2	2	3	3	0	0	1	0	1	-	-	-
CO 5	2	2	3	3	3	3	3	0	1	1	1	1	-	-	-

UNIT-I

Introduction to Kotlin - Basic expressions - Control flow statements - null safety – Functions- passing functions as arguments - simple lambdas. Object oriented programming in Kotlin - Classes and Objects – Constructors - Visibility modifiers - Subclasses and Inheritance – Interfaces - Data classes - Singleton class – Pairs- Triples.

UNIT-II

Introduction to Android Architecture: History - Features and Android Architecture – Android SDK Tools - Application Components - User Interface Design - Views - View Groups – Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Android Localization.

UNIT-III

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS. Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity. Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT-IV

Camera –Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, Working with Google Maps extensions - Maps via intent - Location based Services - Location Updates - Location Providers - Selecting a Location Provider - Finding Location.

UNIT-V

Content Providers – Uri - CRUD access –Browser – CallLog – Contacts – Media Store - Data Access and Storage - Shared Preferences - Storage External - Network Connection - SQLite Databases - Deploying Android Application to the World.

Text Books:

1. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012.
2. Dawn Griffiths and David Griffiths, “Head First Android Development”, 3rd Edition, O'Reilly Media Publishers, 2021.

Suggested Reading:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
2. Wei-Meng Lee, Beginning Android 4 Application Development, 4th Edition, Wiley India (Wrox), 2013.

Online Resources:

1. https://developer.android.com
2. http://www.androidcentral.com/apps
3. https://www.opensesame.com/c/android-app-development-beginners-training-course

22CSE08

USER INTERFACE AND USER EXPERIENCE DESIGN
(Professional Elective-III)

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

Pre-requisites: Fundamental Computer Skills, Knowledge of Web Technologies.

Course Objectives:
This course aims to:
1. Familiarize students with the fundamental principles and concepts of user interface (UI) and user experience (UX) design.
2. Equip students with the practical skills and knowledge necessary to design effective UI/UX interfaces.
3. Understand the importance of applying user-centered design methods throughout the design process.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Apply user-centered design principles to create interfaces that meet the needs and preferences of target users.
2. Demonstrate proficiency in designing intuitive user interfaces that are easy to navigate and understand.
3. Develop the skills to create wireframes, prototypes, and mockups using industry-standard design tools.
4. Gain an understanding of accessibility guidelines and principles, designing interfaces that are accessible to users with disabilities.
5. Identify emerging trends and technologies in UI/UX design.

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

UNIT - I
Introduction to UI/UX Design: Understanding UI/UX Design, Definition and importance of UI/UX design, Difference between UI and UX, Roles and responsibilities of UI/UX designers, Overview of the design process. **User-Centered Design Principles**: Principles of user-centered design, User research methods (interviews, surveys, and observations), Creating user personas and scenarios, conducting user journey mapping exercises.

UNIT – II
Design Fundamentals: Basic principles of visual design (layout, typography, color), Gestalt principles and their application in UI design, Applying visual hierarchy to improve user experience, Introduction to design tools (Sketch, Figma, Adobe XD).
Interaction Design: Principles of interaction design, Designing effective navigation systems, Feedback mechanisms and user affordances Prototyping techniques for interaction design.

UNIT - III

Usability and User Testing: Understanding usability principles, Nielsen's heuristics for user interface design, conducting heuristic evaluations of UI designs, Usability testing methods (moderated vs. unmoderated, remote testing).

User Testing and Feedback: Planning and conducting usability tests, Analyzing usability test results incorporating user feedback into UI design iterations, Best practices for iterative design and testing cycles.

UNIT - IV

Accessibility in UI/UX Design: Understanding accessibility guidelines (WCAG), Designing accessible interfaces for users with disabilities, Assistive technologies and their impact on UI/UX design

Emotional Design and Engagement: Principles of emotional design, creating emotionally engaging user experiences, Strategies for enhancing user engagement and retention, Case studies of emotionally successful UI/UX designs

UNIT - V

Responsive and Mobile Design: Principles of responsive web design, Mobile-first design approach, Adapting layouts and content for different screen sizes, Testing and debugging responsive designs

Designing for Mobile Platforms: Mobile UI design patterns and conventions, Navigation and interaction patterns for mobile apps, Challenges and best practices for designing mobile interfaces, Introduction to mobile prototyping tools (InVision, Marvel)

Text Books:

1. Krug, S. “Don’t Make Me Think”, 3rd Edition, Rider publication, 2014.
2. Don Norman, "The Design of Everyday Things", 2nd Edition, Basic Books, 2013.

Suggested Reading:

1. Jim K., “Design Basics Index”, How Books, 2010.
2. Lidwell, W., Holden, K. and Butler, J. “Universal Principles of Design”, Rockport Publishers, 2010.

Online Resources:

1. User Interface Design - Course (nptel.ac.in)
2. Introduction to User Experience Design Course (Georgia Tech) | Coursera.

22CIE15

EXTENDED REALITY
(Professional Elective-III)

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

Pre-Requisites
Basic knowledge on computer hardware and software components.

Course Objectives:
This course aims to:
1. To understand immersive technology current state of development for designing and developing immersive experiences.
2. To understand the sensory, emotional and narrative immersion for best practice user interface and experience design.
3. To understand the intersection of AI and VR/XR, looking at how AI is being used to improve everything from graphics rendering to user interaction.
4. To understand the applications of VR/XR in healthcare, discussing the latest research, challenges and opportunities for healthcare professionals.
5. To understand the design principles that guide the creation of immersive experiences, from 3D modelling to user interface design.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Define and explain principles in immersive technology for designing and developing immersive experiences.
2. Explain the sensory, emotional and narrative immersion for best practice user interface and experience design.
3. Model and create intersection of AI and VR/XR to user interaction.
4. Design the applications of VR/XR in healthcare, discussing the latest research, challenges and opportunities for healthcare professionals.
5. Choose the creation of immersive experiences, from 3D modelling to user interface design.

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

UNIT – I
Immersive Technology: Introduction Promise and Potential, Knowing immersive technologies - AR/VR/ExR, Overview of immersive technologies, AR/VR Milestones and breakthroughs, Current state, Statistical data, Potential and Limitations of immersive technologies.
The Psychology of Presence in Immersive Technologies: Knowing presence, Theories of presence, Factors contributing to presence, Measuring, Advantages and limitations of measuring presence and Application of presence.

UNIT – II

Designing Immersive Experience:

Introduction, designing for sensory immersion, Designing for emotional immersion, Designing for narrative immersion, Best practices for user interface and experience design.

Evolution of VR Hardware: Introduction to virtual reality hardware, The rise of consumer virtual reality, Virtual reality hardware design challenges, The future of virtual reality hardware, Role of haptic feedback on virtual reality hardware, Types of haptic feedback, Benefits and limitations of haptic technology, Case studies

UNIT – III

AI in AR/VR/XR: Introduction, AI and its usage in VR/AR, Graphic rendering, Natural language processing, User interaction, Predictive analytics.

Business Landscape of AR/VR/XR: Introduction, Funding and investment, Funding and its challenges for VR/XR industry, Monetization strategies, User adoption and marketing, Technology challenges, Case studies.

UNIT – IV

Applications of AR/VR/XR in Healthcare:

Introduction, Diagnosis and treatment, Rehabilitation and physical therapy Medical education and training, Use of immersive technology in patient education and engagement, Case studies, Design principles, Medical realities.

Applications of AR/VR/XR in Education Introduction, Immersive learning environment, Simulations and training, Personalized learning, Collaborative learning, Case studies.

UNIT – V

Ethics in Immersive Technologies:

Introduction to ethics in immersive technologies, Safety and physical health Psychological and emotional impact, Case studies.

3D Modeling and User Interface Design: Introduction to 3D modelling, Modelling technique, Artistic and technical balance, Real-time 3D and game engines, User interface design principles, User interface design software and workflow, Implementing UIs in 3D environment,

Case Study: Building VR Applications with Unity.

Text Books:

1. Immersive Realm of Extended Reality, Author Suman Dutta, First Edition 2024, Copyright © BPB Publications, India, ISBN: 978-93-55517-227

Suggested Reading:

1. VIRTUAL REALITY, Steven M. LaValle, University of Oulu, Cambridge University Press.
2. Virtual and Augmented Reality- An Educational Handbook, By Zeynep Tacgin, Cambridge Scholars Publishing Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK
3. Virtual Reality Technology, Grigore C. Burdea, Philippe Coiffet, John Wiley & Sons, 30 Jun 2003 - Computers - 464 pages
4. Handbook of Augmented Reality, Borko Furht, Springer New York, NY, Hardcover ISBN 978-1-4614-0063-9, eBook ISBN 978-1-4614-0064-6

Online Resources:

1. https://axisxr.gg/the-future-of-xr-trends-to-look-for-in-2024/
2. https://www.interaction-design.org/literature/topics/extended-reality-xr
3. https://www.accenture.com/us-en/services/technology/extended-reality
4. https://www.sngular.com/insights/235/extended-reality-will-it-be-more-widespread-in-2024

22CSE09

HIGH PERFORMANCE COMPUTING
(Professional Elective-III)

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

Prerequisite: Computer Architecture, Computer Networks Operating Systems

Course Objectives: This course aims to:
1. Understand the relevance of High performance computing, architectures and various computational models.
2. Learn basic of Open MP.
3. Learn basics of GPU.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the significance of High Performance Computing and HPC Architecture, Systems and Technologies.
2. Apply models and methodologies for parallel programming and application development.
3. Describe the message passing interface concepts.
4. Explain the architecture of GPU and Edge Computing on SoC.
5. Describe about high performance storage technologies.
6. Design and implement compute intensive applications on HPC platform.

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	-	-	-	-	-	-	-	3	1	1	-
CO 2	2	3	2	3	1	2	-	-	-	-	-	1	2	2	-
CO 3	2	-	-	-	1	-	-	-	-	-	-	-	2	1	-
CO 4	2	-	-	-	-	-	-	-	-	-	-	-	2	1	-
CO 5	2	1	-	1	-	-	-	-	-	-	-	-	1	1	-
CO 6	1	1	2	1	2	2	-	-	-	-	-	-	2	1	-

UNIT – I

Introduction – High Performance Computing Disciplines, impact of supercomputing on science, society and security; anatomy of a super computer, compute performance, a brief history of Supercomputing.

UNIT - II

HPC Architecture, Systems and Technologies: Key properties of HPC, Architecture, Parallel architecture families, Flynn's taxonomy, enabling technology, Van Neumann sequential processors, vector and pipelining, Single instruction Multiple Data Array, Multiprocessors, Heterogeneous computer structures.

Commodity Clusters: Hardware architecture, Programming interfaces, Software environments.

UNIT – III

Symmetric Multiprocessor Architecture: Architecture overview, Amdahl's Law Plus, Processor Core architecture, memory hierarchy, PCI Bus, external interfaces.

OpenMP: Overview of OpenMP programming model, parallel threads and loops, synchronization, reduction.

UNIT-IV

Distributed memory parallel Programming with MPI: Message passing interface standards, MPI basics, communicators, point-to-point messages, synchronization collectives, communication collectives, non-blocking point-to-point communication, user-defined data types.

UNIT – V

Accelerator Architecture: Historic perspective, introduction to Graphics Processing Units, evolution of GPU functionality, modern GPU architecture, heterogeneous system architecture, introduction to System on Chip SoC), HPC on SoC, types of SoC, Edge Computing, High Performance on Edge devices.

Mass Storage: Brief history of storage, storage device technology, aggregated storage, high performance storage, all flash/SSD.

Text Books:

1. Thomas Sterling, Mathew Anderson, "High Performance Computing: Modern Systems and Practices", Morgan Kaufman Publishers, 1st Edition, 2017

Suggested Reading:

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science Series, 2011.
2. Charles Severance, Kevin Dowd, "High Performance Computing", OpenStx CNX, 2021.

Online References:

1. https://nptel.ac.in/courses/106108055.
2. https://prace-ri.eu/wp-content/uploads/Edge-Computing-An-Overview-of-Framework-and-Applications.pdf.

22MBC01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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. Demonstrate the importance of Managerial Economics in Decision Making.
2. Explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. Understand the importance of Project Evaluation in achieving a firm's Objective.

Course Outcomes: Upon completion of this Course, student 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	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	1	1	3	1	1	1	1	1	1	1	-	-	-	-	-
CO 2	2	2	2	2	-	1	1	1	-	1	-	1	-	-	-
CO 3	1	2	1	2	2	-	2	1	-	1	-	-	-	-	-
CO 4	2	2	1	2	2	1	1	3	-	1	-	-	-	-	-
CO 5	1	3	1	2	1	1	2	-	-	1	2	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", 12th Edition, Vikas Publishing House, 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. R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2018.

22CSC25

COMPILER DESIGN LAB

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

Pre-requisites: Data Structures, Design and analysis of algorithms, Formal language and automata theory.

Course Objectives: This course aims to:
1. Define the rules for implementing lexical analyzer and to understand the concepts behind theworking of compiler tools- Lex, Turbo C, Yacc.
2. Analyze and apply regular grammar for various source statements expression.
3. Implement front end of the compiler by means of generating intermediate codes, implement codeoptimization techniques and error handling.

Course Outcomes: Upon completion of this course, students will be able to:
1. Implement the rules for the analyzing phases of a compiler.
2. Examine the concepts of compiler tools: Lex, Flex, Yacc, Turbo C.
3. Apply various Syntax techniques on grammars to build the parsers.
4. Generate various intermediate code representations for source code.
5. Implement the concepts of code optimization, code generation phases.

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

List of Programs:
1. Tokenization – By constructing DFA of Lexical Analyzer.
2. Writing a standalone scanner application using (Tools: Jlex / JFlex / Lex).
3. Implementing parser for a small language.
4. Implementing parser with Scanner, without Scanner or with yacc/bison generators.
5. Program to generate predictive LL1 parsing table for the Expression grammar.
6. Program to generate SLR parsing table for the Expression grammar.
7. Implementation of the language to an intermediate form (e.g. three-address code).
8. Generation of target code (in assembly language).
9. Target Code improvement with help of optimization techniques.
10. Implement Mini Compiler with Phases.

Text Books:
1. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, 2nd edition, Morgan Kafman, 2004.
2. John R Levine, Tony Mason, Doug Brown, “Lex &Yacc”, 3rd Edition, Shroff Publisher, 2007.

Suggested Reading:
1. Kenneth C Louden, “Compiler Construction: Principles and Practice”, Cengage Learning, 2005.
2. John R Levine,”Lex&Yacc”, 2nd Edition, Oreilly Publishers, 2009.

Online Resources:

1. http://www.nptel.ac.in/courses/106108052
2. http://en.wikibooks.org/wiki/Compiler_Construction
3. http://dinosaur.compilertools.net/
4. http://epaperpress.com/lexandyacc/

22CAC14

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB

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

Course Objectives: This course aims to:
1. Provide students with practical experience in implementing AI and ML algorithms.
2. Enable students to train, validate and test ML models.
3. Develop novel solutions for existing AI and ML problems.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand basic components of library environment and installations and design heuristics to solve real world problems.
2. Implement problems using game search algorithms.
3. Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
4. Implement and evaluate various Machine Learning approaches.
5. Design and develop solutions to real world problems using ML techniques.

CO-PO Articulation Matrix

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

List of Experiments:
1. Identification and Installation of python environment towards the artificial intelligence and machine learning, installing python modules/Packages Import scikitlearn, keras etc.
2. Implement A* algorithm on any problem.
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. 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.
7. Demonstration of Logistic Regression for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
8. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
9. Build the decision tree classifier compare its performance with ensemble techniques like random forest, bagging, boosting and stacking Demonstrate it with different decision trees.
10. Demonstration of SVM and use for character recognition task.
11. Demonstration of Clustering algorithms - k-Means, Agglomerative and DBSCAN to classify for the standard datasets

Text Books:
1. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Ed., 2015.
2. Giuseppe Bonaccorso, "Machine Learning Algorithms", 2nd Edition, Packt, 2018

Suggested Reading:

1. Tom M. Mitchell, "Machine Learning", McGraw Hill, 4th Ed., 2017.
2. Rich, Knight, Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Ed., 2017.
3. Puneet Mathur, "Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance", 1st Ed, Apress, 2019.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Ed., CRC Press, 2014.
5. Saroj Kaushik, "Artificial Intelligence", 1st Ed., Cengage Learning India, 2011.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc24_cs88/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs81/preview

20CSC26

MINI PROJECT

Instruction	4 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	2

Objective:

The main objective of this mini project is to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. It enables the students to design and develop solutions to real world problems by applying programming knowledge to become a good engineer. It acts like a beginners guide to do larger projects later in their career.

Course Outcomes:

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

1. Identify and understand the real world problems.
2. Represent the solutions by using various design aids/charts/diagrams.
3. Implement the solutions using modern tools/languages.
4. Analyze and interpret the experimentation results, draw conclusions.
5. Communicate effectively through technical reports and presentation according to the documentation/report guidelines.

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

Some of the guidelines for Mini Project:

1. **Selection of Topic**: Selection of topic is a huge and important task in a Mini Project. One should have a clear idea about one's subject strengths and the selected topic should be relevant to it. Always select the project that has value addition.As a graduate you should select a project which is either advantageous to a lot of people or enhance your technical and managerial skills. Your project must play its role towards a positive growth/development in that specific field.
2. **Research about the selected topic online:** Do some online research about the selected topic. Go through the research papers from different researchers around the world on the topics related to Mini Project. Find some websites containing the information about the materials used for Mini Project.
3. **Suggestions from subject experts:** Go to the subject experts in your department and interact with them about the Mini Project topic. You can also meet many subject experts from other department or various parts of the society through physically or social media and some discussion forums. This helps you in getting suggestions in different possible ways, through which you can get a clear idea on your Mini Project topic.
4. **Planning:** After getting a clear idea about the topic, prepare a rough plan about procurement of resources, experimentation and fabrication along with your teammates. Make a rough schedule, adapt to it and distribute the work among your teammates. This will keep your Mini Project on track and individuals will come to know about their part in the Mini Project rather than any individual (leader) taking full responsibilities.
5. **Execution of plans:** Make sure that the materials will be ready for the experimentation/fabrication by the scheduled time. Follow the schedule during

experimentation/fabrication to get accurate and efficient results.

6. **Presentation:** Experimentation/Fabrication does not make a Mini Project successful; one should be able to present the results in proper way. So it should be prepared in such a way that, it reflects the exact objective of your Mini Project.

Guide lines / Instructions:

1. Each Mini project must be done in a group of 2-3 students.
2. Choose the topic/problem related to the fields/courses studied earlier or current semester.
3. Each group must prepare a title of the mini project that relates to any engineering discipline and the title must emulateany real-world situation / problem.
4. Submit an early proposal (1-2 pages report describing what is the project about and the outcome of the final productwould be, by the end of **Fourth Week**.
5. The title must be submitted to the respective lecturer by the end of week 9.
6. Report must be submitted during the project presentation (**14th Week**).
7. Students are required to carry out the mini project in any one of the areas/courses that they have studied earlier orstudying currently.
8. The progress of the mini project is monitored by the mentor and coordinator **every week**. Each student has to maintain a **project diary** duly signed by the mentor.

Assessment:

1. 10% Early proposal (abstract).
2. 50% Continuous evaluation (progress of the project including literature review, design, development, coding,documentation according to the time lines).
3. 20% presentation and demonstration (structured, fluent, logic, output) ; 10% Viva Voce (Evaluated by internal PRC-Project Review Committee).
4. 10% Final Report writing.

22CSV02

PRODUCT MANAGEMENT ESSENTIALS

Instruction	1 T Hour per Week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	0.5

Course Objectives: This course aims to:

1. Introduce students to the fundamental concepts and theories of product management, including market analysis.
2. Equip students with the skills necessary to create and execute effective product strategies.
3. Students will work on case studies, simulations, and projects to gain experience in product ideation.

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

1. Define the product manager's position in an organization and the key responsibilities.
2. Demonstrate understanding of key product management concepts, including market analysis, customer segmentation, and product development lifecycle.
3. Develop strategic product plans, including creating product roadmaps, defining pricing strategies, prioritizing features based on market needs, and formulating go-to-market strategies.
4. Learn to use data analytics and metrics to make informed product decisions, track product performance.
5. Gain an awareness of ethical considerations in product management, including privacy issues, social impact, and sustainability.

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

UNIT – I

Introduction to Product Management Essentials: Explore the Specialization in Product Ideation, Design, and Management.

UNIT-II

Product Manager Roles: Roles and Responsibilities of the Product Manager, Product vs Project vs Program,
Types of Product Managers, How to Become a Product Manager, The Product-Development Life Cycle.

UNIT-III

Managing Innovative Product Teams: Organizing and Managing a Product Team, 5C Analysis, Creating an Opportunity Hypothesis, Validating the Hypothesis ,Creating the Product Requirements Document (PRD, User Experience Design, Product Managers vs Designers

UNIT-IV

The Design Process: Usability Testing ,Dieter Rams' 10 Principles of Good Design, Product/Engineering Relationships, Software Development Methodologies, Waterfall Development ,Agile Development ,Scrum, Kanban, Top Roadmapping Tools, Top Prototyping Tools, Top Sprint Tools.

UNIT-V

Market Development and Commercialization: Marketing Challenges, Common Marketing Mistakes, Know Your Customer, Rethinking the 4Ps of Marketing, Revisiting Customer Development, Market Type and Marketing, Solving Customer Problems, Segmenting the Market and Expanding Your Markets.

Online Resources:

1. https://www.coursera.org/learn/product-management-essentials.
2. https://www.futurelearn.com/courses/product-management-essentials.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTIONS AND EXAMINATION

(Inline with AICTE Model Curriculum with effect from AY 2025-26)
(R22 Regulation)

B.E. (Computer Science and Engineering)

SEMESTER – VII

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.	22CAC04	Deep Learning	3	-	-	3	40	60	3
2.	22CSC27	Information and Network Security	3	1	-	3	40	60	4
3.	22EEM01	Universal Human Values-II: Understanding Harmony	-	1	-	-	50	-	1
4.	22CSEXX	Professional Elective Course -IV	3	-	-	3	40	60	3
5.	22CSEXX	Professional Elective Course -V	3	-	-	3	40	60	3
6.	22XXXXX	Open Elective Course-II	3	-	-	3	40	60	3
PRACTICAL									
7.	22CSC28	Information and Network Security Lab	-	-	2	3	50	50	1
8.	22CSEXX	Professional Elective - V Lab	-	-	2	3	50	50	1
9.	22CSC37	Project Part-I	-	-	4	-	50	-	2
TOTAL			**15**	**2**	**8**	**-**	**400**	**400**	**21**

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

Professional Elective -IV	
22CAE08	Reinforcement Learning
22CSE10	Software Project Management
22CIE55	Cyber Security
22ITE07	Cloud Computing
22ADE32	Social Network Analytics

Open Elective - II	
22EEO01	Energy Management System
22MEO02	3D Printing
22EGO02	Gender Sensitization
22BTO04	Bioinformatics
22CAO02	Ethical Intelligence

Professional Elective -V	
22CAE19	Natural Language Processing
22CSE11	Client End Technologies
22CIE53	Blockchain Technology
22ITE11	Devops Tools
22ADE14	Generative AI

Professional Elective -V Lab	
22CAE20	Natural Language Processing Lab
22CSE12	Client End Technologies Lab
22CIE54	Blockchain Technology Lab
22ITE12	Devops Tools Lab
22ADE15	Generative AI Lab

22CAC04

DEEP LEARNING

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

Pre-requisites: Artificial intelligence, Machine Learning

Course Objectives: This course aims to:
1. Provide students with a strong foundation in the history, concepts, and mathematical principles of deep learning.
2. Develop students' skills in gradient descent methods and regularization techniques for effective model training.
3. Equip students to design and implement convolutional and recurrent neural network architectures.
4. Enhance students' understanding and application of autoencoders and regularization methods for robust models.
5. Expose students to the latest deep learning models and trends, preparing them for future advancements.

Course Outcomes: Upon completion of this course, students will be able to:
1. Demonstrate comprehensive understanding of foundational deep learning concepts and neural network architectures.
2. Design and apply sophisticated neural network models to solve complex real-world problems.
3. Utilize diverse training algorithms and optimization methods to enhance deep learning model performance.
4. Implement innovative techniques for model development and regularization to improve generalization and robustness.
5. Investigate and apply recent advancements in deep learning, including transformers and GANs, to stay current in the field.

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

UNIT-I

Neural Networks: History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent.

UNIT-II

Backpropagation Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition.

Regularization: Bias Variance Tradeoff, L2 regularization, early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout.

UNIT-III

Convolutional Neural Network: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types.

Pre-trained models: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet.

Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks

UNIT-IV

Auto encoders: relation to PCA, Regularization in auto encoders, Denoising auto encoders, sparse auto encoders,

Contractive auto encoders

Recurrent Neural Networks: Vanishing and Exploding Gradients, GRU, LSTMs. Encoder Decoder Models, Attention Mechanism.

UNIT-V

Transformers: ViT and BERT models.

Generative Adversarial Networks (GANs): Introduction, Discriminator, Generator, Activation, Common

Activation functions for GANs**.**

Recent Trends: Zero-shot, One-shot, Few-shot Learning; Self-supervised Learning.

Text Books:

1. Goodfellow. I., Bengio. Y. and Courville. A., "Deep Learning ", MIT Press, 2016.
2. Rothman, Denis, "Transformers for Natural Language Processing: Build innovative deep neural network architectures for NLP with Python, PyTorch, TensorFlow, BERT, RoBERTa, and more", Packt Publishing Ltd, 2021.
3. Ganguly Kuntal, "Learning generative adversarial networks: next-generation deep learning simplified", Packt Publishing, 2017

Suggested Reading:

1. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
2. Bishop, Christopher M. Pattern Recognition and Machine Learning. Springer, 2006. ISBN 978-0-387-31073-2
3. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
4. Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.
5. Richard Hartley, Andrew Zisserman, Multiple View Geometry in Computer Vision, 2004. David Marr, Vision, 1982.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs41/
2. https://onlinecourses.nptel.ac.in/noc22_cs22/
3. https://onlinecourses.nptel.ac.in/noc19_cs85/

22CSC27

INFORMATION AND NETWORK SECURITY

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

Pre-requisites: Data Communication and computer networks.

Course Objectives: This course aims to:

1. Understand the importance of confidentiality, integrity, availability and authentication.
2. Understand various cryptographic algorithms.
3. Understand Hashing techniques.
4. Describe key management and distribution and application security schemes.
5. Understand implementation of Transport layer and web security

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

1. Recall the security principles, attacks, services and mechanisms.
2. Identify classical encryption techniques and block ciphers.
3. Apply hash and MAC algorithms, and digital signatures.
4. Analyze and evaluate key management and application security schemes like PGP, S/MIME.
5. Create IP security, SSL/TLS, and case studies.

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

UNIT-I

Security Concepts: Introduction, Information Security Policy, Standards, and Practices; Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.

Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography

UNIT-II

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, Block cipher operation, Stream ciphers, RC4.

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange.

UNIT-III

Cyptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512).

Message authentication codes: Authentication requirements, HMAC, Digital signatures, Elgamal Digital Signature Scheme.

UNIT–IV

Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

E-Mail Security: Pretty Good Privacy, S/MIME.

UNIT–V

IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload.

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH).

Case Studies: Secure Multiparty Calculation, Single sign On.

Text Books:

1. William Stallings, "Cryptography and Network Security - Principles and Practice", 7th Edition, Pearson Education,
2. Atul Kahate, "Cryptography and Network Security", 3rd Edition, Mc Graw Hill,
3. Michael E. Whitman and Herbert J. Mattord , "Principles of Information Security", 4th Edition., Cengage Learning.

Suggested Reading:

1. C K Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security", 1st Edition, Wiley India,
2. Forouzan Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Mc Graw Hill.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. WM. Arthur Conklin, Greg White, "Principles of Computer Security", TMH.
5. Neal Krawetz, "Introduction to Network Security", CENGAGE Learning.
6. Bernard Menezes, "Network Security and Cryptography", CENGAGE Learning.

Online resources

1. https://onlinecourses.nptel.ac.in/noc21_cs16/

22EEM01

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

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

Instruction	1 T Hours per Week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Introduction:

This course discusses the role of human values in one's family, in society and in nature. During the Induction Program, students would get an initial exposure to human values through Universal Human Values–I. This exposure is to be augmented by this compulsory full semester foundation course.

Course Objectives: This course aims to:

1. Understand the concept of universal human values
2. Cultivate empathy and respect for diversity
3. Inspire the social responsibility and global citizenship

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

1. Become familiar about themselves, and their surroundings (family, society, nature).
2. Develop empathy and respect for diversity by gaining an appreciation for different cultures, perspectives, and identities
3. Exhibit responsible and ethical behavior by adhering to principles of integrity, honesty, compassion, and justice.
4. Recognize their role as global citizens.
5. Exhibit a sense of social responsibility.

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

1 - Slightly, 2 - Moderately, 3 - Substantially

MODULE -1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration.
- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario.
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE- 2: Understanding Harmony in the Human Being - Harmony in Myself

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE-3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- Understanding the meaning of Trust; Difference between intention and competence.
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals.
- Strategy for transition from the present state to Universal Human Order:
  a. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers.
  b. At the level of society: as mutually enriching institutions and organizations.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

MODULE -4: Understanding Harmony in Nature and Existence - Whole existence as Coexistence.

- Understanding the harmony in Nature.
- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature.
- Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- Holistic perception of harmony at all levels of existence.
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability Identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability Identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

MODE OF CONDUCT (L-T-P-C 0-1-0-0)

- While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
- In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection, and self-exploration.
- Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentors, in a group sitting.
- **Tutorials (experiments or practical) are important for this course**. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included.
- The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to the development of commitment, namely behaving and working based on basic human values.
- **It is advised to share the experience of the Faculty to the class in a capsule form.**
- **Involve more in evaluating the student by different activities with proper RUBRCCS**

ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self- assessment, peer assessment etc. will be used in evaluation.

EXAMPLE:

Module-1:	10 M
Module -2:	10 M
Module- 3:	10 M
Module-4:	10 M
Attendance & Attitude:	10 M

The overall pass percentage is 50%. In case the student fails, he/she must repeat the course.

Text books:

1. "A Foundation Course in Human Values and Professional Ethics" by R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2022.
2. "Teacher's Manual for A Foundation Course in Human Values and Professional Ethics" by R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2022.

Suggested Reading:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth – by Mohandas Karamchand Gandhi

22CAE08

REINFORCEMENT LEARNING
(Professional Elective-IV)

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

Prerequisites: Probability and Statistics, Machine Learning, Data Structures

Course Objectives: This course aims to:

1. To Understand the fundamental principles of Reinforcement Learning and MDP Process
2. To Analyze Monte Carlo Methods and Temporal-Difference learning techniques.
3. Evaluate the use of Eligibility Traces in reinforcement learning through case studies

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

1. Acquire the fundamental concepts of Reinforcement Learning.
2. Apply the concepts of Finite Markov Decision Process to solve the complex problems.
3. Analyze and evaluate the effectiveness of Monte Carlo methods and On/Off Policy methods
4. Analyze and apply Temporal Difference Learning for real world problems.
5. Evaluate eligibility traces and novel reinforcement learning solutions.

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

UNIT-I:

Introduction to Reinforcement Learning:-Examples, History of RL, Limitations, Scope, Elements of Reinforcement Learning, An n-armed bandit problem, Action-value methods, Incremental Implementation, Tracking a nonstationary problem, Optimistic initial values, Upper- Confidence-Bound Action Selection, Gradient bandits.

UNIT-II:

Finite Markov Decision Processes: The Agent-Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation.

UNIT-III:

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off- Policy prediction via importance sampling, Incremental implementation, Off-policy monte carlo control

UNIT-IV:

Temporal-Difference learning: TD prediction, Advantages of TD prediction methods, Optimality of TD(0), Sarsa: On-policy TD control, Q-Learning: Off-policy TD control

UNIT-V:

Eligibility Traces: n-step TD prediction, The forward view of TD(λ),the backward view of TD(λ), Equivalences of forward and backward views, Sarsa(λ), Watkin's Q(λ), Off-policy eligibility traces using importance sampling.

Case studies: TD-Gammon, Samuel's Checkers Player.

Text Books:

1. "Reinforcement learning: An introduction," First Edition, Sutton, Richard S., and Andrew G. Barto, MIT press 2020.
2. "Statistical reinforcement learning: modern machine learning approaches," First Edition, Sugiyama, Masashi. CRC Press 2015.

Suggested Reading:

1. "Bandit algorithms," First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020.
2. "Reinforcement Learning Algorithms: Analysis and Applications," Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021.
3. Alexander Zai and Brandon Brown "Deep Reinforcement Learning in Action," First Edition, Manning Publications 2020.

Online Resources:

1. https://nptel.ac.in/courses/106106143
2. https://www.coursera.org/specializations/reinforcement-learning

22CSE10

SOFTWARE PROJECT MANAGEMENT
(Professional Elective -IV)

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

Pre-requisites: Software engineering

Course Objectives: This course aims to:
1. Acquire knowledge on software process management
2. Acquire managerial skills for software project development
3. Understand software economics

Course Outcomes: Upon completion of this course, students will be able to:
1. Gain knowledge of software economics, phases in the life cycle of software development, project organization, project control and process instrumentation
2. Analyze the major and minor milestones, artifacts and metrics from management and technical perspective
3. Design and develop software product using conventional and modern principles of software project management
4. Apply project organization and software metrics concepts through working in a group as team leader in a project.
5. Describe Staffing in Software through working in a group as team leader

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

UNIT - I

Software Process: Maturity Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP)

UNIT - II

Project Life Cycle and Effort Estimation: Software process and Process Models – Choice of Process models – Rapid Application development– Agile methods – Dynamic System Development Method – Extreme Programming- Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques -COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

UNIT - III

Activity Planning and Risk Management: Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling -Network Planning models – Formulating Network Model – Forward Pass and Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning -Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT - IV

Project Organizations: Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation, the seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, and metrics automation.

UNIT - V

Staffing in Software Projects: Managing people, Organizational behavior, Best methods of staff selection, Motivation, The Oldham, Hackman job characteristic model, Stress, Health and Safety, Ethical and Professional concerns, Working in teams, Decision making, Organizational structures, Dispersed and Virtual teams, Communications genres, Communication plans, Leadership.

Text Books:

1. Watts S. Humphrey, "Managing the Software Process", 1st Edition, Pearson Education, 2002.
2. Walker Royce, "Software Project Management", 17th Edition, Pearson Education, 2022.

Suggested Reading:

1. Watts S. Humphrey, "An Introduction to the Team Software Process", Pearson Education, 2000
2. James R. Persse, "Process Improvement Essentials", O'Reilly, 2006
3. Bob Hughes and Mike Cotterell, "Software Project Management", 4th Edition, TMH, 2006
4. Andrew Stellman and Jennifer Greene, "Applied Software Project Management", O'Reilly, 2006.
5. Richard H. Thayer and Edward Yourdon, "Software Engineering Project Management", 2nd Edition, Wiley India, 2004.
6. Jim Highsmith, "Agile Project Management", Pearson education, 2004.

Online Resources:

1. Software Project Management - Course (nptel.ac.in)
2. Software Engineering: Software Design and Project Management Course by The Hong Kong University of Science and Technology | Coursera

22CIE55

CYBER SECURITY
(Professional Elective -IV)

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

Pre-Requisites:
A foundational understanding of computer science principles, basic programming skills, knowledge of operating systems, familiarity with network fundamentals, prior coursework or experience in IT (network security, software development), and comfort with technical terminology and cybersecurity concepts.

Course Objectives: This course aims to:
1. Gain a comprehensive understanding of cybersecurity principles, including definitions, challenges, and human factors.
2. Analyze the origins, categories, and methods of cybercrimes, including tools and defenses.
3. Examine vulnerabilities in software platforms and operating systems, and strategies for prevention, detection, and mitigation.
4. Educate on the security requirements and risk management strategies for databases and cloud environments.
5. Introduce security concerns of cyber-physical systems (CPS) and guide on using threat intelligence tools and recovery processes.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand and articulate key principles and challenges of cybersecurity, including human factors and the cybersecurity kill chain.
2. Identify and describe various categories of cybercrimes and implement appropriate tools and methods for defense.
3. Recognize, prevent, and mitigate vulnerabilities in software and operating systems, ensuring secure software lifecycle processes.
4. Understand security requirements for databases and cloud environments, employing risk analysis and security tools to protect data and services.
5. Assess security and privacy concerns of CPS, apply threat intelligence tools, and manage investigation and recovery processes following cybersecurity incidents.

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

UNIT – I
Cybersecurity: Definition, Principles. **Cybersecurity challenges**: old techniques and broader results, the shift in the threat landscape. **Cybercrime:** Definition and Origins of the word. **Cyberoffenses:** Categories of Cybercrime. **Tools and Methods Used in Cybercrime**: Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDos Attacks, SQL Injection, Buffer Overflow.

Understanding the Cybersecurity Kill Chain: External reconnaissance, Access, and privilege escalation. **Authentication, Authorization, and Accountability (AAA):** Access control, Identity management, user authentication, and technical aspects of accountability.

UNIT – II

Software Security: Categories of Vulnerabilities, Prevention and Detection of Vulnerabilities, Mitigating Exploitation of Vulnerabilities. **Security in the Design of Operating Systems:** Simplicity of Design Layered Design Kernelized Design Reference Monitor Correctness and Completeness Secure Design Principles Trusted Systems Trusted System Functions.

UNIT – III

Web and Mobile Security: Fundamental Concepts and Approaches, Sandboxing, Client-Side and Server-Side Vulnerabilities and Mitigations. **Cybercrime: Mobile and Wireless Devices**: Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security challenges posed by mobile devices, registry settings for mobile devices, Authentication Service Security, Attacks on Mobile phones.

UNIT – IV

Database Security: Security Requirements of Databases, Reliability, and Integrity, Database Disclosure. **Cloud Computing Security**: Introduction to Cloud Computing, Service and Deployment Models, Risk Analysis, Cloud as a Security Control, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

UNIT – V

Threat Intelligence: Introduction, Open-Source Tools, Microsoft Threat Intelligence, Leveraging Threat Intelligence to Investigate Suspicious Activity. **Investigating an Incident**: Investigating an Incident, Scoping the issue, Key artifacts, investigating a compromised system on-premises, Investigating a compromised system in a hybrid cloud. **Recovery Process**: Disaster recovery planning process, challenges. **Cyber-Physical Systems (CPS):** Characteristics, Risks, Security and Privacy Concerns.

Text Books:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cybercrimes, Computer Forensics, and Legal Perspectives”, First Edition, Wiley India, 2011.
2. Security in Computing, Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Fifth Edition, Prentice Hall, 2018.
3. The Cyber Security Body of Knowledge, Awais Rashid, Howard Chivers, George Danezis, Emil Lupu, Andrew Martin, First Edition, 2019
4. Cybersecurity - Attack and Defense Strategies, Yuri Diogenes, Erdal Ozkaya - Third Edition, Packt Publishing, 2022.

Reference Books:

1. Cybersecurity Essentials, Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, John Wiley & Sons, Sybex A Wiley Brand, 2018.
2. Network Security Assessment, Chris McNab, Third Edition, O'Reilly Media, Inc., 2016.
3. Computer security: principles and practice, William Stallings, Lawrie Brown, Second Edition, Pearson Education, 2013.
4. Network Security Essentials: Applications and Standards, William Stallings, Fourth Edition, Pearson Education, 2011.

Online Resources:

1. OWASP - Open Web Application Security Project: https://owasp.org
2. NIST Cybersecurity Framework: https://www.nist.gov/cyberframework
3. SANS Institute: https://www.sans.org/
4. CIS - Center for Internet Security: https://www.cisecurity.org
5. ISACA: https://www.isaca.org

22ITE07

CLOUD COMPUTING
(Professional Elective-IV)

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

Prerequisite: Knowledge on Data Bases and computing mechanisms.

Course Objectives: This course aims to:
1. Gain a comprehensive understanding of fundamental concepts in cloud computing, including its goals, benefits, risks, challenges, service models, and deployment models.
2. Explore cloud-enabling technologies such as cloud data center technology, virtualization, multitenant technology, and containerization, along with their roles and implications in cloud computing environments.
3. Analyze specialized cloud mechanisms and management mechanisms to understand their significance in optimizing cloud performance and resource utilization.
4. Examine various access-oriented and data-oriented security mechanisms implemented in cloud computing environments
5. Evaluate different cloud computing architectures to design scalable, resilient, and efficient cloud solutions aligned with organizational requirements and objectives.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the fundamental cloud computing concepts, including service models, deployment models.
2. Analyze cloud enabled technologies and evaluate various cloud infrastructure components, storage technologies, and networking principles.
3. Apply the advanced cloud computing mechanisms and cloud management mechanisms
4. Analyze the security challenges, identify potential risks, and evaluate strategies for securing cloud deployments.
5. Critique different cloud computing architectures, evaluating their scalability, resilience, and suitability for diverse application scenarios leverage emerging trends such as edge computing and fog computing

CO-PO Articulation Matrix

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

UNIT - I

Fundamental Concepts of Cloud Computing: Goals and Benefits, Risks and Challenges, Cloud Computing Service and Deployment Models: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Multi-Cloud

UNIT - II

Cloud-Enabling Technology: Cloud Data Center Technology, Modern Virtualization, Multitenant Technology, Service Technology and Service APIs, Fundamental of Containerization, Containers, Container Images, Multi-Container Types. **Cloud Infrastructure Mechanisms:** Logical Network Perimeter, Virtual Server, Hypervisor, Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-Made Environment.

UNIT - III

Specialized Cloud Mechanisms: Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-Per-Use Monitor, Audit Monitor, Failover System, Resource Cluster, Multi-Device Broker, State Management Database

Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System**.**

UNIT - IV

Cloud Computing Architectures: Workload Distribution Architecture, Elastic Resource Capacity Architecture, Multi Cloud Architecture, Hypervisor Clustering Architecture, Cloud Balancing Architecture **Specialized Cloud Architectures:** Edge Computing Architecture, Fog Computing Architecture, Metacloud Architecture, Federated Cloud Application Architecture**.**

UNIT - V

Cloud Computing Security: Threat Agents, Common Threats, **Cloud Security and Cybersecurity Access-Oriented Mechanisms:** Cloud-Based Security Groups, Hardened Virtual Server Image, Identity and Access Management (IAM) System, **Cloud Security and Cybersecurity Data-Oriented Mechanisms:** Data Loss Prevention (DLP) System, Trusted Platform Module (TPM). **Cloud Delivery Model Considerations:** Case Study on Cloud Provider and Consumer Perspective.

Text Books:

1. Thomas Erl, Eric Barceló Monroy, “Cloud Computing: Concepts, Technology, Security, and Architecture”, 2nd Edition, 2023, Pearson, ISBN: 9780138052287.

Suggested Reading:

1. Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi, “Cloud Computing: Principles and Practice", 2020.
2. Comer, D, “The Cloud Computing Book: The Future of Computing Explained”, 1st edition,. Chapman and Hall/CRC, 2021. https://doi.org/10.1201/9781003147503.
3. Sean Howard, “Edge Computing with Amazon Web Services: A practical guide to architecting secure edge cloud infrastructure with AWS”, 1st Edition, ISBN: 9781835081082, Packt Publishers, 2024.

22ADE32

SOCIAL NETWORK ANALYTICS
(Professional Elective-IV)

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

Prerequisite: Web Technologies, Computer Networks and Data Warehousing and Data Mining.

Course Objectives: This course aims to:
1. Understand the concept of Social networks and related applications.
2. Learn Social network analysis software Tools and Libraries.
3. Understand social network Graphs and Community Mining Algorithms.
4. Learn visualization of social networks.
5. Analyze human behavior in social web and related communities.

Course Outcomes: Upon completion of this course, students will be able to:
1. Design the social networks
2. Gain skills in tracking the social networks and its tools.
3. Use Open source tools to perform social network analysis.
4. Visualize social networks and analysis.
5. Predict human behavior in social network and related communities

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

UNIT - I

Introduction to Social Network Analytics: Social Networks Perspective - Analysis of Network Data - Interpretation of Network Data - Social Network Analysis in the Social and Behavioral Sciences - Metrics in social network analysis.

UNIT - II

Social Network Analysis, Software Tools and Libraries: Data Representation, network measures, Modeling and aggregating social network data, Social network analysis software Tools and Libraries.

UNIT - III

Cliques, Clusters, Components and Community Mining Algorithms Applications: Components and Sub graphs: Sub graphs - Ego Networks, Triads, Cliques, Hierarchical Clustering, Triads, Network Density and conflict. Density: Egocentric and Socio centric - Digression on Absolute Density – Community structure and Density, Centrality: Local and Global - Centralization and Graph Centers, Cliques and their intersections, Components and Citation Circles - Positions, Sets and Clusters.

UNIT - IV

Visualizing Social Networks with Matrix: Matrix and node and link diagrams, Hybrid representations, cover networks, Community welfare, Collaboration networks, Co-Citation networks, Advances in Network Visualization - Elites, Communities and Influence, Applications of Social Network Analysis.

UNIT - V

Predicting Human Behavior and Privacy Issues: Understanding and predicting human behavior for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

Text Books:

1. David Eas ley, Jon Kleinberg, "Networks, Crowds and Markets", Cambridge Press, 2010.
2. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.

Suggested Reading:

1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting and Using Metrics, 1stb Edition, McGraw Hill, 2011.
2. Guandong Xu ,Yanchun Zhang and Lin Li,-Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
3. Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.
4. Hansen, Derek, Ben Sheiderman, Marc Smith, Analysing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 2011.

Online Resources:

1. https://www.coursera.org/course/sna
2. https://www.coursera.org/course/networks

22CAE19

NATURAL LANGUAGE PROCESSING
(Professional Elective-V)

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. Understand various Natural Language Processing Fundamentals.
2. Understand probabilistic NLP and classification of text using Python's NLTK Library
3. Understand various text representations and labelling techniques.
4. Understand various NLP models and named entities.
5. Learn RNN for NLP.
6. Understand usage of GRU and LSTM models for translation.
7. Understand various applications of NLP.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the fundamentals of Natural Language Processing, manipulate and analyse language data.
2. Demonstrate key concepts from NLP, text representation and linguistics to describe and analyse language.
3. Demonstrate the word embedded techniques and classification of the text.
4. Make use of the Deep learning and Transformers for NLP.
5. Develop NLP applications using appropriate NLP tools and techniques.

CO-PO Articulation Matrix

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

UNIT- I: Introduction to NLP: Definition, History, NLP in the real world, Approaches to NLP, NLP Pipeline.
Language Processing and Python: Computing with Language: Texts and Words, A Closer Look at Python: Texts as Lists of Words, Computing with Language: Simple Statistics.
Accessing Text Corpora and Lexical Resources: Accessing Text Corpora, Conditional Frequency.

UNIT- II: Basic Vectorization approaches of Text Representation: One-Hot Encoding, Bag of Words, Bag of N-Gram, TF-IDF; Distributed universal text and handcrafted feature Representations, Neural language models, N-gram language model.
Processing Raw Text: Accessing Text from the Web and from Disk, Text Processing with Unicode.
Categorizing and Tagging Words: Using a Tagger, Tagged Corpora, Mapping Words to Properties Using Python Dictionaries, Automatic Tagging.

UNIT-III: Word Embeddings: Count Vector, Frequency based Embedding, Prediction based Embedding,Word2Vec and Glove.
Learning to Classify Text: Supervised Classification and Text classification with Machine learning algorithms.

UNIT-IV: Deep learning for NLP: RNN for language model, Sequence Labelling and Sequence Classification, Encoder-Decoder with RNNs, GRUs and LSTMs for machine translation, Convolutional neural networks for sentence classification and Evolution metrics for NLP.
Transformers for NLP: Attention , Transformers and BERT.

UNIT-V: Case Study on NLP: Sentiment analysis, Machine translation, Automated speech recognition systems, Question-answering based systems, Topic modelling, Text Generation and Summarization.

Text Books / Suggested Reading:

1. Steven Bird, Ewan Klein, and Edward Lope, Natural Language Processing with Python. O‟Reily,2009.
2. Deep Learning for Natural Language Processing Develop Deep Learning Models for Natural Language in Python (Jason Brownlee), Machine Learning Mastery,2017.
3. Lewis Tunstall, Leandro von Werra, Thomas Wolf - Natural Language Processing with Transformers_ Building Language Applications with Hugging Face-O'Reilly Media (2022).
4. Akshay Kulkarni, Adarsha Shivananda, Natural Language Processing Recipes: Unlocking Text Data with Machine Learning and Deep Learning using Python. Apress, 2019.
5. Sudharsan Ravichandiran ,Getting Started with Google BERT Build and train state-of-the-art natural language processing models using BERT.

Online Resources:

1. https://models.quantumstat.com/
2. https://www.coursera.org/learn/attention-models-in-nlp
3. https://github.com/keon/awesome-nlp

22CSE11

CLIENT END TECHNOLOGIES
(Professional Elective-V)

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

Prerequisite: Knowledge of a Programming Language, Web Technologies, Databases.

Course Objectives: **This course aims to:**
1. Acquire knowledge on Client end technologies to develop client end web applications.
2. Learn to develop web applications using Angular.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand fundamentals of Client end Technologies.
2. Learn the concept of TypeScript and ECMAScript.
3. Apply the advanced concepts of Angular and WebAPI.
4. Develop Angular applications.
5. Evaluate different web applications to implement optimal solutions for real time problems.

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

UNIT – I

JavaScript and jQuery : Understanding the DOM ,DHTML and manipulating the HTML5 Document ,Validating UI, Working with external JavaScript libraries like jQuery and jQueryUI.

UNIT – II

TypeScript and ECMAScript (ES6): Understanding TypeScript and ECMAScript, Prototypes, Classes, Properties, Methods, Events, and Constructors, Scoping and Modules ,Understanding and Working with Promise ,Trans piling TypeScript.

UNIT – III

Angular: Introduction to Angular, working environment, Angular Modules, Angular Components, Templates and Styles.

UNIT – IV

Advanced Angular Concepts: Routing, Observables, Components and Databinding ,Services and Dependency Injection ,Data binding the UI and performing CRUD operations with the Web API using Angular on MongoDB, Enriching the UX.

UNIT - V

Web APIs and Asynchronous Applications: Node & Express Environment, HTTP Requests & Routes-Handle requests to an Express with routes, Asynchronous JavaScript- Manage asynchronous JavaScript control flow with Promises.

Text Books:

1. Ng-book The Complete book on Angular, Nathan Murray,2018.
2. HTML5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery), Dreamtech, 2017.

Suggested Reading:

1. AngularJS in Action, Jeremy Wilken, Manning publications, 2018.
2. Angular: From Theory To Practice: Build the web applications of tomorrow using the Angular web framework from Google, Asim Hussain, CodeCraft Publisher, 2017.
3. Head First JavaScript Programming: A Brain-Friendly Guide, Elisabeth Robson , Eric Freeman, O'Reilly Publisher, First Edition,2014.

Online Resources:

1. https://www.w3.org/standards/webdesign/.
2. https://www.w3schools.com/angular/.
3. https://www.w3schools.com/jquery/default.asp.
4. https://www.typescriptlang.org/docs/handbook/typescript-in-5-minutes.html.

22CIE53

BLOCKCHAIN TECHNOLOGY
(Professional elective-V)

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. To get acquainted with the foundations of Bockchain.
2. To provide the significance of the bitcoin ecosystem.
3. To explore the consensus mechanisms and technologies that support ethereum.
4. To introduce Hyperledger Fabric and its architecture.
5. To familiarize Blockchain use cases in various domains.

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

1. Define distributed systems and blockchain
2. Explain the concepts of bitcoin and consensus mechanisms in bitcoin mining.
3. Explore the consensus mechanisms and technologies that support Ethereum.
4. Describe Hyperledger Fabric architecture and Hyperledger Projects.
5. Analyse blockchain use cases in various domains.

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

UNIT –I

Blockchain Foundations: Overview of distributed systems, Introduction to Blockchain, Generic elements of a blockchain,Features of Blockchain, Applications of Blockchain, Hash Functions and Merkle Trees, Components of Blockchain Ecosystem, Cryptography and Consensus Algorithms; Types of Blockchain, Blockchain Platforms.

UNIT –II

Bitcoin Platform: Bitcoin definition, Keys and addresses , Public keys and Private keys in bitcoin, Thetransaction life cycle, The transaction structure, Bitcoin payments, Consensus mechanism in bitcoin, Wallet types, Non-deterministic wallets, Deterministic wallets, Alternative Coins- Namecoin, Litecoin,Zcash.

UNIT –III

PermissionlessBlockchainEthereum: Introducing Smart Contracts, Ethereum blockchain , The Ethereum stack,Ethereum virtual machine (EVM), Consensus mechanism in Ethereum, The Ethereum network, EthereumDevelopment, Setting up a development environment, Development tools and clients, Applications developed on Ethereum.

UNIT –IV

Permissioned Blockchain Hyperledger Fabric: Introduction to Hyperledger Fabric, Hyperledger Fabric architecture, Membershipservices, Hyperledger Projects- Fabric, Sawtooth lake, Iroha , Components of the Fabric,Peers or nodes, Applications on Blockchain, Alternate Blockchains- Ripple, Corda.

UNIT –V

Case studies using Blockchain: Cross border payments, Know Your Customer (KYC), Food supplychain, Mortgage over Blockchain, Identity on Blockchain, Blockchain in Insurance Industry, Education, Healthcare,realestate management and Metaverse

Text Books:

1. Imran Bashir, “Mastering Blockchain”, Second Edition, Packt Publishing, 2018
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", First Edition, O'Reilly, 2018

Suggested Reading:

1. Andreas M. Antonopoulos, “Mastering Bitcoin Unlocking Digital Cryptocurrencies”, First Edition Apress,2017
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing, 2019.
3. Ramchandra Sharad Mangrulkar, Pallavi Vijay Chavan, “Blockchain Essentials - Core Concepts and Implementations”, APress Publishing, 2024

Online Resources:

1. https://andersbrownworth.com/blockchain/public-private-keys/
2. https://archive.trufflesuite.com/guides/pet-shop/
3. https://ethereum.org/en/
4. https://www.hyperledger.org/projects/fabric
5. NPTEL courses:

a. Blockchain and its Applications,
b. Blockchain Architecture Design and Use Cases

22ITE11

DEVOPS TOOLS

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

Course Objectives: The aim of this course is
1. To study the fundamentals of DevOps.
2. To describe version control tools in DevOps
3. To study the integration process in DevOps.
4. To understand the containerization in DevOps.
5. To describe the deployment process in DevOps.

Course Outcomes: Upon completing this course, students will be able :
1. To identify the components of DevOps.
2. To interpret the Git for source code management.
3. To investigate the integration process in DevOps
4. To express proficiency in containerization using Docker.
5. To articulate the deployment process in DevOps.

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

UNIT-I

Introduction to DevOps , DevOps Perspective , DevOps and Agile , Team Structure , Coordination , Barriers , The Cloud as a Platform: Features of the Cloud , DevOps Consequences of the Unique Cloud Features , Operations: Operations Services, Scrum, Kanban, and Agile.

UNIT-II

Overview GIT and its principal command lines: Installation, Configuration, Vocabulary, Git Command Lines, Understanding the GIT process and Gitflow pattern: Starting with the Git Process, Isolating your code with branches, Branching Strategy with Gitflow.

UNIT-III

Continuous Integration and Continuous Delivery: Technical Requirements CI/CD principles, Using a package manager in the CI/CD process, Using Jenkins for CI/CD implementation , Using GitLab CI .

UNIT-IV

Containerizing your application with Docker: Installing Docker, Creating Docker file, Building and running a container on a local machine, Pushing an Image to Docker Hub, Deploying a container to ACI with CI/CD pipeline. Using Docker for running command Line tools, Introduction to Kubernetes
Tools: Docker Compose, Docker Swarm

UNIT-V

Getting Started with Docker Composer, Deploying a Docker compose containers in ACI, Installing Kubernetes, First example of Kubernetes application of deployment, Deploying the code: The Puppet master and Puppet agents, Ansible, PalletOps, Deploying with SaltStack, DevOps Best Practices, **Tools: Ansible, Saltstack**

Text Books:

1. Len Bass, Ingo Weber and Liming Zhu, DevOps: A Software Architect's Perspective, Addison-Wesley, Pearson Publication, Second Edition, 2015.
2. Mikael Krief, Learning DevOps: A comprehensive guide to accelerating DevOps culture adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins, Packt Publishing , 2022.

Suggested Reading:

1. Ryan Russell and Jason Southgate, "Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet", Packt Publishing ,2018.
2. Joakim Verona, "Practical DevOps", 2nd edition ,Packt Publishing , 2018.

22ADE14

GENERATIVE AI
(Professional Elective-V)

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. To learn the fundamental concepts of Generative AI
2. To acquire the knowledge of encoders, decoders and autoregressive models
3. To acquire the knowledge of various generative models for image generation, style transfer and text generation
4. To learn to apply transforms, prompt engineering and APIs for real world problems
5. To learn to implement develop application using chat GPTs and open API

Course Outcomes: Upon successful completion of this course, students will be able to
1. Understand the fundamental concepts and significance of Generative AI and the unique challenges associated with generative models.
2. Learn the structure, function, and applications of autoencoders and autoregressive models in machine learning.
3. Understand the principles, architecture, and applications of Generative Adversarial Networks for image generation and style transfer.
4. Grasp the architecture and functionality of transformers, and apply prompt engineering techniques using Hugging Face pretrained transformers and APIs.
5. Explore the advancements, capabilities, and practical applications of GPT models, including developing a GPT-3 powered question-answering application.

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

UNIT-I
Introduction: An Introduction to Generative AI, Applications of AI, The rules of Probability, Why use generative models, Unique challenges of generative models.

UNIT-II
Auto Encoders and Autoregressive Models: Auto encoders, Regularized autoencoders, Stochastic Encoders and Decoders, Autoregressive Models, Fully Visible sigmoid Belief Network (FVSBN), Neural Autoregressive Density Estimation (NADE), Masked Autoencoder for Distribution Estimation (MADE)

UNIT III
Generative Adversarial Network: Generative Adversarial Networks, Vanilla GAN, Progressive GAN, Style transfer and Image transformation, Image Generation with GANs, Style Transfer with GANs

UNIT-IV

Transformers and Prompt Engineering: Transformers, Large Language Models, MLM/NSP, Generative Pretrained Transformers (GPT), Task – Specific GPT Fine Tuning, Prompt Engineering, Hugging face pretrained Transformers, Hugging face APIs

UNIT-V

Chat GPTs and OpenAI GPT 3, 3.5, 4, OpenAI APIS, working with the OpenAI Playground, Application and Use Cases: Content Filtering, Generating and Transforming Text, Classifying and Categorizing Text, building a GPT-3, Powered Question, Answering APP

Text Books:

1. Steve Tingiris Exploring GPT-3, Packt Publishing Ltd. Uk, 2021
2. Joseph Babcock Raghav Bali, Generative AI with Python and Tensor flow 2, Packt Publishing Ltd. UK, 2021

Suggested Reading:

1. Sabit Ekin, Prompt Engineerign for Chat GPT: Aquick Guide to Techniques, Tips, and Best Practices, DOI: 10.36227/techrxiv.22683919.v2, 2023
2. Fregly Chris, Antje Barth, and Shelbee Eigenbrode. Generative AI on AWS: building context-aware multimodal reasoning applicaions, Orielly, 2023.
3. Auffarth, B. "Generative AI with Langchain: Build large language model (LLM) apps with python, chatgpt, and other llms." Packt Publishing, 2023.

Online Resources:

1. https://huggingface.co/
2. https://www.udemy.com/course/generative-ai-for-beginners-b/
3. https://www.coursera.org/learn/generative-ai-with-llms?
4. https://ai.google/discover/generativeai/

22EEO01

ENERGY MANAGEMENT SYSTEM
(Open Elective-II)

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

Prerequisites: None.

Course Objectives: This course aims to:

1. Know the concept of Energy Management.
2. Understand the formulation of efficiency for various Engineering Systems
3. Enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding Energy Management

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

1. Know the current Energy Scenario and importance of Energy Conservation.
2. Understand the concepts of Energy Management, Energy Auditing.
3. Interpret the Energy Management methodology, Energy security and Energy Strategy.
4. Identify the importance of Energy Efficiency for Engineers and explore the methods of improving Energy Efficiency in mechanical systems, Electrical Engineering systems
5. Illustrate the Energy Efficient Technologies in Civil and Chemical engineering systems

CO-PO Articulation Matrix

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

UNIT-I

Various form of Energy and its features: Electricity generation methods using different energy sources such as Solar energy, wind energy, Bio-mass energy, and Chemical energy such as fuel cells. Energy Scenario in India, Impact of Energy on economy, development, and environment sectors of national and international perspective.

UNIT-II

Energy Management-I: Defining Energy Management, need for Energy Management, Energy management techniques, importance of Energy Management, managing the Energy consumption, Energy Audit and Types, Energy Audit Instruments.

UNIT-III

Energy Management-II: understanding Energy costs, bench marking, Energy performance, matching energy use to requirement, optimizing the input, fuel & Energy substitution, material and Energy balance diagrams, Energy pricing, Energy and Environment, Energy Security

UNIT-IV

Energy Efficient Technologies-I: Importance of Energy Efficiency for Engineers, Energy Efficient Technology in Mechanical engineering: Compressed Air System, Heating, ventilation and air-conditioning, Fans and blowers, Pumps and Pumping Systems,

Energy Efficient Technology in Electrical engineering: Automatic Power Factor Controllers, Energy Efficient Motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, space cooling, energy efficiency of lifts and escalator, energy saving potential of each technology.

UNIT-V

Energy Efficient Technologies-II: Energy Efficient Technology in Civil Engineering: Intelligent Buildings, And Various Energy Efficiency Rating Systems for Buildings, Green Buildings Energy Efficiency: management of green buildings, importance of embodied energy in selection of sustainable materials, green building design, waste reduction/recycling, rainwater harvesting, maintenance of the green buildings, green building certification, Renewable energy applications.

Energy Efficient Technology in Chemical Engineering: Green chemistry, Low carbon cements, recycling paper.

Text Books:

1. Umesh Rathore, 'Energy Management', Kataria publications, 2nd ediiton, 2014.
2. G Hariharaiyer, “Green Building Fundamentals”, Notion press.com
3. K V Shama, P Venkataseshaiah, "Energy management and conservation", I. K. International Publishing agency pvt. ltd., 2011, ISBN: 978-93-81141-29-8

Suggested Reading:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects
2. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014) An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering, The University of Adelaide and Queensland Universityof Technology.
3. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

22MEO02

3D PRINTING
(Open Elective-II)

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

Prerequisite: Nil

Course Objectives: This course aims to
1. Make students understand the basic concept of digital manufacturing.
2. Teach different processes involved in digital fabrication of products.
3. Demonstrate the STL file generation and manipulations.
4. Demonstrate various post processing techniques.
5. Demonstrate the applications of RP in different fields of engineering

Course Outcomes: Upon completion of this course, students will be able to
1. Understand the concept of 3D printing processes, advantages, and limitations.
2. Evaluate real-life scenarios and recommend the appropriate 3D printing technology.
3. Analyze various pre-processing and post processing techniques.
4. Identify components and construct basic 3D printer.
5. Explain current and emerging 3D printing technologies in diversified applications

CO-PO Articulation Matrix

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

UNIT-I

Introduction to 3D Printing: Introduction to 3D printing, evolution, distinction between 3D printing and CNC machining. Design considerations: Materials, size, resolution, mass customization. additive vs. subtractive manufacturing, its advantages and limitations

UNIT-II

Photo polymerization processes: Photo polymerization, Stereo lithography Apparatus (SLA), Applications, advantages and disadvantages.

Powder bed fusion processes: Introduction, Selective laser Sintering (SLS), Materials,Applications, advantage and disadvantages.

Extrusion based systems: Fused deposition modeling (FDM), principles, Materials, Process Benefits and Drawbacks.

Laminated Object Manufacturing(LOM), Principles, Materials, Process Benefits and Drawbacks.

Material Jetting AM Processes: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Process

UNIT-III

Pre processing in AM: Modeling and viewing 3D scanning; Model preparation – STL conversion, STL error diagnostics, STL file Repairs, generic solution, slicing, newly proposed file formats.

Post processing in AM: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements usingnon thermal and thermal techniques.

UNIT-IV

Construction of basic 3D printer: Construction of 3D printing machine – axes, linear motion guide ways, ball screws, motors, bearings, encoders, process chamber, safety interlocks, sensors.

UNIT-V

Applications of AM: Application in construction and architectural engineering, aerospace industry, automotive industry, jewelry industry, coin industry. medical and bioengineering applications: planning and simulation of complex surgery, forensic science.

Text Books:

1. Gibson, DW. Rosen and B.Stucker; Additive manufacturing methodologies: Rapid prototyping to direct digital manufacturing, Springer, 2010.
2. Chee Kai Chua, Kah Fai Leong, 3D printing and additive manufacturing: principles and application, 4 th edition of rapid prototyping, World scientific publishing company, 2014.
3. P.K. Venuvinod, Rapid prototyping – Laser based and other technologies, Kluwer, 2004.

Suggested Reading:

1. Jacob, Paul, Rapid tooling: Technologies and industrial applications, Taylor & Francis Group, 2000.
2. Alain Bernard, Georges Taillandier, Additive Manufacturing, Wiley, 2014

22EGO02

GENDER SENSITIZATION
(Open Elective-II)

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

Prerequisite: No specific prerequisite is required.

Course Objectives: This course aims to :
1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways in which gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

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

UNIT – I
Understanding Gender:
Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)
Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II
Gender and Biology:
Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)
Two or Many? Struggles with Discrimination.
UNIT – III
Gender and Labour:
Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV
Issues of Violence
Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:
New Forums for Justice.
Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V
Gender: Co - Existence
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Text Books:
1. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed,
2. Gogu Shyamala, Deepa Sreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender"**,** Telugu Akademi, Hyderabad, 2015.

Suggested Reading:
1. Menon, Nivedita. "Seeing like a Feminist", Zubaan-Penguin Books, New Delhi, 2012.
2. Abdulali Sohaila, "I Fought For My Life…and Won", Available online at:
http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Online Resources:
1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

22BTO04

BIOINFORMATICS
(Open Elective-II)

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

Prerequisites: The school level basic knowledge in Fundamental science is required

Course Objectives: This course aims to:
1. Provide elementary knowledge in biology and bioinformatics and biological information available to a biologist on the web and learn how to use these resources on their own.
2. Learn the fundamentals of biological databases, Sequence analysis, data mining, sequence alignment and phylogenetics.
3. Learn methods for determining the predicting gene and protein.

Course Outcomes: Upon completion of this course, students will be able to:
1. Explain the basic concepts of biology and bioinformatics.
2. Identify various types of biological databases used for the retrieval and analysis of the information.
3. Explain the sequence analysis and data mining.
4. Discuss the methods used for sequence alignment and construction of the phylogenetic tree.
5. Describe the methods used for gene and protein structure prediction.

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

UNIT-I

Introduction And Basic Biology: Bioinformatics- Introduction, Scope and Applications of Bioinformatics; Basics of DNA, RNA, Gene and its structure, Protein and metabolic pathway; Central dogma of molecular biology; Genome sequencing, Human Genome Project.

UNIT-II

Biological Databases: Introduction to Genomic Data and Data Organization, types of databases, biological databases and their classification, Biological Databases - NCBI, SWISS PROT/Uniport, Protein Data Bank, Sequence formats; Information retrieval from biological databases; Data mining of biological databases

UNIT-III

Sequence Analysis and Data Mining: Scoring matrices, Amino acid substitution matrices- PAM and BLOSUM; Gap, Gap penalty; Database similarity searching - BLAST, FASTA algorithms to analyze sequence data, FASTA and BLAST algorithms comparison; Data Mining- Selection and Sampling, Pre-processing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Text Mining Tools

UNIT-IV

Sequence Alignment And Phylogentics: Sequence Alignment – Local and Global alignment; Pairwise sequence alignment – Dynamic Programming method for sequence alignment - Needleman and Wunsch algorithm and Smith Waterman algorithm. Multiple sequence alignment - Methods of multiple sequence alignment, evaluating multiple alignments, applications of multiple sequence alignment. Concept of tree, terminology, Methods of phylogenetic analysis, tree evaluation – bootstrapping, jack knifing

UNIT-V.

Macromolecular Structure Prediction:

Gene prediction, - neural networks method, pattern discrimination methods, conserved domain analysis; Protein structure basics, protein structure visualization, Secondary Structure predictions; prediction algorithms; Chou-Fasman and GOR method, Neural Network models, nearest neighbor methods, Hidden-Markov model, Tertiary Structure predictions; prediction algorithms; homology modeling, threading and fold recognition, ab initio prediction.

Text Books:

1. David Mount, "Bioinformatics Sequence and Genome Analysis", 2nd edition, CBS Publishers and Distributors Pvt. Ltd., 2005
2. Rastogi SC, Mendiratta N and Rastogi P, "Bioinformatics: Methods and Applications Genomics, Proteomics and Drug discovery", 3rdedition, PHI Learning Private Limited, New Delhi, 2010

Suggested Reading:

1. Baxebanis AD and Francis Ouellette BF, "Bioinformatics a practical guide the analysis of genes and proteins", 2nd edition, John Wiley and Sons, Inc., Publication, 2001
2. Vittal R Srinivas, "Bioinformatics: A modern approach. PHI Learning Private Limited", New Delhi, 2009
3. JiXiong, "Essential Bioinformatics", Cambridge University Press, 2006

22CAO02

ETHICAL INTELLIGENCE
(Open Elective-II)

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

Pre-requisites: Not required

Course Objectives: This course aims to:
1. To learn conceptual framework for analyzing ethical issues that AI systems and algorithms, pose to our society.
2. To provide a good understanding of the foundations of modern and ancient approaches to ethics and their differences.
3. Applying knowledge and understanding of AI in information transmission and processing.

Course Outcomes: Upon completion of this course, students will be able to:
1. Enhance and apply their understanding of ethics broadly.
2. Gain familiarity with the problems of ethics.
3. Come up with possible solutions, specifically related to algorithms and AI.
4. Apply their ethical understanding in analyzing cases involving AI.
5. Can apply ethical understanding to any field like social media, data etc.

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

UNIT I

Introduction: Definition of morality and ethics in AI, Impact on society, Impact on human psychology, Impact on the legal system, Impact on the environment and the planet, Impact on trust.

Software Qualities and Normative Ethics: Interpretability, transparency, and normative ethics, Interpretability, transparency, and policy making, Extensibility, usability, and communicability.

UNIT-II

AI and Ethics- Challenges and Opportunites: Challenges, Opportunities- AI Technologies, ethical issues in artificial intelligence, Societal Issues Concerning the Application of Artificial Intelligence in Medicine, Decision-making role in industries, National and International Strategies on AI.

UNIT III

AI Standards and Regulation: Model Process for Addressing Ethical Concerns during System Design, Transparency of Autonomous Systems.

Data Privacy Process: Algorithmic Bias Considerations, Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT IV

Ethics of information and Ethics of AI: Ethical issues for different strengths/grades of AI and AI algorithms, Ethics of AI on the Web and in Web based applications, AI technology and social hierarchy.
Normative ethics proposals: Advantages and disadvantages, Care ethics, Virtue Ethics, Problems with implementation, Problems with uptake and enforcement.

UNIT V

AI, Information transmission, Information processing, and Privacy.
Big data and privacy: Big data and human identity, Gender and cultural bias.
Black boxes: Big data, Recurrent Neural Nets, Black boxes, and social construction

Text Books:

1. John C. Havens "Heartificial Intelligence: Embracing Our Humanity to Maximize Machines Paperback "– Illustrated, 2 February 2016 .
2. Patrick Lin, Keith Abney, George A Bekey, "Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.
3. Ethics, Moral Philosophy, and AI Bauer, W. A. (2020). "Virtuous vs. utilitarian artificial moral agents. AI and Society". Bryson, J. J. (2018)..

Suggested Reading:

1. Michael J. Quinn "Ethics for the Information Age"
2. Mark coeckelbergh " AI Ethics"

Online Resources:

1. NPTEL :: Humanities and Social Sciences - NOC: Towards an Ethical Digital Society: From Theory to Practice https://archive.nptel.ac.in/courses/109/106/109106184/
2. AI Ethics https://www.coursera.org/articles/ai-ethics
3. Ethical Intelligence: Change the Way You Live Your Life https://www.udemy.com/course/ethical-intelligence-change-the-way-you-live-your-life/?couponCode=NVDPRODIN35

22CSC28

INFORMATION AND NETWORK SECURITY LAB

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

Pre-requisites: Data Communication and computer networks.

Course Objectives: This course aims to:
1. Provide practical understanding of cryptography and its application to network security.
2. Familiarize with symmetric and asymmetric cryptography.
3. Learn various approaches on encryption techniques and hashing algorithms.
4. Able to understand the significant functionalities of secure communication.

Course Outcomes: Upon completion of this course, students will be able to:
1. Apply symmetric and asymmetric key algorithms for cryptography and analyze the attacks
2. Identify the use of key distribution scheme
3. Create and evaluate Authentication functions
4. Analyze and design network security protocols
5. Identify and investigate network security threat using tools

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

List of Experiments:
1. Perform encryption, decryption using the following Substitution techniques
   (i) Ceaser cipher (ii) Playfair cipher iii) Hill Cipher
2. Perform encryption and decryption using following Transposition techniques
   (i) Rail fence ii) Row Transformation iii) Column Transformation.
3. Implementation of Data Encryption Standard (DES) algorithm for Symmetric key encryption.
4. Implementation of Advanced Encryption Standard (AES) algorithm for Symmetric key encryption.
5. Implementation of RSA Asymmetric key encryption algorithm.
6. Demonstrate how two parties can securely exchange secret keys over an insecure communication channel using the Diffie-Hellman key exchange algorithm.
7. Implementation of SHA-256 cryptographic hash function.
8. Implementation of Digital Signature Standard (DSS) for generating and verifying Digital Signatures.
9. Implementation of Secure Socket Layer (SSL).
10. Demonstrate Intrusion Detection System (IDS) using any tool e.g. Snort or any other tools.

Text Books:
1. William Stallings, “Cryptography and Network Security: Principles and Practice” Pearson Education, 6th Edition.
2. Chris Brenton, “Mastering Network Security” Bk & Cd-Rom Edition 2017.

Suggested Reading:

1. J.W. Rittiaghouse and William M.Hancok “Cyber Security Operations Handbook” Elseviers.
2. Eric Chou, “Mastering Python Networking” 3rd Edition, 2020.
3. Jean-Philippe Aumasson “Serious Cryptography: A Practical Introduction to Modern Encryption”, 2017.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs16/preview.

22CAE20

NATURAL LANGUAGE PROCESSING LAB
(Professional elective-V)

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

Course Objectives: This course aims to:
1. To learn the fundamentals of natural language processing.
2. To understand the various text processing techniques in NLP.
3. To understand the role Text Classification, Deep Learning for Text Classification techniques of NLP.
4. Using Topic Modeling, Case Studies and apply the NLP techniques to IR applications.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the basic concepts of Natural language processing pipeline.
2. Implement various feature engineering and text representation techniques in NLP.
3. Illustrate text classification techniques to build NLP models.
4. Explore text summarization methods and example systems.
5. Develop strong problem solving skills by working on real world datasets and projects.

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

List of Experiments:
1. Demonstrate the NLP Pipeline, Workflow of the NLP Project and NLP all libraries.
2. Implement preprocessing steps: Tokenization, Stop Word Removal, Stemming and lemmatization.
3. Develop an application to explore Text Representation techniques: One-hot encoding, Bag of Words, TF-IDF and N Gram.
4. Develop the word embedded techniques: Word2Vec and Glove.
5. Build a text classification with sentiment analysis: Apply the text preprocessing techniques and classification algorithms.
6. Implement the text classification with RNN: LSTM and GRU, CNN.
7. Implement the text classification with Attention: Self – Attention and Multi Head Attention.
8. Implement the Text classification with Transformers.
9. To Build a Text Summarization using NLP techniques.
10. To build a Text generation using NLP Techniques.

Text Books / Suggested Reading:
1. Steven Bird, Ewan Klein, and Edward Lope, Natural Language Processing with Python. O‟Reily, 2009.
2. Deep Learning for Natural Language Processing Develop Deep Learning Models for Natural Language in Python (Jason Brownlee), Machine Learning Mastery, 2017.
3. Lewis Tunstall, Leandro von Werra, Thomas Wolf - Natural Language Processing with Transformers_ Building Language Applications with Hugging Face-O'Reilly Media (2022).

4. Akshay Kulkarni, Adarsha Shivananda, Natural Language Processing Recipes: Unlocking Text Data with Machine Learning and Deep Learning using Python. Apress, 2019.
5. Sudharsan Ravichandiran , Getting Started with Google BERT Build and train state-of-the-art natural language processing models using BERT.

Online Resources:

1. https://models.quantumstat.com/
2. https://www.coursera.org/learn/attention-models-in-nlp
3. https://github.com/keon/awesome-nlp

22CSE12

CLIENT END TECHNOLOGIES LAB
(Professional Elective-V)

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

Prerequisite: Knowledge of a programming language, web technologies, databases.

Course Objectives: This course aims to:
1. Acquire knowledge on Client end technologies to develop client end web applications.
2. Learn to develop web applications using Angular.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand fundamentals of Client end Technologies.
2. Learn the concept of TypeScript and ECMAScript.
3. Apply the advanced concepts of Angular and WebAPI.
4. Develop Angular applications.
5. Evaluate different web applications to implement optimal solutions for real time problems.

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

List of Experiments:
1. Evaluation of Angular JS frameworks.
2. Validation of Web pages using JavaScript.
3. Implement event handling using JQuery.
4. Explore the features of ES6 like arrow functions, callbacks, promises, async/await.
5. Implement Routing in AngularJS.
6. Implement CRUD operations with the Web API using Angular on MongoDB.
7. Create a custom server using http module and explore the other modules of Node JS like OS, path, event.
8. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman).
9. Implement an application for reading the weather information from openweathermap.org.
10. Displaying the information in the form of a graph on the web page.

Text Books:
1. Nathan Murray, “Ng-book The Complete book on Angular”, 2018.
2. “HTML5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Dreamtech, 2017.

Suggested Reading:
1. Jeremy Wilken, “AngularJS in Action”, Manning publications, 2018.
2. Asim Hussain, “Angular: From Theory to Practice: Build the web applications of tomorrow using the Angular web framework from Google”, Code Craft Publisher, 2017.

3. Elisabeth Robson, Eric Freeman, “Head First JavaScript Programming: A Brain-Friendly Guide”, O'Reilly Publisher, First Edition, 2014.

Online Resources:

1. https://www.w3.org/standards/webdesign/.
2. https://www.w3schools.com/angular/.
3. https://www.w3schools.com/jquery/default.asp.
4. https://www.typescriptlang.org/docs/handbook/typescript-in-5-minutes.html.

22CIE54

BLOCKCHAIN TECHNOLOGY LAB
(Professional Elective-V)

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

Course Objectives: This course aims to:
1. Familiarize the basic concepts of blockchain.
2. Provide the significance of the Ethereum blockchain.
3. Introduce solidity programming for developing blockchain applications
4. Explore Remix Tool for developing smart contracts.
5. Explore the features of Hyper ledger Fabric .

Course Outcomes: Upon successful completion of this course, students will be able to:
1. Explore the working of blockchain fundamentals such as cryptography and distributed computing.
2. Implement smart contract on the Ethereum blockchain.
3. Build smart contracts using Solidity programming language
4. Write smart contracts using the Remix tool.
5. Acquire thorough knowledge of Hyperledger fabric.

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

List of Experiments:
1. Explore Blockchain Foundations: Elements of Distributed Computing, Elements of Cryptography, Digital Signature.
2. Familiarize with the working of Remix Ethereum tool, Truffle and Ganache.
3. Setup a Simple Ethereum wallet and use it to send and receive Ethers.
4. Introduction to solidity program structure, compilation and deployment environment.
5. Write a Solidity program for incrementing/decrementing a counter variable in a smart contract.
6. Write a Solidity program to send ether from a Meta-mask account to another Meta-mask account through a smart contract.
7. Write a Solidity program to simulate a lottery game.
8. Write a Solidity program to track provenance and movement of goods through the supply chain, ensuring transparency and authenticity (Supply-Chain).
9. Write a Solidity program that automatically pays out claims based on predefined conditions eliminating the need for intermediate (Insurance).
10. Hyperledger Fabric Demo.

Text Books:
1. Imran Bashir “Mastering Blockchain”, Second Edition, Packt Publishers, 2018.
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", 1st Edition O'Reilly, 2018.
3. Mackay Hazel, “Python Programming Handbook for Blockchain Technology Development : A Complete Beginners Guide to Learning Essential Skills to Build Secure Smart Contracts and Decentralized Applications with web3.py”, Independently Published, 2024

Suggested Reading:

1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 1st Edition, Apress, 2017.
2. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to BuildSmart Contracts for Ethereum and BlockChain", Packt Publishing, 2019.

Online Resources:

1. https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
2. https://www.hyperledger.org/projects/fabric
3. https://www.packtpub.com/big-data-and-business-intelligence/hands-blockchain-hyperledger
4. https://www.amazon.com/Hands-Blockchain-Hyperledger-decentralized-applications/dp/1788994523
5. https://github.com/HyperledgerHandsOn/trade-finance-logistics

22ITE12

DEVOPS TOOLS LAB
(Professional Elective-V)

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

Course Objectives: This course aims to:
1. Study the DevOps fundamentals for software development.
2. Know the Version Control using GIT to handle the coding.
3. Build, test and deploy applications using Jenkins and Maven.
4. Use the docker for containerization.
5. Build the deployment process of software.

Course Outcomes: Upon completion of this course, students will be able to:
1. Apply the DevOps basics for product development.
2. Demonstrate the version control tools.
3. Examine the Jenkin and Maven tools.
4. Demonstrate the Docker for containerization.
5. Describe the deployment process using puppet.

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

List of Experiments:
1. To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities.
2. Explore the Version Control System tools for Source Code Management.
3. Install git and create a GitHub account and to execute various GIT operations.
4. Installing and configuring Jenkins to set up a build job will help you comprehend continuous integration.
5. To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
6. To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
7. To learn Docker file instructions, build an image for a sample web application using Docker file.
8. Deploy a containerized application on Kubernetes cluster.
9. To install and configure Pull based Software Configuration Management and provisioning tools using Puppet.
10. To learn Software Configuration Management and provisioning using Puppet Blocks(Manifest, Modules, Classes, Function)

Text Books:
1. Len Bass, Ingo Weber and Liming Zhu, DevOps: A Software Architect's Perspective, Addison-Wesley, Pearson Publication, 2nd Edition, 2015.
2. Mikael Krief, Learning DevOps: A comprehensive guide to accelerating DevOps culture adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins, Packt Publishing, 2022.

Reference Books:

1. Ryan Russell and Jason Southgate, “Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet”, Packt Publishing, 2018.
2. Joakim Verona, “Practical DevOps”, 2nd Edition, Packt Publishing, 2018.

22ADE15

GENERATIVE AI LAB
(Professional Elective-V)

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

Course Objectives: This course aims to:
1. Understand fundamental concepts of generative AI models including autoencoders, GANs, and transformers.
2. Gain proficiency in implementing generative AI models using TensorFlow or PyTorch.
3. Learn to evaluate and interpret the performance of generative AI models effectively.
4. Explore real-world applications of generative AI across various domains such as image generation and natural language processing.
5. Enhance problem-solving skills by experimenting with different model architectures and datasets in generative AI tasks.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Gain comprehensive understanding of generative AI concepts including autoencoders, autoregressive models, GANs, and transformer models.
2. Develop proficiency in implementing various generative AI models using TensorFlow or PyTorch.
3. Learn to evaluate model performance using appropriate metrics and analyze results effectively.
4. Enhance creative problem-solving abilities by experimenting with architectures, datasets, and hyperparameters.
5. Gain insights into real-world applications of generative AI models such as image generation, style transfer, and question answering.

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

List of Programs:
1. Implement a basic autoencoder using TensorFlow or PyTorch and train it on a dataset like MNIST for image reconstruction.
2. Explore different regularization techniques such as L1/L2 regularization or dropout and compare their effects on the autoencoder's performance.
3. Implement a variational autoencoder (VAE) and train it on a dataset like FashionMNIST to generate new images.
4. Implement a basic autoregressive model like the Fully Visible Sigmoid Belief Network (FVSBN) using PyTorch or TensorFlow and train it on a sequential dataset like time series data.
5. Implement NADE and train it on a dataset like CIFAR-10 for image generation.
6. Implement MADE and train it on a dataset like CelebA for image generation.
7. Implement a Vanilla GAN using TensorFlow or PyTorch and train it on a dataset like CIFAR-10 for image generation.
8. Implement Progressive GAN and train it on a large dataset like LSUN for high-resolution image

generation.

9. Implement a style transfer algorithm using GANs and apply it to images from the CIFAR-10 dataset.
10. Implement a basic transformer model using PyTorch or TensorFlow and train it on a text dataset like WikiText-2 for language modeling.
11. Fine-tune a pre-trained GPT model on a specific task such as sentiment analysis using a dataset like IMDB reviews.
12. Utilize the OpenAI API to build a question-answering application powered by GPT-3, allowing users to input questions and receive relevant answers.

Suggested Reading:

1. Steve Tingiris, “Exploring GPT-3”, Packt Publishing Ltd. Uk, 2021
2. Joseph Babcock Raghav Bali, “Generative AI with Python and Tensor flow 2”, Packt Publishing Ltd. UK, 2021
3. Sabit Ekin, “Prompt Engineering for Chat GPT: Aquick Guide To Techniques, Tips, and Best Practices”, DOI: 10.36227/techrxiv.22683919.v2, 2023
4. Foster, D. "Generative Deep Learning. Teaching Machines to Paint, Write, Compose and Play (2019)." Beijing-Boston-Farnham-Sebastopol-Tokyo, OREILLY (2019): 330.
5. Hany, John and Greg Walters, “Hands-On Generative Adversarial Networks with PyTorch 1. x: Implement next-generation neural networks to build powerful GAN models using Python”. Packt Publishing Ltd, 2019.

22CSC37

PROJECT PART – 1

Instruction	4 P Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	2

The objective of 'Project Phase – I' is to enable the student take up an investigative study in the broad field of Computer Science and Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an **individual basis or two/three students in a group**, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/ Modelling / Simulation / Experiment / Design /Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before the Department Review Committee.

Course Outcomes:

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

1. Review the literature related to the problem area / selected topic.
2. Undertake problem identification, formulation, solution and prepare synopsis of the selected topic.
3. Gather the required data and Set up the environment for the implementation.
4. Conduct preliminary analysis/modelling/simulation experiment.
5. Communicate the work effectively in both oral and written forms.

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

Guidelines for awarding CIE (Max. Marks: 100)		
Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report Submission
Department Review Committee (DRC)	5	Relevance of the Topic
	5	Presentation Slide Preparation
	5	Presentation
	5	Question and Answers
	5	Quality of Report

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTIONS AND EXAMINATION

(Inline with AICTE Model Curriculum with effect from AY 2025-26)
(R22 Regulation)

B.E. (Computer Science and Engineering)

SEMESTER –VIII

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.	22EGC03	Employability Skills	-	-	2	3	50	50	1
2.	22CEM01	Environmental Science	2	-	-	2	-	50	Non Credit
3.	22XXXXX	Open Elective Course-III	3	-	-	3	40	60	3
PRACTICAL									
4.	22CSC38	Technical Seminar	-	-	2	-	50	-	1
5.	22CSC39	Project Part-II	-	-	8	-	100	100	4
TOTAL			**5**	**-**	**12**	**-**	**240**	**260**	**9**

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

Open Elective -III	
22CEO01	Infrastructure for Smart Cities
22EEO06	Waste Management
22EGO01	Technical Writing Skills
22CHO02	Fundamentals of Nano Science and Nano Technology
22ADO01	Industry 5.0:Applcations of AI

22EGC03

EMPLOYABILITY SKILLS

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

Prerequisite: Basic Knowledge of Soft skills in the professional setting.

Course Objectives: This course aims to:
1. Learn the art of communication, participate in group discussions and case studies with confidence and to make effective presentations.
2. With- resume packaging, preparing them to face interviews.
3. Build an impressive personality through effective time management, leadership qualities, self-confidence and assertiveness.
4. Understand professional etiquette and to make them learn academic ethics and value system.
5. Be competent in verbal aptitude.

Course Outcomes: Upon completion of this course, students will be able to:
1. Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress.
4. Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
5. Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.

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

UNIT I

Verbal Aptitude: Error Detection, Articles, Prepositions, Tenses, Concord and Transformation of Sentences-Jumbled Words/Sentences- Vocabulary, Synonyms, Antonyms, One Word Substitutes, Idioms and Phrases, Word/Sentence/Text Completion- Reading Comprehension.

UNIT II

Group Discussion & Presentation Skills: Dynamics of Group Discussion-Case Studies- Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Accuracy, Coherence. Elements of Effective Presentation – Structure of a Presentation – Presentation tools – Body language -

Preparing an Effective PPT.

UNIT III

Behavioural Skills: Personal strength analysis-Effective Time Management- Goal Setting- Stress management-

Corporate Culture – Grooming and etiquette-Statement of Purpose (SOP).

UNIT IV

Mini Project: Research-Hypothesis-Developing a Questionnaire-Data Collection-Analysis-General and Technical Report - Writing an Abstract –Technical Report Writing-Plagiarism-Project Seminar.

UNIT V

Interview Skills: Cover Letter and Résumé writing – Structure and Presentation, Planning, Defining the Career Objective, Projecting ones Strengths and Skill-sets – Interviews: Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Mock Interviews.

Text Books:

1. Leena Sen, "Communication Skills", Prentice-Hall of India, 2005.
2. Gulati and Sarvesh, "Corporate Soft Skills", New Delhi: Rupa and Co., 2006.
3. Edgar Thorpe and Showick Thorpe , "Objective English", 2nd edition, Pearson Education, 2007.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.

Suggested Reading:

1. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
2. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", 2018.
3. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.
4. Shalini Verma, "Body Language - Your Success Mantra", S Chand, 2006.

22CEM01

ENVIRONMENTAL SCIENCE

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non Credit

Course Outcomes: This course aims to:

1. Identify various natural resources and effects of their over utilization.
2. Outline the working mechanism of ecosystem.
3. Illustrate the importance of bio-diversity conservation.
4. Identify remediation measures for environmental pollution through legislations.
5. Explain environmental issues and possible sustainable solutions.

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

UNIT-I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT–II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004.
2. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria & Sons, 2009.

Suggested Reading:

1. C. S. Rao,” Environmental Pollution Control Engineering”, Wiley, 1991.
2. S. S. Dara, “A Text Book of Environmental Chemistry &Pollution Control”, S. Chand Limited, 2006

22CEO01

INFRASTRUCTURE FOR SMART CITIES
(Open Elective-III)

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

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

1. Understand the necessity of infrastructural development for smart cities.
2. Illustrate the components and planning aspects of a smart city.
3. Outline smart transportation systems for smart cities.
4. Summarise the significance of disaster resilient infrastructure in smart cities.
5. Review policies and implementation of smart cities at national and global perspective.

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

UNIT-I :

Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective for smart cities. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment

UNIT II :

Planning and development of Smart city Infrastructure: Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security.

UNIT III:

Intelligent transport systems: Connected vehicles, autonomous vehicles, GPS, Navigation system, traffic safety management, mobility services, E-ticketing.

UNIT IV:

Disaster resilient Infrastructure: Electricity, sanitation and water supply systems, fire hazard management, earthquake resilient structures, ICT tools.

UNIT V:

Infrastructure Management: System and Policy for Smart city, integrated infrastructure management systems, worldwide policies for smart city, Government of India - policy for smart city, Smart cities in India, Case studies of smart cities.

Text Books:

1. John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); “Remaking the city: Social science perspective on urban design”; State University of New York Press, Albany (ISBN: 0-87395-678-8)
2. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science

Suggested Reading:

1. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science.
2. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines(1).pdf
3. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988 5. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ar12/preview
2. http://acl.digimat.in/nptel/courses/video/105105160/L01.html

22EEO06

WASTE MANAGEMENT
(Open Elective-III)

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

Prerequisite: None.

Course Objectives: This course aims to:
1. Provide the concept of effective utilization of any scrap.
2. Dispense the processes of all disciplines of engineering.
3. Imaprt the technique of connectivity from waste to utility.

Course Outcomes: Upon completion of this course, students will be able to:
1. Categorize the waste based on the physical and chemical properties.
2. Explain the hazardous waste management and treatment process.
3. Illustrate the environmental risk assessment, methods, mitigation and control.
4. Interpret the biological treatment of solid and hazardous waste.
5. Identify the waste disposal options, describe the design and construction, Operation, Monitoring, Closure of landfills.

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

UNIT -I

Introduction to Waste Management and Municipal Solid Waste Management: Classification of waste, Agro based, Forest residue, Industrial waste, e-Waste, Municipal Solid Waste Management. Fundamentals Sources, Composition, Generation rates, Collection of waste, Separation, Transfer and Transport of waste, Treatment and disposal options.

UNIT -II

Hazardous Waste Management and Treatment: Hazardous Waste Identification and Classification, Hazardous waste management: Generation, Storage and collection, Transfer and transport, Processing, Disposal, Hazardous Waste Treatment: Physical and Chemical treatment, Thermal treatment, Biological treatment, Pollution Prevention and Waste minimisation, Hazardous Wastes Management in India.

UNIT -III

Environmental Risk Assessment: Defining risk and environmental risk, Parameters for toxicity quantification, Types of exposure, Biomagnifications, Effects of exposure to toxic chemicals, Risk analysis and Risk matrix, Methods of risk assessment, Mitigation and control of the risk, Case studies.

UNIT -IV

Biological Treatment: Solid and Hazardous Waste Composting, Bioreactors, Anaerobic decomposition of solid waste, Principles of biodegradation of toxic waste, Inhibition, Co-Metabolism, Oxidative and Reductive processes, Slurry phase Bioreactor, In-situ-remediation.

UNIT -V

Waste Disposal: Key Issues in Waste Disposal, Disposal Options and Selection Criteria, Sanitary Landfill: Principle, Landfill processes, Landfill Gas Emission: Composition and properties, Hazards, Migration, Control, Leach ate Formation: Composition and properties. Leach ate migration, Control, Treatment, Environmental Effects of Landfill, Landfill Operation Issues, Design and construction, Operation, Monitoring, Closure of Landfills-Landfill Remediation, National and International Waste Management programs.

Text Books:

1. John Pichtel, Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham, P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, NewYork, 1994
3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, NewYork, 1997.

Suggested Reading:

1. Basics of Solid and Hazardous Waste Mgmt. Tech. by KantiL.Shah 1999, Prentice Hall.
2. Solid and Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist.

22EGO01

TECHNICAL WRITING SKILLS
(Open Elective-III)

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

Prerequisite: Language proficiency and the ability to simplify complex technical concepts for a diverse audience.

Course Objectives: This course aims to:
1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes: Upon completion of this course, students will be able to:
1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words.
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

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

UNIT-I

Communication – Nature and process.

Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.

Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT-II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT-III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles: Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

UNIT-IV

Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals: Definition, types, characteristics, structure and significance.

UNIT-V

Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.
Technical Presentations: Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Books:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communications-Principles and Practice", Oxford University Press, Second Edition, 2012.
2. M Ashraf Rizvi, "Effective Technical Communication", Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading:

1. Kavita Tyagi & Padma Misra, "Basic Technical Communication", PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill, 2003

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

22CHO02

FUNDAMENTALS OF NANO SCIENCE AND NANO TECHNOLOGY
(Open Elective-III)

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. Introduction and classification of nanoscience and nanomaterials
2. Explain the unique properties of nanomaterials.
3. The various synthesis routes of nanomaterials
4. The tools required for the characterization of nanomaterials.
5. The applications of nanomaterials.

Course Outcomes: Upon completion of this course, students will be able to:
1. Explain the types of nanomaterials and classify them.
2. Understand various defects, and the effect of nano dimensions on the material behavior.
3. Discuss the bottom up and top-down synthesis of nanomaterials.
4. Explain the characterization of nanomaterials using various techniques.
5. Enlist and explain various applications of nanomaterials in diversified fields and areas.

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

UNIT I

Introduction: History and scope, classification of nanostructured materials, Fascinating nanostructures, applications of nanomaterials

UNIT II

Unique properties of nanomaterials: Microstructure and defects in nanocrystalline materials – dislocations, Twins, stacking faults and voids, Grain boundaries, triple junctions and disclinations.
Effect of nano-dimensions on materials behavior – Elastic properties, magnetic properties, electrical properties, optical properties, thermal properties, and mechanical properties.

UNIT III

Synthesis Routes: Bottom-up approaches – PVD, CVD, sol-gel process, wet chemical synthesis and self-assembly. Top-down approaches – mechanical alloying, nanolithography.

UNIT IV

Tools to Characterize Nanomaterials : Scanning electron microscopy, transmission electron microscopy, x-ray diffraction, atomic force microscopy, nanoindentation

UNIT V

Applications of Nanomaterials : Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nano sensors, Nano catalyst, Food and Agriculture Industry, Cosmetics and Consumer Goods, Structure and Engineering, Automotive Industry, Water Treatment and the Environment, Nano-medical Applications, Textiles, Paints, Energy, Defense and Space Applications.

Text books:

1. Murty BS, Shankar P, Baldev Raj, Rath BB, James Murday. Textbook of Nanoscience and Nanotechnology. Bangalore: Springer; 2013.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wiley India Edition, 2012.

Suggested Readings:

1. Nano: The Essentials by T. Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira, and Daniel L. Schodek
3. Transport in Nano structures- David Ferry, Cambridge University press 2000.
4. Nanofabrication towards biomedical application: Techniques, tools, Application, and impact – Ed. Challa S., S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

22ADO01

INDUSTRY 5.0: APPLICATIONS OF AI
(Open Elective-III)

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. Introduce Artificial Intelligence in detail from its basics to future applications and tools of Industry 5.0
2. Provide insights on technological advancements and focus on preparing students and researchers for Industry 5.0
3. Impart the importance of AI technologies in assistive technology
4. Discuss the available applications of AI for promoting early diagnosis of diseases
5. Understand the various AI technologies

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

1. Summarize the evolution, current applications, and future challenges of artificial intelligence.
2. Evaluate the foundational elements and impacts of AI within machine learning paradigms.
3. Analyze AI's effectiveness in diagnosing diseases and enhancing assistive technology.
4. Design AI-driven solutions for modernizing and improving agricultural practices.
5. Assess AI's role in advancing radiotherapy techniques and ensuring quality assurance.

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

UNIT-I

Artificial Intelligence Insight: Artificial Intelligence: What and Why, History of AI, What is AI?,The Basics, AI Environment, Challenges in AI, Current work in AI for environment, Customer Experience (CX) and the use of AI, Future of AI, Future challenges in AI

UNIT-II

Influence of AI in Machine Learning: Definition, What is Machine Learning, Importance of Machine Learning, Types of Machine Learning, Approaches of Machine Learning - Machine Learning Algorithm, Programming Languages, Frameworks, Databases, Deployment tools, Methodology for Model Building, Machine learning methods, Statistical Measures, Application areas of Machine Learning, Medical Machine Learning , Influence of AI and ML in Clinical and Genomic Diagnostics.

UNIT-III

Artificial Intelligence in Healthcare sector & Assistive Technology (AT): AI in diagnosis of Genetic Diseases, Cancer, Diabetes, AI in Diagnosis of Syndrome, AI in diagnosis of Psychiatric Disorders, Depression, Alzheimer's Disease, Autism Spectrum Disorder, Anxiety, Parkinson's Disease, AI in other Diagnosis, Infectious, Lung and Brain Disease, Case studies on AI in systems Biology, AI technologies in Systems Biology towards Pharmacogenomics, AI in Systems Biology for Cancer Cure, Applications of AI for COVID-19 Pandemic, Transformative impact of AI on AT, AI experience and AT for disables people in India, AI Powered technology for an inclusive world .

UNIT-IV

Artificial Intelligence in Agriculture: Need of AI in Agriculture, Emerging Agricultural Technologies, Soil and water sensors, Weather Tracking, Satellite Imaging Agriculture, Automation Systems, RFID Technology, Potential Agricultural Domain for Modernization, AI transformation in Agricultural Scenarios.

UNIT-V

Artificial Intelligence in Radiotherapy: Importance of Artificial Intelligence in Radiotherapy , AI tools for automated treatment planning (ATP), Present ATP techniques, AI applications, Advancements and Research Guidance in ATP, AI challenges in ATP, AI in Intensity-modulated Radiotherapy (IMRT), AI for IMRT Dose Estimation, AI for IMRT Planning Support, AI for Modeling IMRT outcome and plan deliverability, AI for AUTO- Segmentation of OAR in IMRT, AI in Brachytherapy, AI in Radiotherapy Quality Assurance, Challenges associate with AI for Quality Assurance in RT, Future directions to improve AI-based Quality Assurance in RT, AI in Radiation Biology, AI in Radiation Protection/Safety, Motivations to develop AI-Based systems for Radiation protection .

Text books:

1. Kaliraj, P., & Devi, T. (Eds.). (2021). Artificial Intelligence Theory, Models, and Applications (1st ed.). CRC Press, Taylor & Francis Group, Boca Raton, ebook ISBN 9781032008097 Auerbach Publications. https://doi.org/10.1201/9781003175865

22CSC38

TECHNICAL SEMINAR

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

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the topic
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

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

1. Study and review research papers of new field/areas and summarize them.
2. Identify promising new directions of various cutting edge technologies in Computer Science and Engineering
3. Impart skills to prepare detailed report describing the selected topic/area.
4. Acquire skills to write technical papers/articles for publication.
5. Effectively communicate by making an oral presentation before the evaluating committee.

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

Seminars are to be scheduled **from 3rd week to the last week of the semester** and any change in schedule shall be discouraged. For the award of sessional marks students are **judged by three (3) faculty members** and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding Marks		
S. No.	Description	Max. Marks
1	Contents and Relevance	10
2	Presentation Skills	10
3	Preparation of Presentation slides	05
4	Question and Answers	05
5	Report in prescribed format	20

22CSC39

PROJECT PART - II

Instruction	8 Hours per week
Duration of SEE	-
SEE	100 Marks
CIE	100 Marks
Credits	4

The objective of 'Project: Part Phase - 2' is to enable the student extend further the investigative study taken up, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Department Review Committee.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Demonstrate a sound technical knowledge of their selected topic.
2. Design engineering solutions to complex problems utilizing a systematic approach.
3. Conduct investigations by using research-based knowledge and methods to provide valid conclusions.
4. Create/select/use modern tools for the modelling, prediction and understanding the limitation of complex engineering solutions.
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

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

Guidelines for awarding CIE (Max. Marks: 100)		
Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Department Review Committee (DRC)	15	Review 1
	15	Review 2
	10	Demonstration of Work / Results
	10	Innovation / Research Related Work
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to Publication
	10	Report Preparation
	10	Analytical/ Programming/Experimentation Skills

Guidelines for awarding SEE (Max. Marks: 100)		
Evaluation by	Max. Marks	Evaluation Criteria/Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the Project • Innovation, • Applications, • Live Research Projects, • Scope for further study, • Applications to Society
	20	Viva-Vice

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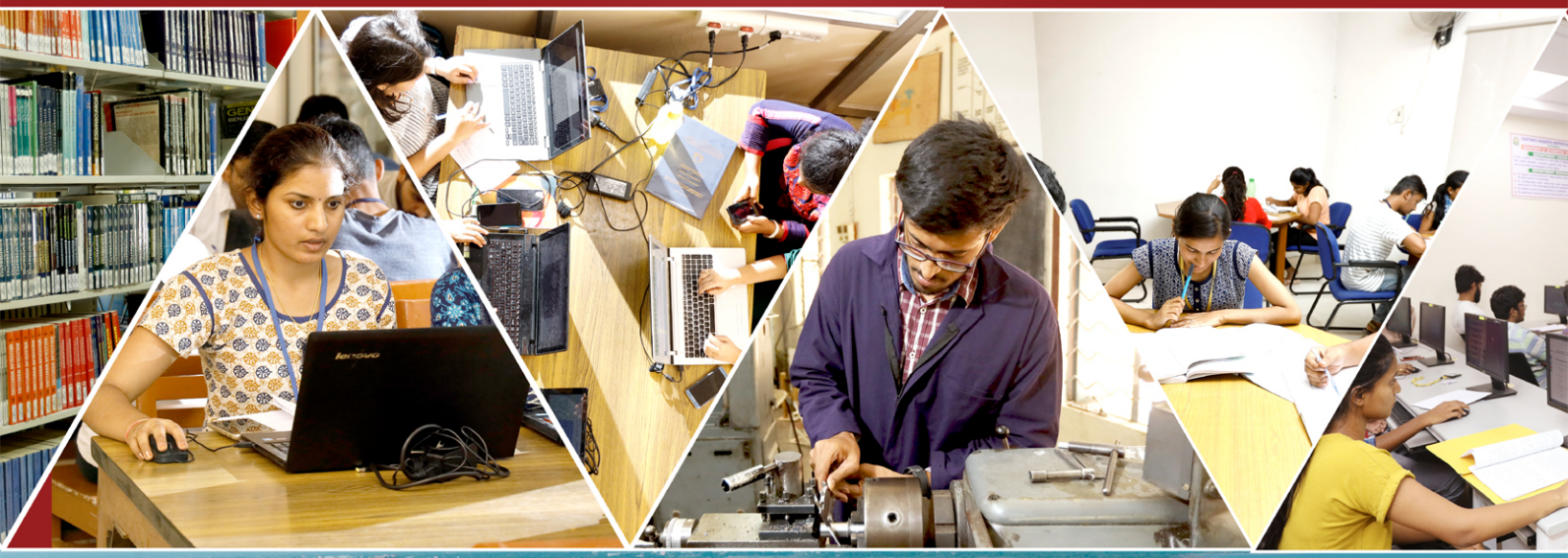

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