SCHEME OF INSTRUCTION AND SYLLABI (R-22A)

OF

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

IN

INFORMATION TECHNOLOGY

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

(R-22A Regulation)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

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

DEPARTMENT OF INFORMATION TECHNOLOGY

INSTITUTE VISION AND MISSION

VISION

To be a Centre of Excellence in Technical Education and Research.

MISSION

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

DEPARTMENT VISION AND MISSION

VISION

To be a center of excellence in the field of Information Technology that yields pioneers and research experts who can contribute for the socio-economic development of the nation.

MISSION

- To impart state-of-the-art value based education in the field of Information Technology.
- To collaborate with industries and research organizations and excel in the emerging areas of research.
- To imbibe social responsibility in students.
- To motivate students to be trend setters and technopreneurs.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of IT will be able to:

1. Analyze and provide solutions for real world problems using state-of-the-art engineering, mathematics, computing knowledge and emerging technologies.
2. Exhibit professional leadership qualities and excel in interdisciplinary domains.
3. Demonstrate human values, professional ethics, skills and zeal for lifelong learning
4. Contribute to the research community and develop solutions to meet the needs of public and private sectors. /Work in emerging areas of research and develop solutions to meet the needs of public and private sectors.

PROGRAM SPECIFIC OUTCOMES (PSOs):

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

1. Contribute to the growth of the nation by providing IT enabled solutions.
2. Develop professional skills in the thrust areas like Computer Networks, Image Processing, Data Mining, Internet of Things, Cloud Computing and Information Security.
3. Pursue higher studies in specializations like Artificial Intelligence, Data Science, Cyber Security and Software Engineering in reputed Universities.

PROGRAM OUTCOMES (POs):

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for
i) Independent and life-long learning
ii) Adaptability to new and emerging technologies and
iii) Critical thinking in the broadest context of technological change. (WK8)

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY
(Inline with AICTE Model Curriculum with effect from AY 2024-25)
(R-22A Regulation)

SEMESTER – I

S.No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC01	Linear Algebra and Calculus	3	1	-	3	40	60	4
2	22PYC01	Optics and Semiconductor Physics	3	-	-	3	40	60	3
3	22CSC01N	Problem Solving and Programming using C	2	1	-	3	40	60	3
4	22EGC01N	English	2	-	-	3	40	60	2
PRACTICAL									
5	22PYC03	Optics and Semiconductor Physics Lab	-	-	3	3	50	50	1.5
6	22EGC02N	English lab	-	-	2	3	50	50	1
7	22CSC02N	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
8	22MEC01N	Engineering Graphics	-	1	3	3	50	50	2.5
9	22MEC38N	Digital Fabrication Workshop	-	-	3	3	50	50	1.5
TOTAL			**10**	**3**	**14**	**-**	**410**	**490**	**20**
Clock Hours per Week: 27									

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

22MTC01

LINEAR ALGEBRA AND 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. Explain the Partial Derivatives and the extreme values of functions of two variables.
2. Discuss Physical interpretations of scalar and vector functions.
3. Discuss line, surface and volume integrals.
4. Explain the concepts of basis, dimension of vector space and matrix representation of a linear transformation.
5. 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	3	3	3	-	-	-	-	-	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	-	-	-	-	-	2
CO 4	3	3	3	3	-	-	-	-	-	-	1
CO 5	3	3	3	3	-	-	-	-	-	-	1

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Vector space: Vector space, Subspace, linear combination of vectors, linear span, row and column

spaces, linear dependent, independent vectors, basis, dimension, linear transformation, invertible transformation, matrix of linear transformation, kernel and range of LT, rank and nullity of LT-rank nullity theorem(without proof), change of basis.

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22PYC01

OPTICS AND SEMICONDUCTOR PHYSICS

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

Instruction	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 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	2	2	2	3	2	2	1	1	2	1	2
CO 2	3	3	3	3	3	3	3	2	2	3	2
CO 3	3	3	3	3	3	2	2	1	2	1	2
CO 4	2	2	2	1	2	2	2	1	2	2	2
CO 5	3	2	2	2	2	2	3	2	2	3	2

UNIT-I

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

UNIT-II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser – Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction–Applications.

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

UNIT-III

Principles of Quantum Mechanics: Introduction – Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ – Time-dependent and time-independent Schrodinger

equations – Born interpretation – Probability current –Wave packets –Uncertainty principle –Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22CSC01N

PROBLEM SOLVING AND PROGRAMMING USING C

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. Understanding the steps in problem solving and formulation of algorithms to problems.
2. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
3. Develop intuition to enable students to come up with creative approaches to problems.

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

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

CO-PO Articulation Matrix

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

UNIT-I

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

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

UNIT-II

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

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

UNIT–III

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

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

UNIT-IV

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

Pointers: Declaring a Pointer, Initializing Pointers, Indirection Operator and Dereferencing, Arrays and Pointers, Pointers and Strings, Pointers to Pointers, Array of Pointers, Pointers to an Array, Two-dimensional Arrays and Pointers, Pointers to Functions and Dynamic Memory Allocation.

UNIT–V

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

Files: Using Files in C, Declaration of File Pointer, Working with Text Files, Character Input and Output, Working with Binary Files, Sequential Versus Random File Access, File Record.

TEXT BOOK:

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

SUGGESTED READING:

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

ONLINE RESOURCES:

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

22EGC01N

ENGLISH

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

Prerequisite: Basic knowledge of English grammar and vocabulary.

COURSE OBJECTIVES: The course is taught with the objectives of enabling the students to

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

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

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

CO-PO Articulation Matrix

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

UNIT-I

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

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

Reading Task I.

UNIT-II

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

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

Reading Task II.

UNIT-III

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

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

Reading Task III.

UNIT-IV

Professional Writing Skills-1: Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails, Email and Mobile etiquette.

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

Reading Task IV

UNIT-V

Professional Writing Skills-2: Report writing – Importance, structure, elements & style of formal reports; Writing a formal report. Writing for Blogs.

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

Reading Task V.

TEXT BOOKS:

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

SUGGESTED READING:

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

22PYC03

OPTICS AND SEMICONDUCTOR PHYSICS LAB

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

Instruction	3P Hours per Week
Duration of SEE	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 opto electronic 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 semi conductor devices.
5. Find the applications of thermistor.

CO-PO Articulation Matrix

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	2	3	1	3	3	3	2	1	2
CO 2	3	2	1	2	2	2	2	2	1	1	3
CO 3	3	2	3	2	3	1	2	3	2	1	2
CO 4	3	3	2	2	2	1	3	2	1	1	3
CO 5	3	1	2	3	2	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.

22EGC02N

ENGLISH LAB

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

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

Prerequisite: Basic Knowledge of English Communication.

COURSE OBJECTIVES: This course will introduce the students

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

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

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

CO-PO Articulation Matrix

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

LIST OF EXPERIMENTS:

COMPUTER-AIDED LANGUAGE LEARNING LAB

1. **Introduction to English Phonetics**: Introduction to English Phonetics and organs of speech.
2. **Sound system of English**: Speech sounds- Vowels andConsonants- structure of syllables (Introduction to syllables) - Basic phonetictranscription practice.
3. **Word and Sentence stress**: Rules of word stress -Primary stress, Secondary stress; Sentence stress (word emphasis in sentences) -Practice.
4. **Intonation**:Types of Intonation, Practice in Articulation – MTI-Errors in pronunciation.

5. **Listening skills**: understanding Listening- Practice in Listening comprehension texts.

INTERACTIVE COMMUNICATION SKILLS LAB

1. **JAM-** Ice Breaking, Speaking Activity**.**
2. **Role play/Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
3. **GroupDiscussions -** Dynamics of a Group Discussion, Group Discussion Techniques,Non-Verbal Communication.
4. **Read and Review** - Preparation for active reading and instructing the students to cultivate effective reading habits to read select texts, review and write their responses.
5. **Poster presentation –** Theme, poster preparation, team work and presentation.

TEXT BOOKS:

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

SUGGESTED READING:

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

SUGGESTED SOFTWARE:

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

22CSC02N

PROBLEM SOLVING AND PROGRAMMING USING C LAB

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

COURSE OBJECTIVES: This course aims to

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.

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

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

CO-PO Articulation Matrix

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

LABORATORY / PRACTICAL EXPERIMENTS:

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

TEXT BOOKS:

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

SUGGESTED SOFTWARE:

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

ONLINE RESOURCES:

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

22MEC01N

ENGINEERING GRAPHICS

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

PREREQUISITE: Nil

COURSE OBJECTIVES: This course aims to
1. Get exposure to a cad package and its utility.
2. Understand orthographic projections.
3. Visualize different solids and their sections in orthographic projection.
4. Prepare the student to communicate effectively by using isometric projection.
5. Prepare the student to use the techniques, skills, and modern tools necessary for practice.

COURSE OUTCOMES: Upon completion of this course, student will be able to
1. Become conversant with appropriate use of CAD software for drafting and able to draw conic sections.
2. Understand orthographic projections of points and straight lines.
3. Draw the projections of planes.
4. Draw and analyze the internal details of solids through sectional views.
5. Create an isometric projections and views.

CO-PO Articulation Matrix

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

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

TEXT BOOKS:
1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.

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

SUGGESTED READING:

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

22MEC38N

DIGITAL FABRICATION WORKSHOP

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

Prerequisite: Nil

Course Objectives:
This course aims to:

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

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

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

CO-PO Articulation Matrix

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

LIST OF EXPERIMENTS:
GROUP 1: Workshop Practice

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dovetail joint on the given wooden piece according to the given dimensions.
3. (a) Wiring of one light point controlled by one single pole switch, a three-pin socket controlled by a single switch.
   (b) Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three-pin socket.
4. Stair case wiring of one light point controlled from two different places independently using

two 2way switches.

5. To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings, and bends.
6. To connect the GI pipes as per the given diagram using, Coupling, Unions, reducers, and bends. To connect the GI pipes as per the given diagram using shower, tap, and valves and demonstrate by giving water connection.

GROUP 2: Additive Manufacturing /3D Printing

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

TEXT BOOKS:

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

SUGGESTED READING:

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY
(Inline with AICTE Model Curriculum with effect from AY 2024-25)
(R-22A Regulation)

SEMESTER-II

S. No	Course Code	Title of the Course	Scheme of nstruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1	22MTC04	Differential Equations and Numerical Methods	3	1	-	3	40	60	4
2	22CYC01	Chemistry	3	-	-	3	40	60	3
3	22EEC01	Basic Electrical Engineering	2	1	-	3	40	60	3
4	22ITC20N	Data Structures using C ++	3	-	-	3	40	60	3
PRACTICAL									
5	22CYC02	Chemistry Lab	-	-	3	3	50	50	1.5
6	22MBC02N	Community Engagement	-	-	2	-	50	-	1
7	22ITC21N	Data Structures using C++ Lab	-	-	2	3	50	50	1
8	22MEC37N	Robotics and Drones Lab	-	1	3	-	100	-	2.5
9	22EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
TOTAL			**11**	**3**	**12**	**-**	**460**	**390**	**20**
Clock Hours per Week: 26									

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

22MTC04

DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

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

COURSE OUTCOMES: Upon completing this course, students will be able to
1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Solve the algebraic, transcendental and system of equations.
4. Apply interpolation and numerical differentiation techniques for given data.
5. Test the convergence and divergence of Infinite series.

CO-PO Articulation Matrix

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
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 forward and backward interpolation formulae, Gauss's forward and backward interpolation

formulae, Lagrange's interpolation, Numerical differentiation at the tabulated points with forward, backward and central differences**.**

UNIT-V

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

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2011.
3. M.K. Jain, S.R.K Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering and Computation", New age International Publications, 2008.

SUGGESTED READING:

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

22CYC01

CHEMISTRY

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

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

COURSE OUTCOMES: 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 chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

CO-PO Articulation Matrix

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

UNIT-I

Atomic and molecular structure and Chemical Kinetics:

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

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

UNIT-II

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

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III

Stereochemistry and Organic reactions :

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

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

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

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

UNIT–IV

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

UNIT-V

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

Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).

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

TEXT BOOKS:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat 16th Edition Rai Publishing Company Ltd., New Delhi, (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", 7th Edition Pearson, Delhi, (2019).

4. A Textbook of Polymer Science and Technology , Shashi Chawla ,Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READING:

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

22EEC01

BASIC ELECTRICAL ENGINEERING

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. Understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis.
2. Comprehend the basic principle of operation of AC and DC machines.
3. Infer about different types of electrical wires and cables, domestic and industrial wiring, safety rules and methods of earthing.

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

1. Understand the concepts of Kirchhoff's laws and their application various theorems to get solution of simple dc circuits.
2. Predict the steady state response of RLC circuits with AC single phase/three phase supply.
3. Infer the basics of single-phase transformer.
4. Describe the construction, working principle of DC machine and 3-phase Induction motor.
5. Acquire the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.

CO-PO Articulation Matrix

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

UNIT-I

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

UNIT-II

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, series RL and RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

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

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt generators. DC Motors: Classification, Torque Equation,

Characteristics and Speed control of DC Shunt and Series Motors, Losses and efficiency Three - Phase Induction Motors: Principle of operation, Applications

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22ITC20N

DATA STRUCTURES USING C++

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

Prerequisites: Problem Solving and Programming using C (22CSC01N), Problem Solving and Programming using C Lab (22CSC02N)

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

COURSE OUTCOMES: Upon completion of this course, students will be able to
1. Understand the concepts of OOPs.
2. Analyse the time complexity of operations on data structures.
3. Apply sorting techniques, pattern-matching algorithms, and hashing.
4. Demonstrate operations on linear and nonlinear data structures.
5. Develop solutions to the problems using linear and nonlinear data structures.

CO-PO Articulation Matrix

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

UNIT-I

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

UNIT-II

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

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

UNIT-III

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

Stacks: The Stack Abstract Data Type, A C++ Stack Interface, A Simple Array-Based Stack

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

UNIT-IV

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

UNIT-V

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

Graphs: Graphs, Data Structures for Graph, Graph Traversals

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

TEXT BOOKS:

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

SUGGESTED READING:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Addison-Wesley, 2007.
2. Narasimha Karumanchi, "Data Structures and Algorithms for GATE", Career Monk Publications, 2011.
3. D. Samantha, "Classic Data Structures", Prentice Hall India, 2nd Edition, 2013.

WEB RESOURCES:

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

22CYC02

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

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. Impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. Provide the knowledge in both qualitative and quantitative chemical analysis.
3. The student should be conversant with the principles of volumetric analysis.
4. Apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. 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 and 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	2	-	-	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	-	-	-	-	2
CO 3	3	2	3	-	-	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	-	-	-	-	2
CO 5	3	2	3	-	-	2	-	-	-	-	2

LIST OF EXPERIMENTS:

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2} & Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution.
4. Determination of Alkalinity of water.
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order).
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (Second order).
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.

9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

TEXT BOOKS:

1. J. Mendham and Thomas, "Vogel's Text Book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi, 6th Edition, 2002.
2. B.D.Khosla, V.C.Garg & A.Gulati,; R., "Senior practical physical chemistry", Chand & Co. : New Delhi (2011).

SUGGESTED READING:

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.

22MBC02N

COMMUNITY ENGAGEMENT

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

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

CO-PO Articulation Matrix

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

MODULE I: Appreciation of Rural Society
Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources. Rural Infrastructure.

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

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

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

TEXT BOOKS:
1. Singh, Katar, "Rural Development: Principles, Policies and Management", Sage Publications, New Delhi, 2015.

2. "A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies", 2002.
3. "United Nations, Sustainable Development Goals", 2015, un.org/sdgs
4. M.P Boraia, "Best Practices in Rural Development", Shanlax Publishers, 2016.

JOURNALS:

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

22ITC21N **DATA STRUCTURES USING C++ LAB**

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

Prerequisites: Problem Solving and Programming using C (22CSC01N), Problem Solving and Programming using C Lab (22CSC02N)

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

COURSE OUTCOMES: Upon completion of this course, students will be able to
1. Practice the concepts of OOPs.
2. Define ADT for linear and nonlinear Data Structures.
3. Apply sorting techniques, pattern matching algorithm, and hashing.
4. Demonstrate standard operations on linear and nonlinear data structures.
5. Develop solutions to the problems using linear and nonlinear data structures.

CO-PO Articulation Matrix

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

LIST OF EXPERIMENTS:

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

TEXT BOOKS:
1. Michael T.Goodrich, Roberto Tamassia, David M.Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.

2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", Career Monk Publications, 5th Edition, 2017.
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++" 2nd Edition, Universities Press, 2007

SUGGESTED READING:

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

WEB RESOURCES:

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

22MEC37N

ROBOTICS AND DRONES LAB

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO Articulation Matrix

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

LIST OF EXPERIMENTS:

Experiment No	Title	CO
1.	Introduction to Robotics, Definition and scope of robotics, Robot configurations-Cartesian, cylinder, polar and articulate. Uses and Significance of Robots, Parts of a Robot, Current applications and future trends. Introduction to Arduino, C++, Arduino Programming Environment. Interfacing Arduino with Electronic Devices such as LEDs/Piezo Buzzer.	1
2.	Interfacing Arduino with Electronic Devices such as Push Button/Potentiometer.	1
3.	Introduction to Sensors, Types of Sensors, Reading Data from Sensors, Interfacing Sensors with Microcontrollers. Interfacing Arduino with Ultrasonic Distance Sensor and Reading Sensor Data on Serial Monitor.	2
4.	Interfacing Arduino with IR Sensor and Reading Sensor Data on Serial Monitor.	2
5.	Interfacing Arduino with Rotary Encoder and Reading Sensor Data on Serial Monitor.	2
6.	Introduction to motors, Types of motors, Motor drivers, Interfacing motors with Microcontrollers, Introduction to Li-ion, LIPO batteries, uses and safety precaution. Implement a system that utilizes an Arduino microcontroller to control the precise movement of a servo motor.	3
7.	Implement a system that utilizes an Arduino microcontroller to control the precise and sequential movements of a stepper motor.	3
8.	Construct a two-wheel robot using DC motors controlled by an Arduino microcontroller. Implement a program that allows the robot to execute specific movements. The robot should: i. Move forward with controlled acceleration. ii. Move backward with controlled deceleration.	3
9.	Construct an Obstacle avoidance robot.	3
10.	Construct a Pick and place robot.	3
11.	OpenCv for image processing: i. Extraction of RGB values of a pixel ii. Create colored shapes and save image iii. Extraction of ROI	4
12.	Assembly of quad copter drone.	5
Open-Ended Project on Autonomous System		

Note:

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

Suggested Reading:

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

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

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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2	2	-	-	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	-	-	-	-	2
CO 3	3	2	3	-	-	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	-	-	-	-	2
CO 5	3	2	3	-	-	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
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY
(Inline with AICTE Model Curriculum with effect from AY 2025-26)
(R-22A Regulation)

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		CIE	SEE	
THEORY									
1.	22ECC40	DC Circuits, Sensors and Transducers.	3	-	-	3	40	60	3
2.	22ITC01N	Digital Logic and Computer Architecture	3	-	-	3	40	60	3
3.	22ADC31N	Exploratory Data Analysis and Visualization	2	-	-	3	40	60	2
4.	22ITC05N	Discrete Mathematics	3	-	-	3	40	60	3
5.	22ITC02N	Java Programming	3	-	-	3	40	60	3
6.	22CSC14N	Design and Analysis of Algorithms	3	-	-	3	40	60	3
7.	22EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	50	Non Credit
PRACTICAL									
8.	22ITC03N	Java Programming Lab	-	-	3	3	50	50	1.5
9.	22ITC06N	Algorithms and Competitive Programming Lab	-	-	3	3	50	50	1.5
10.	22ADC32N	Exploratory Data Analysis and Visualization Lab			2	3	50	50	1
11.	22ITI01	Moocs / Training / Internship - I	3 to 4 weeks / 90 Hours				50		2
		TOTAL	**19**	**0**	**8**	**-**	**440**	**560**	**23**
Clock Hours per Week: 27									

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

22ECC39N

DC CIRCUITS, SENSORS AND TRANDUCERS

Instruction	3 L 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 Sensors, and Transducers.
3. Understand Interfacing of various modules of sensors with myRIO

COURSE OUTCOMES:Upon completion of this course, students will be able to
1. Develop devices like rectifiers, filters, regulators, etc.
2. Develop the robot using the relevant sensors
3. Evaluate the performance of actuators in practical applications
4. Acquire the data from various sensors and transducers with the help of myRIO
5. Analyze usage of sensors/transducer for the development of real-time 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	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	1	2	2	3	2	3	2	1	~	2
CO2	3	3	3	2	1	2	2	3	2	3	2	1	3	2
CO3	3	2	3	2	3	3	2	3	2	3	2	1	2	2
CO4	3	3	3	3	3	3	2	3	2	3	2	2	2	2
CO5	3	3	3	3	3	3	2	3	2	3	2	2	2	2

UNIT I

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

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

UNIT II

Sensors: Definition, classification of sensors

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

Velocity, motion, force sensors: Tachogenerator, Optical encoders, Strain Gauge as force Sensor, **Fluid pressure:** Tactile sensors, **Flow Sensors**:Ultrasonic and laser, **Level Sensors:** Ultrasonic and Capacitive

Temperature and light sensors: Resistance Temperature detectors, Photo Diodes, Applications of Photo Diodes.

UNIT III

Transducers: Definition, classification of Transducers

Mechanical Transducers: Displacement-to-Pressure, Seismic Displacement Transducers

Passive Electrical Transducers: LVDT, Resistor Moisture Transducer
Active Electrical Transducers: Hall Effect Transducer, Piezoelectric transducer

UNIT IV
Actuators: Introduction, Types of actuators in IOT, Real life examples of actuators in IOT
ROBOT Sensors: sensors in robot – Touch sensors**;** Camera Systems in Machine : Camera Technology, History in Brief, Machine Vision versus closed Circuit Television (CCTV).
Collision Avoidance sensors: Principle, Laser, LED.

UNIT V
Hardware/software platforms: Introduction to LabVIEW, Data Acquisition System: hardware Overview of my RIO, Converting Raw Data Values to a Voltage.
Sensors Interfacing with my RIO: Introduction, Pin configuration, diagrams of thermistor, photo cell, hall effect, 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. Roland Siegwart & Illah R. Nourbakhsh, "Introduction to autonomous mobile robots", Prentice Hall of India, 2004
4. Ed Doering, NI myRIO Project Essentials Guide, Feb.2016

SUGGESTED READING:
1. 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
2. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
3. User guide and specifications NI myRIO-1900.

22ITC01N

DIGITAL LOGIC AND COMPUTER ARCHITECTURE

Instruction	3 Hours Per Week
Duration Of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES:

1. To Familiarize With Data Representation, Number System And Logic Gates.
2. To Provide Understanding Of Combinational And Sequential Logic Circuits , Digital Registers And Counters.
3. To Present The Operation Of The Central Processing Unit.
4. To Facilitate The Techniques That Computers Use To Communicate With Input And Output Devices.
5. To Introduce The Concept Of Memory Hierarchy And Memory Management.

COURSE OUTCOMES: Upon Completing This Course, Students Will Be Able To

1. Apply Boolean Algebra For Simplification And Learn Representation Of Data Using Numbers.
2. Understand Fundamentals Of Combinational & Sequential Logic Gates, Registers And Counters.
3. Infer The Architecture And Functionality Of The Central Processing Unit.
4. Explore The Techniques That Computers Use To Communicate With I/O Devices For Data Transfer.
5. Comprehend Memory Hierarchy, Cache Memory And Virtual Memory.

CO-PO and CO-PSO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	1	1	0	1	0	0	0	1	0	0	2	0	2
CO2	2	2	1	0	1	0	0	0	0	0	0	1	0	2
CO3	2	2	1	0	0	0	0	0	0	0	2	0	0	2
CO4	2	1	0	0	0	0	0	0	0	0	0	0	0	2
CO5	2	2	1	0	0	0	1	0	1	0	2	1	0	2

UNIT–I

Data Representation: Number Systems, Octal, Binary, Hexadecimal And Decimal Representation, Complements: (R-1)'S Complement, R's Complement, Subtraction Of Unsigned Numbers.
Digital Logic Circuits: Digital Computers, Logic Gates, Boolean Algebra, Map Simplification, Sum-Of-Products And Product-Of-Sums Simplification, Don't -Care Conditions.

UNIT–II

Combinational Circuits: Decoders, Encoders, Multiplexers, Half-Adder, Full-Adders.
Flip-Flops: SR, D, JK, T Flip- Flops, Edge Triggered Flip-Flops, Excitation Tables.
Registers: Register With Parallel Load, Bidirectional Shift Register With Parallel Load, 4-Bit Synchronous Binary Counter.

UNIT-III

Central Processing Unit: Computer Registers, General Register Organization, Instruction Cycle, Instruction Formats: Three Address Instructions, Two-Address Instructions, One-Address

Instructions, Zero-Address Instructions, RISC Instructions, Addressing Modes, Data Transfer And Manipulation, Program Control.

UNIT-IV

Input-Output Organization: Input-Output Interface: I/O Bus And Interface Modules, Asynchronous Data Transfer: Strobe Control, Handshaking, Asynchronous Communication Interface, Modes Of Transfer, Interrupt-Initiated I/O, Priority Interrupt: Daisy Chaining Priority, Parallel Priority Interrupt, Priority Encoder, Direct Memory Access(DMA): DMA Controller.

UNIT- V

Memory Organization: Memory Hierarchy, Main Memory: RAM And ROM Chips, Memory Address Map, Memory Connection To CPU, Auxiliary Memory: Magnetic Disks, Associative Memory: Hardware Organization, Cache Memory: Associative Mapping, Direct Mapping, Set-Associative Mapping, Virtual Memory: Address Space And Memory Space.

TEXT BOOK:

1 M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education. 2016.

REFERENCES:

1. Stephen Brown, Zvonkovranesic, "Fundamentals Of Digital Logic With VHDL Design", 2nd Edition, Mcgraw Hill, 2009.
2. ZVI Kohavi, "Switching And Finite Automata Theory", 2nd Edition, Tata Mcgraw Hill, 1995.
3. William Stallings, "Computer Organization And Achitecture", 8th Edition,PHI.2010
4. Carl Hamachar, Vranesic, Zaky, "Computer Organization", 5th Edition, Mcgraw Hill.2002.

WEB RESOURCES:

1. https://nptel.ac.in/courses/108105132
2. https://nptel.ac.in/courses/106105163

22ADC31N

EXPLORATORY DATA ANALYSIS AND VISUALIZATION

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

Prerequisite: Python Programming

COURSE OBJECTIVES: This course aims to

1. Introduce the fundamentals of NumPy, including array creation, manipulation, and mathematical operations, to build a strong foundation for numerical computing in Python.
2. Familiarize students with core Pandas data structures and operations for loading, manipulating, and summarizing structured datasets.
3. Teach essential data preprocessing techniques such as handling missing values, transforming data, and combining datasets using Pandas for real-world data analysis.
4. Explain methods for data aggregation and grouping along with time series handling to manage, analyze, and interpret time-dependent data effectively.
5. Develop skills in data visualization using Matplotlib and Seaborn to present analytical results clearly through various types of charts and plots.

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

1. Apply NumPy operations such as array creation, indexing, arithmetic computations, transposition, and random number generation to efficiently perform numerical and data manipulation tasks.
2. Perform data manipulation, analysis, and summarization on structured data by utilizing Pandas data structures and functionalities.
3. Apply data cleaning and wrangling techniques using Pandas to handle missing data, transform and categorize values, perform hierarchical indexing, merge and reshape datasets, and prepare data for meaningful analysis.
4. Summarize and analyze data using group operations, and handle time series data by converting dates, selecting time-based data, and performing resampling and frequency changes with Pandas.
5. Create and customize a variety of visualizations using Matplotlib and Seaborn, including line plots, bar charts, histograms, scatter plots, and categorical plots, to effectively communicate data insights.

CO-PO-PSO Articulation Matrix

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

UNIT - I

Numpy Basics: Creating ndarrays, Data Types for ndarrays, Arithmetic with Numpy Arrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes, Pseudo Random Number Generation, Universal Functions.

UNIT - II

Getting Started with Pandas: Series, DataFrame and Index Objects, Reindexing, Dropping Entries from an Axis, Indexing, Selection and Filtering, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels, Summarizing and Computing Descriptive Statistics.

Data Loading, Storage and File Formats: Reading Text Files in Pieces, Writing Data to Text Format.

UNIT - III

Data Cleaning and Preparation: Filtering out Missing Data, Filling in Missing Data, Transforming Data using a Function or Mapping, Replacing Values, Renaming Axis Indexes, Discretization and Binning, Detecting and Filtering, Categorical Extension Type in Pandas, Computations with Categoricals.

Data Wrangling: Hierarchical Indexing-Reordering and Sorting Levels, Summary Statistics by Level, Indexing with a DataFrame's Columns, Database-Style DataFrame Joins, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap, Reshaping with Hierarchical Indexing.

UNIT - IV

Data Aggregation and Group Operations: Column-Wise and Multiple Function Application, Returning Aggregated Data without Row Indexes, General Split-apply-combine.

Time Series: Date and Time Data Types and Tools, Converting Between String and Datetime, Time Series Basics-Indexing, Selection, Subsetting, Time Series with Duplicate Indices, Generating Date ranges, Frequencies and Dateoffsets, Resampling and Frequency Conversion-Down Sampling, Upsampling and Interpolation.

UNIT - V

Plotting and Visualization: Figures and Subplots, Colors, Markers and Line styles, Ticks, Labels and Legends, Saving Plots to File, Seaborn - Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots, Facet Grids and Categorical Data.

TEXT BOOKS:

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

SUGGESTED READING:

1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, 2nd Edition, 2023.

WEB 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

22ITC05N **DISCRETE MATHEMATICS**

(Common to CSE-AIML, AIML, CET and IT branches)

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

COURSE OBJECTIVES: This course aims to

1. Introduce Propositional, Predicate Logic and various proof techniques for validation of arguments.
2. Develop an understanding of counting, functions and relations.
3. 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, and relations in Real-world scenarios.
3. Model solutions using Generating Functions and Recurrence Relations.
4. Determine the properties of graphs and trees to solve problems arising in computer science applications.
5. Distinguish between groups, semi groups and monoids in algebraic systems

CO-PO-PSO Articulation Matrix

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Introduction to Graphs: Graphs and their basic properties- degree, path, cycle, Sub graphs, Complements and Graph Isomorphism, Euler trails and circuits, Hamiltonian paths and cycles, planar graphs, Euler formula, Graph Coloring.

Trees: Definitions, Properties, Spanning Trees, **Minimum Spanning trees**: The Algorithms of Kruskal and Prim

UNIT-V

Algebraic Structures: Algebraic Systems, Examples and General Properties, Semi groups and Monoids.

Groups: Definitions and Examples, Subgroups, Homomorphisms and cyclic groups

TEXT BOOKS:

1. Rosen, K. H. (2019). Discrete Mathematics and Its Applications. (8th Edition) ISBN10: 125967651X ISBN13: 9781259676512(latest edition)
2. Oscar Levin Discrete Mathematics An Open Introduction (4th Edition) ISBN 9781032966168 2025
1. 2025, CRC Press.
3. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TATA Mc Graw-Hill Edition, 1995.

SUGGESTED READING:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", An Applied Introduction, 5th edition, Pearson Education, 2016. (latest edition)
2. Singh, S.B., Discrete Mathematics, Khanna Book Publishing Company, New Delhi. SBN: 9789382609407, 9789382609407 Edition: 3, 2019 (latest edition)
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

WEB RESOURCES:

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

22ITC02N **JAVA PROGRAMMING**

(Common to CSE, IT, AI&DS , CET and allied branches)

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

COURSE OBJECTIVES: the course aims to

1. Introduce the fundamental concepts of Object-Oriented Programming (OOP).
2. Guide students through the process of creating and managing classes and objects.
3. Explain and demonstrate the use of inheritance and polymorphism.
4. Teach effective handling of runtime exceptions and the basics of multithreading.
5. Provide hands-on experience with Java's IO package for application development.

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

1. Apply OOP concepts to develop structured Java applications.
2. Utilize inheritance and interfaces to enhance code reusability and flexibility.
3. Implement exception handling and multithreading to manage complex program flows.
4. Build applications using the Java Collection Framework.
5. Develop programs that handle input and output operations using the IO package.

CO-PO-PSO Articulation Matrix

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

UNIT-I

Introduction to Java: Procedural and object-oriented programming paradigms, Principles, Features, Basic structure a java program, Java Primitive Data Types, Basic Operators, Flow-control statements. Defining Classes, Adding Instance Fields and Methods, Object Creation, Constructors, Access Modifiers, Method Overloading and Constructor Overloading, Use of static and final keyword, Arrays, Strings and String Tokenizer, Scannner.

UNIT-II

Inheritances and Packages: Types of Inheritance, super keyword, preventing inheritance, the Object class, method overriding and dynamic method dispatch, abstract classes and methods. Interfaces, Interfaces vs. Abstract classes, Inner classes and types, Packages, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

UNIT-III

Exception Handling and Threading: What are exceptions, Error vs. Exception, usage of try, catch, throw, throws and finally clauses, Multithreading in Java, Life cycle of Thread, how to create

threads, Thread class in java, Thread priorities, Thread Synchronization. Introduction to Generics, Advantages of Generics, Generic class, Type Parameters, Generic Methods.

UNIT-IV

Collections: Overview of Java Collection Framework, Collection Interfaces – Collection, Set, List, Map, Collection classes – Array List, Linked List, Hash Set, Tree Set, Hash Map, Tree Map, Iteration over Collections – Iterator and List Iterator, Comparable and Comparator interface, Introduction to Java 8 Features, Lambda Expressions, Functional Interfaces.

UNIT-V

Java I/O and NIO: Input Stream, Output Stream, Reader, Writer, File Reader, File Writer, Buffered Reader, Buffered Writer, Object Serialization and Deserialization, Java NIO: Non-blocking I/O, Path, Files, Selectors, Channels, Buffers, Asynchronous I/O, NIO vs. IO

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, Tata McGraw Hill Publications, 2020.
2. K Somasundaram "Advanced Programming in Java2" Jaico Publishing House, 2008.

SUGGESTED READING:

1. E Balaguruswamy "Programming with Java", TataMcGraw-Hill, 6th Edition, 2019.
2. Paul Deitel and Harvey Deitel "Java How to Program, Early Objects ", 11th Edition., 2018.

WEB RESOURCES:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2

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

Prerequisite: Basics of Data structures and algorithms.

COURSE OBJECTIVES: This course aims to

1. Provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms.
2. Introduce the different algorithmic approaches for problem solving through numerous example problems.
3. 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 and recurrence-solving techniques to analyze the performance of recursive algorithms
2. Apply greedy and dynamic programming strategies to solve optimization problems and identify the most suitable design approach based on problem characteristics.
3. Implement backtracking and branch-and-bound techniques to solve combinatorial and decision problems and evaluate their efficiency.
4. Solve and evaluate the performance of graph traversal and shortest path algorithms.
5. Demonstrate NP-completeness through problem reductions and complexity classes.

CO-PO Articulation Matrix

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

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 **Analysis of recursive algorithms through recurrence relations:** Iterative/Expansion 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.

UNIT - III

Backtracking: The general Method, 8-Queens Problem, Graph Coloring, Hamiltonian Cycle. **Branch-and-Bound**: The general method, FIFO branch and bound, LC branch and bound, 0/1

Knapsack Problem using FIFO branch and bound, Travelling Salesperson problem using LC branch and bound.

UNIT - IV

Graph Algorithms: Applications of DFS: Bi-Connected components, strongly connected components, topological sorting. **Shortest Path Algorithms**: Dijkstra's, Bellman-Ford, Floyd-Warshall

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 Problem.

TEXT BOOKS:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 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/

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

(BE/BTech III/IV/VI/VII Semester - Common to all branches)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	0

Prerequisite: Basic awareness of Indian Constitution and Government.

COURSE OBJECTIVES: The course will introduce the students to

1. Understand the history of framing of the Indian Constitution.
2. Awareness 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 : After successful completion of the course the 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. Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
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 district administration.

CO-PO-PSO Articulation Matrix

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

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 and significance 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.

TEXT BOOKS:

1. Sastry Ravindra, (Ed), "Indian Government & Politics", Telugu Akademy, 2nd edition, 2018.
2. "Indian Constitution at Work", NCERT, 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.

22ITC03N

JAVA PROGRAMMING LAB

(Common to CSE, IT, AI&DS , CET and allied branches)

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. Introduce the core principles of Object-Oriented Programming (OOP).
2. Explain the object-oriented approach to designing and implementing classes and objects.
3. Demonstrate the use of inheritance and polymorphism in Java.
4. Illustrate exception handling and multithreading techniques for managing runtime behaviour.
5. Explore Java's IO package for developing basic input/output functionalities in applications.

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

1. Apply OOP principles to design and develop Java applications.
2. Implement inheritance and interfaces to build modular and reusable code.
3. Use exception handling and multithreading to manage multiple execution paths efficiently.
4. Develop robust applications utilizing the Java Collection Framework.
5. Integrate Java IO concepts for effective data input and output operations in applications.

CO-PO-PSO Articulation Matrix

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

LIST OF EXPERIMENTS

1. Implement the program(s) to handle the various data types, operators, expressions, control-flow, and strings.
2. Develop a java program(s) for constructors.
3. Develop a java program to demonstrate the method overloading and riding.
4. Develop a java program(s) to deal with different types of inheritances and interfaces.
5. Implement the program(s) to demonstrate the packages.
6. Develop a java program(s) to handle user defined exceptions with multiple catch blocks.
7. Implement program(s) to demonstrate Multithreading and thread synchronization.
8. Implement program(s) to demonstrate generics.
9. Implement the collection framework classes with Iterator/List Iterator.
10. Develop a java program(s) to implement the features of JDK8.

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, Tata McGraw Hill Publications, 2020.
2. K Somasundaram "Advanced Programming in Java2" Jaico Publishing House, 2008.

SUGGESTED READING:

1. E Balaguruswamy "Programming with Java", TataMcGraw-Hill, 6th Edition, 2019.
2. Paul Deitel and Harvey Deitel "Java How to Program, Early Objects ", 11th Edition., 2018.

WEB RESOURCES:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2

22ITC06N

ALGORITHMS AND COMPETITIVE PROGRAMMING LAB

Instruction	0L-0T-3P
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5 Credits

Prerequisites:

Problem Solving and Programming using C (22CSC01N), Problem Solving and Programming using C Lab (22CSC02N), Data Structures using C++ (22ITC20N), Data Structures using C++ Lab (22ITC21N)

COURSE OBJECTIVES: This course aims to

1. Learn to solve different kinds of puzzles and problems.
2. Understand basic algorithms and how to use them to solve problems.
3. Improve your coding skills in programming languages like C++ / Java.
4. Learn to collaborate with others while also trying to do your best.
5. Learn what you need to do to do well in programming contests.

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

1. Demonstrate comprehension of complex problems and develop algorithmic solutions to address them effectively.
2. Apply various data structures and algorithms to solve computational problems efficiently.
3. Evaluate and optimize code performance by applying advanced algorithmic optimizations and runtime analysis techniques.
4. Explain problem-solving approaches, algorithms, and implementations clearly and concisely, fostering effective communication within the programming community.
5. Utilise techniques and strategies to solve competitive programming challenges, resulting in improved contest performance.

CO-PO-PSO Articulation matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	0	1	0	0	0	0	0	1	2	3	3
CO 2	2	3	2	0	1	0	0	0	0	0	1	2	3	3
CO 3	2	3	2	0	1	0	0	0	0	0	1	2	3	3
CO 4	2	3	2	0	0	0	0	0	0	0	1	2	3	3
CO 5	2	3	2	0	1	0	0	0	0	0	1	2	3	3

Week 1-2: Foundations & Fast I/O — Getting Started with Code

1. Session 1 : Overview

- Overview of Competitive Coding; Setting up the development environment (IDEs, online judges like leetcode, codechef, codeforces, topcoder, hackerrank, etc)
- Basic programming constructs in competitive coding: STLs in CPP, Bitwise operations
- Asymptotic Notation, TLE
- Sample Programs:
  - Sum of N Numbers: Given N numbers, print their sum and average.
  - Check if a Number is Power of 2: Determine if a given number is a power of 2 using bitwise operators.

- Fast Exponentiation: Compute a^b mod m efficiently.

2. **Session 2 : Arrays, Linked Lists and Bit manipulations**
   - Bit Manipulation techniques
   - Arrays and Linked Lists operations
   - Sample Problems
     - Single Number: Find the element that appears once when all others appear twice.
     - Rotate Array: Rotate an array to the right by k steps.
     - Detect Cycle in Linked List: Check if a linked list contains a cycle.

Week 3-4: Data Structures

3. **Session 3 : Stacks and Queues**
   - Stack and Queue operations
   - Practice problems involving expression evaluation, balanced parentheses, sliding window problems
   - Sample Problems:
     - Next Greater Element: For each element, find the next greater element on the right.
     - Valid Parentheses: Check if a string with parentheses is balanced.
     - Sliding Window Maximum: Find the maximum in each sliding window of size k.
4. **Session 4: Trees and Graphs**
   - Tree traversal techniques (DFS, BFS)
   - Graph traversal algorithms (BFS, DFS)
   - Practice problems on Trees and Graphs
   - Sample Problems
     - Binary Tree Level Order Traversal: Print nodes level by level.
     - Lowest Common Ancestor: Find LCA of two nodes in a binary tree.
     - Detect Cycle in Undirected Graph: Check if there's a cycle in an undirected graph.

Week 5-6: Algorithms

5. **Session 5: Heaps and Priority Queues**
   - Applications like Dijkstra's Algorithm, K largest elements
   - Practice problems on Heaps and Priority Queues
   - Sample Problems
     - Kth Largest Element: Find the kth largest element in an array.
     - Merge K Sorted Lists: Merge k sorted linked lists into one sorted list.
     - Top K Frequent Elements: Return the k most frequent elements.

6. **Session 6: Hashing**
   - Hashing concepts: Hash Maps, Hash Sets
   - Applications in frequency counting, subarrays with given sum, anagram grouping
   - Sample Problems
     - Two Sum: Find two numbers that add up to a given target.
     - Longest Consecutive Sequence: Find the longest sequence of consecutive numbers.
     - Group Anagrams: Group words that are anagrams of each other.

Week 7-8: Algorithmic strategies Greedy approach and Divide & Conquer

7. **Session 7: Greedy approach**
   - Key problems: Activity Selection, Fractional Knapsack, Huffman Encoding
   - Practice problems based on Greedy approach
   - Sample Problems
     - Activity Selection: Schedule the maximum number of non-overlapping activities.

- Fractional Knapsack: Maximize value with fractional items.
- Job Sequencing with Deadlines: Maximize profit by scheduling jobs within deadlines.

8. **Session 8: Divide and Conquer**
    - Divide and Conquer Strategy
    - Key problems: Merge Sort, Quick Sort, Binary Search, Count Inversions, Closest Pair of Points
    - Practice problems on Divide and Conquer
    - Sample Problems
        - Merge Sort: Sort an array using merge sort.
        - Count Inversions: Count the number of inversions in an array.
        - Closest Pair of Points: Find the closest pair of points in a 2D plane.
        - Binary Search Variants: Implement binary search and its variants.

Week 9 & 10: Dynamic Programming

9. **Session 9: Dynamic Programming**
    - Approaches: Top-down (memoization) and Bottom-up (tabulation)
    - Fibonacci series as a DP problem;
    - Practice problems using DP
    - Sample Problems:
        - Climbing Stairs: You are climbing a staircase with N steps. You can either take 1 or 2 steps at a time. How many distinct ways can you reach the top?
        - Fibonacci Number: Return the Nth number in the Fibonacci sequence using dynamic programming.
          Coin Change: Find the minimum number of coins to make a given amount.
        - Matrix Chain Multiplication: Determine the most efficient way to multiply a chain of matrices.

10. **Session 10: Dynamic Programming**
    - Complex state transitions and optimization strategies.
    - 0/1 Knapsack, Longest Common Subsequence (LCS), Longest Increasing Subsequence (LIS)
    - Practice problems using DP
    - Sample Problems
        - 0/1 Knapsack Problem: Maximize value without exceeding weight capacity.
        - Longest Common Subsequence: Find the length of the longest common subsequence.
        - Longest Increasing Subsequence: Find the length of the longest increasing subsequence.

Week 1-12: Backtracking & Advanced Backtracking

11. **Session 11: Backtracking**
    - Concepts: Exploring all possible solutions, pruning
    - Problems: N-Queens, Sudoku Solver, Subset Sum, Combination Sum
    - Practice problems on Backtracking
    - Sample Problems
        - N-Queens: Place N queens on an N×N board so they don't attack each other.
        - Subset Sum: Find if a subset exists with a given sum.
        - Word Search: Given a 2D board of characters and a word, find if the word exists in the board by moving horizontally or vertically.

12. **Session 12: Advanced Backtracking**
    - Problems: Graph Coloring, Hamiltonian Cycle, Word Search

- Practice problems on advanced backtracking
- Sample Problems
  - Sudoku Solver: Fill a partially-filled Sudoku grid.
  - Rat in a Maze: Find all paths from source to destination in a maze.
  - Sudoku Solver: Given a partially filled 9x9 Sudoku board, solve it using backtracking.
  - N-Queens II: Find the number of distinct solutions to the N-Queens problem, rather than all the solutions.

Week 13-14: Branch-Bound

13. **Session 13 & 14:**
    - Concepts: State space tree, bounding function, pruning
    - Problems: 0/1 Knapsack using BnB, Traveling Salesman Problem (TSP)
    - Practice problems on Branch and Bound
    - Sample Problems
      - M-Coloring Problem: Color a graph using M colors without adjacent nodes sharing color
      - Word Search in Grid: Search for a word by moving in all 4 directions.

Practice Platforms:

Regularly practice problems on online coding platforms like Leetcode, Codeforces, HackerRank, CodeChef, etc

Contest Simulation: Participate in virtual contests to simulate real competitive coding environments.

Competitive Programming Books:

1. "Competitive Programming" by Steven Halim and Felix Halim
2. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
3. Leetcode 50 Common Interview Questions – Leetcode Clean Code Handbook, 2014

WEB RESOURCES:

1. https://www.topcoder.com/
2. https://www.geeksforgeeks.org/data-structures/?ref=shm
3. https://takeuforward.org/interviews/strivers-sde-sheet-top-coding-interview-problems/
4. https://www.geeksforgeeks.org/dsa-sheet-by-love-babbar/
5. https://neetcode.io/practice
6. https://docs.google.com/spreadsheets/d/1MGVBJ8HkRbCnU6EQASjJKCqQE8BWng4qgL0n3vCVOxE/edit#gid=0
7. https://docs.google.com/spreadsheets/d/1kyHfGGaLTzWspcqMUUS5Httmip7t8LJB0P-uPrRLGos/edit#gid=0

22ADC32N

EXPLORATORY DATA ANALYSIS AND VISUALIZATION LAB

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

Prerequisite: Python Programming

COURSE OBJECTIVES: The course is designed to enable students to

1. Develop foundational skills in performing numerical operations and array manipulations using NumPy.
2. Understand and apply data handling, transformation, and preprocessing techniques using Pandas.
3. Analyze structured datasets to identify trends, summarize information, and prepare data for analysis.
4. Create effective and customized data visualizations using Matplotlib and Seaborn to communicate insights.
5. Integrate EDA techniques in a real-world case study to perform a comprehensive analysis from data loading to visualization.

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

1. Apply NumPy functionalities such as array creation, indexing, broadcasting, and matrix operations for efficient data computation.
2. Utilize Pandas for creating, cleaning, transforming, and analyzing structured data.
3. Perform complex data operations like merging, hierarchical indexing, grouping, and time series analysis using Pandas.
4. Generate various types of data visualizations using Matplotlib and Seaborn to reveal patterns and insights.
5. Execute an end-to-end exploratory data analysis on a domain-specific dataset, integrating all learned skills in a structured workflow.

CO-PO-PSO Articulation Matrix

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

LIST OF PROGRAMS:

1. **NumPy Fundamentals:** Array creation: 1D, 2D, 3D arrays, Indexing, slicing, broadcasting, Arithmetic operations and matrix computations
2. **Advanced NumPy Operations:** Transposition and reshaping arrays, Random number generation, Aggregate functions and axis operations

3. **Pandas:** Series and DataFrame creation, DataFrame indexing, slicing, and selection, Basic operations and attributes
4. **Data Cleaning and Preprocessing:** Handling missing data (dropna, fillna), Replacing values and data type conversion, Detecting and removing duplicates
5. **Data Transformation and Categorization:** Mapping and renaming values, Binning and categorization, Sorting, ranking, and filtering data
6. **Hierarchical Indexing and Merging:** Multi-level indexing, Concatenating and merging DataFrames, Reshaping with stack, unstack, and pivot
7. **Group By and Time Series Analysis:** Grouping and aggregation, Time series conversion and indexing, Resampling, frequency conversion, and date-based selection
8. **Data Visualization with Matplotlib and Seaborn**: Line plots, bar charts, histograms, scatter plots, Customizing plots (labels, legends, styles)
9. **Advanced Visualizations with Seaborn:** Categorical plots (box, violin), Heatmaps and pairplots, Styling themes and color palettes
10. **Case Study: End-to-End EDA**
    - Dataset: Choose from domains like healthcare, e-commerce, finance, or social media etc.
    - Data loading and preprocessing, Cleaning and wrangling, Grouping and time series (if applicable), Data visualization and insights
    - Deliverables: Jupyter notebook/ Colab notebool

TEXT BOOKS:

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

SUGGESTED READING:

1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, 2nd Edition, 2023.

WEB 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

DATASETS:

1. https://www.kaggle.com/datasets?search=Exploratory+data+analysis
2. https://archive.ics.uci.edu/

22ITI01

MOOCS / TRAINING / INTERNSHIP

Instruction	3 to 4 Weeks / 90 Hours
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	2

MOOCS/TRAINING/INTERNSHIP OBJECTIVES:

This MOOCs/Training/Internship aims to:

1. Expose the students to industrial environments and technologies.
2. Provide possible opportunities to learn, make them understand, and sharpen their real-time technical and managerial skills required for the job.
3. Expose students to the current technological developments relevant to the program domain.
4. Understand engineers' responsibilities and ethics.
5. Provide opportunities to interact with the people of industry and society to understand the real conditions.

MOOCS/TRAINING/INTERNSHIP OUTCOMES:

Upon completion of this MOOCs/Training/Internship, students will be able to:

1. Learn new technologies and solve real time problems.
2. Expose to industrial environment problems and technologies.
3. Gain knowledge of contemporary technologies and industrial requirements.
4. Identify, design and develop solutions for real world problems.
5. Communicate their ideas and learning experiences through reports and presentations.

CO-PO-PSO Articulation Matrix

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

1. Evaluation by the Industry (in the scale of 1 to **10** where 1-Unsatisfactory; 10-Excellent)
2. Evaluation by faculty Mentor on the basis of site visit(s) or periodic communication (**15** marks)
3. 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
(AUTONOMOUS)

DEPARTMENT OF INFORMATION TECHNOLOGY
(Inline with AICTE Model Curriculum with effect from AY 2025-26)

(R-22A Regulation)

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.	22MTC15	Probability and Queueing Theory	3	1	-	3	40	60	4
2.	22CSC11N	Database Management Systems	3	-	-	3	40	60	3
3.	22ITC08N	Enterprise Application Development	3	-	-	3	40	60	3
4.	22MBC01	Engineering Economics & Accountancy	3	-	-	3	40	60	3
5.	22CEM01	Environmental Science	2	-	-	2	-	50	NC
6.		**Professional Elective – I**	3	-	-	3	40	60	3
PRACTICAL									
7.	22CSC13N	Database Management Systems Lab	-	-	3	3	50	50	1.5
8.	22ITC09N	Enterprise Application Development Lab	-	-	3	3	50	50	1.5
9.	22ITC07	Mini Project – I	-	-	2	3	50	50	1
10.	22ITU01	Up Skill Certification Course-I	-			-	25	-	0.5
		TOTAL	**17**	**1**	**8**	**-**	**375**	**500**	**20.5**
Clock Hours per Week: 26									

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

Professional Elective - I	
22ITE01	Data Mining
22ADE43N	Digital Image Processing
22ITE03	Fundamentals of Cryptography
22ITE04N	Modern Mobile Application Development
22ITE20	Advanced Data structures

22MTC15

PROBABILITY AND QUEUEING THEORY

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. Able to learn and analyzing data in Linear and Non-Linear form.
2. Able to fit the random data using statistical averages.
3. Able to interpret the continuous probability function
4. Understand the data using the testing of Hypothesis.
5. Able to learn the Queuing models.

COURSE OUTCOMES: Upon successful completion of the course, student will be able to

1. Apply the principle of Least Squares approximating for estimating the value.
2. Analyzing the Random data using Statistical averages.
3. Analyze the Random phenomenon using probability distributions.
4. Distinguishing the data using different methods of hypothesis testing.
5. Analyze the Queue model for the probabilistic nature.

CO-PO-PSO Articulation Matrix

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

UNIT-I: Curve Fitting

Measures of Central Tendency, Measures of Dispersion, Skewness, Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness for frequency distribution, Kurtosis. Correlation, coefficient of correlation, limits of correlation coefficient. Linear Regression, Regression coefficients, Properties of Regression Coefficients. Curve fitting by the Method of Least Squares, Fitting of Straight lines, Second degree parabola and Growth curve

($y = ae^{bx}$, $y = ax^{b} and y = ab^{x}$).

UNIT-II: Random variables

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. Moments (Moments about the mean and moments about a point).

UNIT-III: Probability Distributions

Poisson distribution, Mean and variance, MGF and Cumulates(without proof)of the Poisson distribution, Recurrence formula for the probabilities of Poisson distribution, Fitting of Poisson distribution, Normal distribution, Characteristics of normal distribution and Normal probability Curve, MGF and CGF of Normal distribution, Mean and variance ,Areas under

normal curve. Exponential distribution, MGF, CGF, Mean and variance.

UNIT-IV: Tests of Hypothesis

Parameter and Statistic, Tests of significance, tests of significance for large samples. Tests of significance for single proportion, and difference of proportions. Tests of significance for single mean and difference of means. Small sample test, t-test for single mean and differences of Means. F-test for equality of two population variances. Chi-Square test of goodness of fit and test of independent of attributes, ANOVA (One way classification).

UNIT-V: Queueing Theory

Introduction-Queueing system-The arrival pattern-The service pattern-The queue discipline, Symbolic Representation of a Queueing Model –Characteristics of Infinite Capacity, Single server Poisson Queue Model Queueing problem- Pure Birth and Death Process-Probability Distribution of Departures(pure death process)-Basic queueing Models- Measures of the (M/M/1):($\infty/FIFO)\ model$-Characteristic of Finite Capacity, Single Server Poisson Queue Model III (M/M/1):($N/FCFS$) Model.

TEXT BOOKS:

1. S.C.Gupta, V.K.Kapoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, 2014.
2. T Veerarajan, Probability, Statistics and Random Processes, 2nd Edition, Tata McGraw-Hill.

SUGGESTED READING:

1. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, 3rd Ed., Wiley, 1968.
2. Sheldon Ross, “A First Course in Probability”, 9th Edition, Pearson publications, 2014.

22CSC11N

DATA BASE MANAGEMENT SYSTEMS

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

Prerequisite: Programming and Data Structures.

COURSE OBJECTIVES: This course aims to

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

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

1. Understand fundamental concepts of database and design database schema for an application.
2. Write relational algebra expression and SQL queries for various tasks.
3. Apply the principles of functional dependency and normalization to ensuredata integrity
4. Understand indexing and transaction processing
5. Analyze transaction processing, concurrency control and recovery mechanisms.

CO-PO-PSO Articulation Matrix

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

UNIT-I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators, Database System Architecture, Data Models, **E-R Model**: Introduction, Constraints, E-R Diagrams, E-R Design Issues, Mapping from ER to relational model, Extended E-R Features.

UNIT-II

Relational Algebra: Introduction to relational algebra operations, Basic relational algebra operators, Natural join, Assignment operator. **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. Simple Queries (select/project/join/ aggregate queries), Complex queries (With Clause, Nested Sub queries, Views)

UNIT-III

Functional Dependency: Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Attribute closure, Irreducible Set of Functional Dependencies, lossless decomposition,

Normalization–1NF, 2NF, 3NF and BCNF, Dependency preserved decomposition, Comparison of BCNF and 3NF.

UNIT–IV

Indexing: Basic Concepts, Primary Index, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+Tree Index Files, Hash indices, Bitmap indices. **Transaction Processing:** Concept of transactions and schedules, ACID properties, Conflict-serializability

UNIT-V

Concurrency control: Lock-Based Protocols, Dead lock handling, Timestamp-Based Protocols, Validation-Based Protocols. **Recovery system:** Failure classification, Log based recovery, recovery algorithm, ARIES.

TEXT BOOKS:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill, 2021.
2. C.J. Date, "An Introduction to Database Systems", 8th edition, Pearson, 2020,

SUGGESTED READING:

1. Raghu Ramakrishnan, JohnnesGehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2014.
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. Krishnan, "Database Management Systems", McGraw Hill.

ONLINE RESOURCES:

1. http://www.nptelvideos.in/2012/11/database-managementsystem.html.

22ITC08N

ENTERPRISE APPLICATION DEVELOPMENT

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. Provide knowledge about web pages design and development.
2. Understand how the HTML, CSS and JavaScript components of Bootstrap work.
3. Explore the basic architecture of a React application and develop applications in agile mode.
4. Gain the basics of frond-end and back-end application development using Nodejs.
5. Understand the basics of MongoDB and its Data Model.

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

1. Create web pages with good aesthetic sense of design using HTML and CSS.
2. Create real-world React web applications and related tools.
3. Become an agile practitioner with the ability to quickly complete projects.
4. Build an end-to-end application from scratch using NODE JS.
5. Understand and build logical relationships between documents using MongoDB.

CO-PO-PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	2	0	0	0	0	0	0	0	0	0	3
CO 2	2	2	3	3	3	2	2	0	1	0	2	3	0	3
CO 3	2	3	3	3	3	2	2	0	1	0	2	3	0	3
CO 4	2	3	3	3	3	2	2	0	1	0	2	3	0	3
CO 5	2	2	2	3	3	0	0	0	0	0	1	2	0	3

UNIT-I

Introduction to full stack: MVC pattern**,** Web Fundamentals. **HTML 5.0:** Basic tags, HTML DOM**,** Images, Tables, Lists, Forms, Layout, Graphics, span and div tags.

Introduction to Cascading Style Sheets: Types of CSS**,** CSS Selectors, CSS BOX Model, Text and Font, Color, CSS Positioning and CSS floating, CSS Grid layout Module, CSS Media Queries.

UNIT-II

Java Script: Data Types & Type Conversion, JSON, Events, String and Date Functions, Local Storage, Object Oriented Programming (OOP) in JS, JavaScript Regular Expressions.

Bootstrap: Introduction of Bootstrap, Container and Container-fluid, Bootstrap Carousel.

Bootstrap Component: Button, Grid, Table, Form, Alert, Image, Tabs/Pill, Navbar, Modals.

UNIT-III

React JS: Introduction to React, React with JSX, Actual DOM vs React VDOM, Components, Lifecycle, State, Props, Fragments, Events, Router, Forms, Pagination, Tables, Portals, Hook, Signals. React 18 New features.

Redux and MUI: Introduction to Redux, State, Actions, Reducers, Color Reducer, Sort Reducer, Store, Action Creators, Middleware. React Material UI Introduction and Installation, MUI Input Components.

Integration of Google MAP API and GPS Location Tracking: Incorporating Google MAP API and GPS Location Tracking for location-based services.

UNIT-IV

Node JS: Modules, Node Package Manager(npm), Creating Web Server, Sending Requests and Handling HTTP requests, Handling User authentication with NodeJS, File System, Writing a file asynchronously and Other I/O Operations.

Events: Event Emitter class, Inheriting Events and Returning event emitter.

Express JS: Introduction to the Express framework- Server-side rendering with Templating Engines, Routing, Middleware, Custom Middleware, static files.

UNIT-V

Mongo DB: Introduction, Importance of NoSQL databases, JSON Vs BSON, Data types and examples. CRUD Operations, Data Modelling & Schema Design, Indexing and Aggregation, MongoDB Replication and Sharding.

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.

WEB 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.anarcho-copy.org/Programming%20Languages/Node/

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

COURSE OUTCOMES: Upon Completion of the 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 the 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	1	1	3	1	1	1	-	1	1	1	-
CO 2	2	2	2	2	-	1	-	1	-	1	-
CO 3	1	2	1	2	2	1	-	1	-	1	-
CO 4	2	2	1	2	2	1	-	3	-	1	-
CO 5	1	3	1	2	1	1	-	-	-	1	2

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, Equi-Marginal 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 Iso-costs, MRTS, Input - Output Relations; Laws of Returns. Cost Analysis: Cost Concepts – Types of Costs, Cost - Output Relationship – Short Run and Long Run; Market Structures – Types of Competition, Features of Perfect Competition, Price Output Determination under Perfect Competition, Features of Monopoly Competition, Price Output Determination under Monopoly Competition. Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

UNIT-IV

Accountancy : Book-keeping, Principles and Significance of Double Entry Bookkeeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Ledger Accounts, Trial Balance Concept and preparation of Final Accounts with Simple Adjustments.

UNIT-V

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and Sources of raising Finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical Problems.

TEXT BOOKS:

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

SUGGESTED READINGS:

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

22CEM01

ENVIRONMENTAL SCIENCE

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	0

COURSE OBJECTIVES: This course aims to

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance.
3. To identify the importance of interlinking of food chain.
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

COURSE OUTCOMES: Upon completion of the course, student is able 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-PSO Articulation Matrix

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

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

E RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://archive.nptel.ac.in/courses/120/108/120108004/

22ITE01

DATA MINING

(Professional Elective – I)

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

COURSE OBJECTIVES: This course aims to

1. Introduce the concepts of Data Mining.
2. Familiarize different kinds of data and various preprocessing techniques, Data warehouse fundamentals.
3. Study different frequent pattern discovery methods and classification basics.
4. Learn various advanced classification methods and Prediction.
5. Introduce the concepts of cluster analysis and outlier detection.

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

1. Understand the concepts and issues of data mining.
2. Apply preprocessing techniques, build multidimensional data models and perform OLAP operations.
3. Build association rules through various frequent pattern discovery methods and Understand classification concepts.
4. Analyze and evaluate various models for classification and prediction.
5. Illustrate Clustering and Outlier detection techniques.

CO-PO-PSO Articulation Matrix

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

UNIT-I

Introduction: Data mining, Kinds of data, Kinds of pattern, Major issues in data mining**.**

Getting to know your data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity.

UNIT–II

Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data Warehousing and Online Analytical Processing: Data Warehouse - Basic Concepts, Data Warehouse Modeling - Data Cube and OLAP, Data Warehouse Design and Usage: A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, Data Warehouse Usage for Information Processing.

UNIT-III

Mining Frequent Patterns, Associations and correlations: Basic Concepts, Frequent Item Set Mining Methods, Interesting patterns, Pattern Evaluation Methods.

Advanced Pattern Mining: Pattern Mining in Multilevel and Multidimensional Space.

Classification: Basic Concepts, Decision Tree Induction**.**

UNIT-IV

Classification and Prediction: Bayes Classification Methods, Rule-Based Classification,Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Introducing Ensemble Methods, Bagging, Boosting, Random Forests, Improving Classification Accuracy of Class Imbalanced Data, Prediction.

Advanced Methods: Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors), Classifier Accuracy.

UNIT-V

Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, DBSCAN, Evaluation of Clustering, Clustering graph and network data.

Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity- Based Approaches.

TEXT BOOK:

1. Han J, Kamber M, Jian P, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier, 2012.

SUGGESTED READING:

1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2008.
2. M. Humphires, M.Hawkins, M.Dy, "Data Warehousing: Architecture and Implementation", Pearson Education, 2009.
3. Anahory, Murray, "Data Warehousing in the Real World", Pearson Education, 2008.
4. Kargupta, Joshi, et al, "Data Mining: Next Generation Challenges and Future Directions", Prentice Hall of India Pvt. Ltd, 2007

WEB RESOURCE:

1. https://hanj.cs.illinois.edu/bk3/
2. https://www.kdnuggets.com/
3. http://archive.ics.uci.edu/ml/index.ph

22ADE43N

Digital Image Processing

(Professional Elective #1)

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

Prerequisite: Matrices and Vectors

COURSE OBJECTIVES: This course aims to

1. Understand the Fundamentals of Image Processing
2. Learn Image Enhancement Techniques
3. Study Color Image Processing
4. Understand Image Segmentation and Edge Detection.
5. Explore Image Compression Techniques

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

1. Describe image formation, sensing techniques, and image representation formats used in imaging systems.
2. Apply spatial and transform domain filters for basic image analysis and processing.
3. Explain image enhancement techniques in both spatial and frequency domains.
4. Apply restoration techniques to reconstruct degraded images using noise and degradation models
5. Compare geometric restoration and image compression methods for efficient image representation.

CO-PO-PSO Articulation Matrix

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

UNIT - I

Digital Image Processing and Analysis, Image Processing and Human Vision, Digital Imaging Systems, Digital Imaging Systems, Image Formation and Sensing, Visible Light Imaging, Imaging Outside the Visible Range of the EM Spectrum, Acoustic Imaging, Electron Imaging, Laser Imaging, Computer-Generated Images, Image Representation, Binary Images, Gray-Scale Images, Color Images, Multispectral and Multiband Images, Digital Image File Formats.

UNIT - II

Transform Filters, Spatial Filters and the Wavelet: Lowpass Filters, Highpass Filters, Bandpass, Bandreject and Notch Filters, Spatial Filtering via Convolution, Lowpass Filtering in the Spatial Domain, Highpass Filtering in the Spatial Domain, Bandpass and Bandreject Filtering in the Spatial Domain, Discrete Wavelet Transform,

UNIT - III

Image Enhancement: Gray-Scale Modification, Mapping Equations, Histogram Modification, Adaptive Contrast Enhancement, Color Image, Sharpening, Highpass Filtering, High-Frequency Emphasis (HFE), Directional Difference Filters, Homomorphic Filtering, Unsharp Masking, Edge Detector–Based Sharpening Algorithms, Image Smoothing, Frequency Domain Smoothing, Spatial Domain Smoothing, Smoothing with Nonlinear Filters

UNIT – IV

Image Restoration and Reconstruction: System Model, Noise Models, Noise Histograms, Periodic Noise, Estimation of Noise, Noise Removal Using Spatial Filters, Order Filters, Mean Filters, Adaptive Filters, The Degradation Function, The Spatial Domain – The Point Spread Function, The Frequency Domain – The Modulation/Optical Transfer Function, Estimation of the Degradation Function, Frequency Domain Restoration Filters, Inverse Filter, Wiener Filter, Constrained Least Squares Filter, Geometric Mean FiltersAdaptive Filtering, Bandpass, Bandreject and Notch Filters, Practical Considerations, Geometric Transforms,

UNIT - V

Spatial Transforms, Gray-Level Interpolation, The Geometric Restoration Procedure, Geometric Restoration with CVIPtools, Image Reconstruction, Reconstruction Using Backprojections, The Radon Transform, The Fourier-Slice Theorem and Direct Fourier Reconstruction. **Image Compression:** Compression System Model, Lossless Compression Methods, Huffman Coding, Golomb-Rice Coding, Run-Length Coding, Lempel–Ziv–Welch Coding, Arithmetic Coding, Lossy Compression Methods, Gray-Level Run-Length Coding, Block Truncation Coding, Vector Quantization, Differential Predictive Coding, Model-Based and Fractal Compression, Transform Coding, Hybrid and Wavelet Methods.

TEXT BOOK:

1. Scott E Umbaugh , Digital Image Processing and Analysis, Fourth Edition, Tayler and Frances, 2023

SUGGESTED READING:

1. Wilhelm Burger Mark J. Burge , Digital Image Processing An Algorithmic Introduction, Third edition, 2022
2. Guillermo Guillen, Sensor Projects with Raspberry Pi: Internet of Things and Digital Image Processing, Second Edition, 2024

WEB RESOURCES:

1. https://www.mathworks.com/solutions/image-video-processing/resources.html
2. https://archive.nptel.ac.in/courses/117/105/117105135/

22ITE03

FUNDAMENTALS OF CRYPTOGRAPHY

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 fundamental concepts of computer security and cryptography.
2. Familiarize with the concepts of number theory, block ciphers.
3. Provide knowledge on asymmetric key cryptography and hash functions.
4. Acquaint with message authentication codes and digital signatures.
5. Impart knowledge on key distribution, user authentication.

COURSE OUTCOMES: Upon successful completion of the course the students will be able to
1. Demonstrate the key security concepts, security attacks and cryptography techniques.
2. Analyze the usage of number theory ,block ciphers, symmetric encryption algorithms.
3. Interpret operations of asymmetric key cryptography models and secure hash functions.
4. Examine the concepts of message authentication codes and digital signatures in real time applications.
5. Inspect the knowledge on key distribution, user authentication mechanisms.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	3	1	2	2	1	1	0	0	2	1	2	3	2
CO 2	3	3	1	3	3	1	3	0	0	2	1	2	3	3
CO 3	3	3	1	3	3	2	3	0	0	2	2	2	3	3
CO 4	3	3	1	3	3	2	3	0	0	2	2	2	3	3
CO 5	2	3	1	2	2	2	1	0	0	2	2	2	3	2

UNIT-I

Introduction: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

UNIT-II

Introduction to Number Theory: Divisibility and Division Algorithm, Euclidean algorithm, Modular arithmetic, Prime Numbers, Fermat's theorem and Euler's theorem, Discrete Logarithms.

Block Ciphers and Data Encryption Standard: Traditional Block Cipher Structure, the Data Encryption Standard, DES Example, the Strength of DES, Block Cipher Design Principles, Multiple Encryption, Triple DES.

Advanced Encryption Standard: Finite Field Arithmetic, AES Structure, AES Transformation functions, AES Key Expansion, AES Example, AES Implementation.

UNIT-III

Asymmetric Key Cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie- Hellman key exchange,Homomorphic encryption,Onion routing.

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm,SHA-512 Logic.

UNIT-IV

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of Macs, MACs Based on Hash Functions HMAC, Security of HMAC.

Digital Signatures: Digital Signature**,** ElGamal Digital Signature Scheme**,** NIST Digital Signature Algorithm.

UNIT-V

Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure.

User Authentication: Kerberos, Federated Identity Management.

TEXT BOOK:

1. William Stallings, “Cryptography and Network Security Principles and Practice”,Pearson Education, Seventh Edition,2017.

SUGGESTED READING:

1. V.K.Jain, “Cryptography and Network Security”, First Edition, Khanna Book Publishing,2013.
2. Behrouz A Forouzan, "Cryptography and Network Security", Second Edition, Tata McGraw Hill, 2010.

WEB RESOURCES:

1. Foundations of Cryptography, https://nptel.ac.in/courses/106/106/106106221/
2. Cryptography and Network Security, https://nptel.ac.in/courses/106/105/106105162/

22ITE04N MODERN MOBILE APPLICATION DEVELOPMENT

(Open Elective)

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 Flutter and Dart programming for cross-platform mobile application development.
2. Enable the design, development, and deployment of interactive and data-driven mobile applications.
3. Explore advanced concepts such as state management, animations, API integration, and database connectivity.

COURSE OUTCOMES: Upon completing this course, learners will be able to

1. Develop mobile applications using Flutter widgets, layouts, and animations.
2. Apply state management techniques for efficient app performance.
3. Integrate APIs and databases for real-time data processing.
4. Utilize Dart packages to enhance app functionality and performance.
5. Deploy and optimize Flutter applications on Android and iOS platforms.

CO-PO Articulation Matrix

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

UNIT I

Introduction to Flutter

Features of Flutter, Advantages of Flutter, Disadvantages of Flutter, Architecture of Flutter Applications, Core Principles of Flutter Development, and Comparison with Other Cross-Platform Frameworks, Real-World Applications of Flutter, and Flutter's Role in Modern UI/UX Design

UNIT II

Flutter Basics & Dart Programming

Widgets, Gestures, Introduction to Dart Programming, Variables and Data Types, Decision Making and Loops, Functions, Object-Oriented Programming, Introduction to Widgets, Widget Build Visualization, Basic Programming, OOP Concepts, Exception Handling, Debugging, Asynchronous Programming – Futures, Async, Await, Streams.

UNIT III

UI Development & Layouts

Types of Layout Widgets, Single Child Widgets, Multiple Child Widgets, Advanced Layout Application, Introduction to Gestures, State Management in Flutter, Ephemeral State Management, Application State, Scoped Model, Navigation and Routing, Styles and Assets, Fonts, Model API, Media Query.

UNIT IV

Animations & API Integration

Introduction to Animation-Based Classes, Workflow of Flutter Animation, Working Application, Android-Specific Code on Flutter, Introduction to Packages, Types of Packages, Using a Dart Package, Developing a Flutter Plugin Package, Accessing REST API, Basic Concepts, Accessing Product Service API.

UNIT V

Database & Deployment

SQLite, Cloud Firestore, Internationalization on Flutter, Using intl Package, Testing on Flutter, Types of Testing, Widget Testing, Steps Involved, Working Example, Deployment, Android Application, iOS Application, Development Tools, Widget Sets, Flutter Development with Visual Studio Code, Dart DevTools, Flutter SDK.

TEXT BOOK:

1. Marco L. Napoli, Beginning Flutter: A Hands-On Guide to App Development, Apress, 2019.

SUGGESTED READING:

1 Alessandro Biessek, “Flutter for Beginners: An Introductory Guide to App Development”, Packt Publishing, 2020.
2 Rap Payne, “Flutter & Dart: The Complete Guide to Build Cross-Platform Apps”, 2019.
3 David Griffiths & Dawn Griffiths, “Head First Android Development”, O'Reilly Media, 2017.

WEB RESOURCES:

1. Flutter Official Documentation – https://flutter.dev/docs
2. Dart Language Guide – https://dart.dev/guides
3. Google Codelabs (Flutter Tutorials) – https://codelabs.developers.google.com/?cat=Flutter
4. Flutter & Dart API Reference – https://api.flutter.dev

22ITE20

ADVANCED DATA STRUCTURES

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

Prerequisite: Knowledge on basic Data Structures.

COURSE OBJECTIVES: This course aims to

1. Develop a deep understanding of skip lists and priority queues in optimizing data storage and retrieval.
2. Gain proficiency in various types of balanced trees to efficiently manage and manipulate data structures.
3. Master the implementation and analysis of key graph algorithms, including topological sorting and shortest path algorithms, to solve complex network-related problems.
4. Acquire the skills to implement disjoint set operations and advanced string matching algorithms, optimizing solutions for problems.
5. Understand the concept of NP-completeness and its implications in computational complexity, enabling the identification and analysis of intractable problems in computer science.

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

1. Demonstrate proficiency in understanding and implementing various tree structures, including binary search trees, AVL trees, and red-black trees, for efficient data storage and retrieval.
2. Design and analyze priority queues using heap data structures, understand heap operations, and apply heap-based algorithms effectively.
3. Develop skills in representing graphs and implementing graph algorithms, enabling them to solve graph-related problems efficiently.
4. Gain expertise in hashing techniques, collision resolution methods, and hash table implementations in various data storage and retrieval scenarios.
5. Explore advanced data structures such as tries, disjoint sets, segment trees, and understand their roles in solving specialized computational problems efficiently.

CO-PO-PSO Articulation Matrix

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

UNIT - I

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT- II

Priority Queues (Heaps) – Model, Simple implementations, **Binary Heap:** Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations. **Binomial Queues:** Binomial Queue Structure, Binomial Queue Operations, Implementation of Binomial Queue.

Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree. **Red-Black Trees –** Properties of red-black trees, Rotations, Insertion, Deletion**, Splay Trees**
Red-Black and Splay Trees; B trees: Definition, operations, and applications; R trees: Nearest neighbor query, join and range queries; Comparison of search trees;

UNIT - III
Graphs Algorithms – Elementary Graph Algorithms: Topological sort, **Disjoint Sets** – Equivalence relation, Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm. Digital Search Structures Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries and Suffix Tries

UNIT- IV
String Matching and Text Processing: String Operations, The naive string-matching algorithm, The Rabin-Karp algorithm,Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, The Huffman Coding and Decoding Algorithm,

UNIT-V
Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.

TEXT BOOKS:
1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley.

SUGGESTED READING:
1. Marcello La Rocca, “Advanced Algorithms and Data Structures”, May 2021, ISBN 9781617295485, Manning Publishers.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, Fourth Edition, ISBN: 9780262367509, MIT Press, 2022.

22CSC13N

DATABASE MANAGEMENT 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 concepts of structured query language.
2. Understand about Programming Language / Structured Query Language (PL/SQL).
3. Learn database constraints, DCL, TCL and advanced SQL commands.
4. Familiarize with cursors, triggers, exceptions, procedures and functions in PL/SQL.

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

1. Outline the built-in functions of SQL and Create, Alter and Drop table.
2. Demonstrate Queries to retrieve and Change Data using Select, Insert, Delete and Update. Construct Queries using Group By, Order By and Having Clauses.
3. Demonstrate Commit, Rollback, save point commands and formulate the Queries for Creating Views and constraints.
4. Develop queries using Joins, Sub-Queries.
5. Develop PL/SQL code to create stored procedures, functions, cursors and exceptions.

CO-PO Articulation Matrix

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

LIST OF EXPERIMENTS:

1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using DDL and DML statements.
3. Queries using Group By, Order By, Having Clauses and set operations.
4. Queries on Controlling Data: Commit, Rollback and Save point.
5. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
6. Queries using Joins, views and Sub-Queries.
7. Write PL/SQL code using Basic Variables, bind and substitution variables.
8. Write PL/SQL code using Control Structures.
9. Write PL/SQL code using Procedures, Functions.
10. Write PL/SQL code using Cursors, Triggers and Exceptions.

TEXT BOOKS:

1. "Oracle: The complete Reference", Oracle Press.
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007.

SUGGESTED READING:

1. Rick FVander Lans, "Introduction to SQL", 4th Edition, Pearson Education, 2007.
2. "The Language of SQL (Learning)" by Larry Rockoff.

3. Steven Feuerstein, "Oracle PL/SQL Programming", 6th Edition, O'reilly publications, 2014.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

22ITC09N

ENTERPRISE APPLICATION DEVELOPMENT 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. Understand and practice HTML5 and CSS.
2. Introduce the fundamental concepts of JavaScript and Bootstrap.
3. Understand the concepts of Client-side JS Framework.
4. Work with the concepts of Server-side JS Framework.
5. Be familiar with real time database.

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

1. Apply HTML and CSS effectively to create dynamic websites.
2. Describe and utilize JavaScript concepts in real-world applications.
3. Develop single page applications in React Framework.
4. Use Node.js for server-side application development.
5. Design the Realtime database applications based on the requirements.

CO-PO-PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	3	1	2	2	0	2	0	1	0	2	3	0	3
CO 2	2	3	3	3	3	2	2	0	1	0	2	3	0	3
CO 3	2	3	3	3	3	2	2	0	1	0	2	3	0	3
CO 4	2	3	3	3	3	2	2	0	1	0	2	3	0	3
CO 5	2	3	2	3	3	0	2	0	1	0	2	3	0	3

LIST OF EXPERIMENTS:

1. Design a Login Page using HTML, CSS (Media Query) and JavaScript.
2. Design a chessboard pattern using HTML and CSS.
3. Design a calculator application using JavaScript.
4. Create responsive web page of your class time table by using bootstrap grid system.
5. Create a timer component to start, pause and reset using ReactJS.
6. Create a React component that checks the strength of a password and displays the result to the user. The component will take user input and use a set of rules to determine the strength of the password.
7. Design the authorized end points using JWT (JSON Web Token)
8. Develop a backend application with REST API to perform CRUD operations on student data. (Use Postman Tool)
9. Design replica set of student database and insert records in primary node and display the records in secondary nodes.
10. Create Real-Time Chat Features in a Web Application Using React, Node.js, Socket.io, and MongoDB.

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.

WEB 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.anarcho-copy.org/Programming%20Languages/Node/

22ITC07

MINI PROJECT – I

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

COURSE OBJECTIVES: This course aims to

1. Enable student learning by doing.
2. Develop capability to analyze and solve real world problems.
3. Inculcate innovative ideas of the students.
4. Impart team building and management skills among students.
5. Instill writing and presentation skills for completing the project.

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

1. Interpret Literature with the purpose of formulating a project proposal.
2. Plan, Analyze, Design and implement a project.
3. Find the solution of an identified problem with the help of modern Technology and give priority to real time scenarios.
4. Plan to work as a team and to focus on getting a working project done and submit a report within a stipulated period of time.
5. Prepare and submit the Report and deliver a presentation before the departmental Committee.

CO-PO-PSO Articulation Matrix

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

The Students are required to choose a topic for a mini project related to the courses of the current semester or previous semester. The student has to implement and present the project as per the given schedule. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work has to be submitted for evaluation.

SCHEDULE

S No	Description	Duration
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation and Testing of the Project	7 weeks
4.	Documentation and Project Presentation	4 weeks

Guidelines for the Award of Marks

S No	Description	Max. Marks
1.	Weekly Assessment	20
2.	PPT Preparation	5
3.	Presentation	10
4.	Question and Answers	5
5.	Report Preparation	10

Final Mini Project demonstration and PPT presentation is to be evaluated for the entire class together by the entire faculty handling Mini Project for that class.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY
(Inline with AICTE Model Curriculum with effect from AY 2026-27)
(R-22A Regulation)

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	22CSC21N	Software Engineering	3	-	-	3	40	60	3
2	22CAC21N	Machine Learning	3	-	-	3	40	60	3
3	22ITC10N	Computer Networks	3	-	-	3	40	60	3
4	22ITC12N	Formal Languages and Automata Theory	3	-	-	3	40	60	3
5	22CSC15N	Operating Systems	3	-	-	3	40	60	3
6		**Professional Elective - 2**	3	-	-	3	40	60	3
PRACTICALS									
7	22CSC49	Software Engineering Lab	-	-	2	3	50	50	1
8	22ITC04N	Operating Systems & Computer Networks Lab	-	-	3	3	50	50	1.5
9	22CAC22N	Machine Learning Lab	-	-	3	3	50	50	1.5
10	22ITI02	Industrial / Rural Internship-II	3-4 weeks/ 90 Hours				50	-	2
Total			**18**	**-**	**8**	**-**	**440**	**510**	**24**
Clock Hours per Week: 26									

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

Professional Elective – 2	
22ITE07	Cloud Computing
22CSE10N	Software Project Management
22ITE22	Information Retrieval Systems
22ITE23	Cyber Security Essentials
22ADE65N	Social Network Analytics

22CSC21N

SOFTWARE ENGINEERING

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

Prerequisite: 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-PSO Articulation Matrix

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

Function-oriented modelling, Design Concepts -Coupling, Cohesion, Flow-oriented modelling-DFDs with Examples, 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, 9th Edition, 2023.
2. Pankaj Jalote, "Software Engineering Precise Approach", Wiley Publishers, 2012

SUGGESTED READING:

1. Sommerville "Software Engineering", 10th Edition, Pearson, 2016.
2. Rajib Mall, *Fundamentals of Software Engineering*, 5th Edition, PHI, 2018.

ONLINE RESOURCES:

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

22CAC21N

MACHINE LEARNING

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

COURSE OBJECTIVES: This course aims to
1. To understand the Concepts of Machine Learning.
2. To explore and study various machine learning techniques.
3. To design solutions for real world problems using machine learning techniques.

COURSE OUTCOMES: Upon completion of this course, students will be able to
1. Understand the basic concepts of machine learning approaches and feature engineering.
2. Apply Regression and Classification techniques.
3. Evaluate and compare Supervised and Unsupervised Learning algorithms
4. Analyze and apply the ensemble methods
5. Analyze neural networks and apply to solve real world problems

CO-PO Articulation Matrix:

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

UNIT-I

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

Feature Engineering: Introduction to Features and need of Feature Engineering, Feature Extraction and Selection, Discriminant Analysis (PCA, LDA).

UNIT-II.

Regression: Linear Regression, Multivariate Regression, Non-linear Regression (Independent and Dependent), Lasso and Ridge based regression.

Classification Algorithms: Decision Trees (ID3,C4.5,CART), Naive Bayes Classifier KNN, Logistic regression, SVM, Performance Measures.

UNIT-III

Clustering Algorithms: Similarity measures, Clustering, types of clustering, K-Means clustering, Hierarchical clustering Methods (Birch, Chemelon), Density Based Methods-DBSCAN, Spectral Clustering.

UNIT-IV

Ensemble Learning: Introduction to Ensemble Learning, Bagging, Boosting , Bootstrapping, Adaboosting AdaBoost, Random forest classification, Random Forest Regressor.

UNIT-V

Neural Network: Introduction Neural network, Perceptron, Multi-layer perceptron, Backpropagation, Introduction to reinforcement learning, Scope and Limitations, Examples, Applications of Reinforcement Learning.

Case Studies: House Price Prediction, Weather forecasting, Recommender Systems.

TEXT BOOKS:

1. Guiseppe Bonaccarco,"Machine Learning Algorithms", 2nd Edition,Packt,2018
2. Abhishek Vijavarigia " Machine Learning using Python", BPB Publications,1st Edition 2018.
3. Tom Mitchel " Machine Learning", Tata MacGraw Hill, 2017.

SUGGESTED READING:

1. Marsland, S. "Machine Learning: An Algorithmic Perspective" 1st Edition Chapman and Hall/CRC 2009
2. YuxiLiu " Python Machine Learning", Oxford Press, 2017.
3. Reema Thareja " Python Programming ", Oxford Press, 2017.

ONLINE RESOURCE:

1. https://onlinecourses.nptel.ac.in/noc24_cs51/preview
2. https://www.holehouse.org/mlclass
3. https://www.geeksforgeeks.org/machine-learning/
4. https://www.tutorialspoint.com/machine_learning _with python

22ITC10N **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. Understand the basics of Layering Concepts, Physical layer, data transmission, transmission media.
2. Demonstrate the state-of-the-art knowledge on data link layer concepts.
3. Distinguish the different types of routing algorithms and network layer in the Internet.
4. Introduce Transport Layer basics, UDP and TCP Protocols.
5. Know the concepts of Application Layer Protocols.

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

1. Explain the functions of each layer in the OSI, TCP/IP reference models and demonstrate the concepts of Physical Layer.
2. Analyse the Data Link Layer protocols and MAC mechanisms.
3. Evaluate the Routing algorithms and the IP Protocols.
4. Illustrate the functions and performance of Internet Transport Protocols TCP and UDP.
5. Explore the various Application layer protocols.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	2	1	0	0	0	0	0	0	2	3	2
CO 2	3	3	3	2	1	0	0	0	0	0	0	3	3	2
CO 3	3	3	2	2	3	0	0	0	0	0	0	3	3	2
CO 4	3	3	2	2	2	0	0	0	0	0	0	3	3	3
CO 5	2	2	1	2	3	3	3	2	3	3	3	3	3	2

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, Packet Switching, Circuit Switching and Virtual Circuit Switching. Physical Layer: Guided Transmission media, Twisted Pairs, Coaxial Cable, Fiber Optics, Wireless transmission.

UNIT-II

Data Link Layer: Design Issues, Error Detection and Correction, Elementary Data Link Protocols: Simplex Protocol, A Simplex Stop and Wait Protocol for an Error-free channel, Sliding Window Protocols, Go-Back-N, Selective Repeat. Medium Access Sub Layer: The Channel allocation problem, Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols.

UNIT- III

Network Layer: Design Issues, Routing algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, OSPF, BGP, Quality of Service, The Network layer in the Internet- The IP Version 4 Protocol, IP Addresses, IP Version 6.

UNIT-IV

Transport Layer: Transport Service, Berkeley Sockets, Elements of Transport Protocols, **The Internet Transport Protocols:** Introduction to UDP, 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, SMTP, FTP, TELNET, SNMP.

TEXT BOOKS:

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

SUGGESTED READING:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2021.
2. 2.Chwan-Hwa (John) Wu, J. David Irwin, "Introduction to Computer Networks and Cyber Security", CRC Press, 2013.
3. W. Richard Stevens, "Unix Network Programming", Prentice Hall/Pearson Education, 2009.
4. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 5th Edition, Addison-Wesley, 2012.
5. Larry L. Peterson and Bruce S. Davie "Computer Networks: A Systems Approach", 5e, 2018
6. Behrouz A. Forouzan "Data Communications and Networking", Fourth Edition,2007.

WEB RESOURCES:

1. https://nptel.ac.in/courses/117105148,title of the course
2. Computer Networks - Books, Notes, Tests 2025-2026 Syllabus
3. IEEE Transactions on Networking | IEEE Communications Society
4. Web Resources for Computer Networks, 5 (vu.nl)

22ITC12N

FORMAL LANGUAGES AND AUTOMATA THEORY

Instruction	3 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: The objectives of this course are,

1. To study abstract computing models namely Finite Automata, Pushdown Automata, and Turning Machines.
2. To introduce various grammars, formal languages and equivalence between various languages and their corresponding recognizers.
3. To familiarize with decidability and undecidability of computational problems.

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

1. Build Deterministic, Nondeterministic Finite automata for Languages and show the acceptance of strings using Formal Machines.
2. Develop regular expressions and their equivalent finite automata for various languages.
3. Design context-free grammars, demonstrate ambiguity of grammars and normal forms
4. Construct pushdown automata for languages and Analyze Equivalence of PDA's, CFG's.
5. Design Turing Machines, Analyze and distinguish between decidable and undecidable problems.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	1	1	0	0	0	0	0	1	2	0	2
CO 2	2	1	1	0	1	0	0	0	0	0	1	1	0	2
CO 3	2	2	1	1	1	0	0	0	0	0	1	1	0	2
CO 4	2	2	1	2	1	0	0	0	0	0	1	1	0	2
CO 5	2	2	1	2	1	0	0	0	0	0	2	1	0	2

UNIT-I

Automata: Introduction to Finite Automata, the Central Concepts of Automata Theory: Alphabets, Strings and Languages.

Finite Automata: Deterministic Finite Automata, Nondeterministic Finite Automata, Equivalence of NFA and DFA, Finite Automata with Epsilon -Transitions, Minimization of DFA's.

UNIT-II

Regular Expression and languages: Regular Expressions, Finite Automata and Regular Expression: From DFAs to Regular Expressions, 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 of Regular Languages, Decision Properties of Regular Languages.

UNIT-III

Context Free Grammars and Languages: Context-Free Grammars, Leftmost and Rightmost Derivations, The language of a Grammar, Constructing Parse Trees, The Yield of a Parse Tree, Applications of CFGs, Ambiguous Grammars, Removing Ambiguity From Grammars.

Properties of Context Free Languages: Normal Forms for Context-Free Grammars: Eliminating Useless Symbols, Computing the Generating and Reachable Symbols, Eliminating Epsilon Productions, Eliminating Unit Productions, Chomsky Normal Form, Greibach Normal form.

UNIT-IV

Pumping Lemma for CFL's, Applications of Pumping Lemma for CFL's, Closure Properties of CFL's, and Decision Properties of CFL's.

Pushdown Automata: The Formal Definition of PDA, Graphical Notation for PDA's, Instantaneous Description of a PDA, The Language of a PDA: Acceptance by Final State, Acceptance by Empty Stack, Equivalence of PDA's and CFG's: From Grammars to PDA's, From PDA's to Grammars, Deterministic Pushdown Automata.

UNIT-V

Introduction to Turing Machines: Notation for the TM, Instantaneous Descriptions for TM's, The Language of a TM, Turing Machines and Halting, Extensions to the Basic Turing machine, Restricted Turing machines, Turing Machines and computers.

Undecidability: Codes for Turing Machines, The Diagonalization Language, The Universal Language, Undecidablity of the Universal Language, Undecidable problems about Turing Machines: Rice's Theorem and Properties of RE languages, Post's Correspondence Problem: Definition of PCP, The Modified PCP, Other Undecidable Problems.

TEXT BOOK:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", 3rd Edition, Pearson Education, 2015.

SUGGESTED READING:

1. John C Martin. "Introduction to Language and Theory of Computation", 3rd Edition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2nd Edition, Wiley Publications, 2007.
3. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", 3rd Edition, Prentice Hall of India 2008.
4. ShyamalendraKandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.

WEB RESOURCES:

1. http://courses.cs.vt.edu/cs4114/spring2012/index.php
2. http://online.stanford.edu/course/automata-theory

22CSC15N

OPERATING SYSTEMS

Instruction	3 L Hours
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-PSO Articulation Matrix

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

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, Linux/Unix OS Design and architecture overview.

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. Process management in Unix/Linux. **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. Memory management in Linux/Unix. **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 Defence:** Types of threats in OS, basic security mechanisms, malware taxonomy, viruses, worms, and rootkits, logging, auditing, and recovery.

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.

SUGGESTED READING:

1. Ekta Walia Khanna, "Operating System Concepts", 2nd Edition, Publishing House, 2019.
2. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX® Environment", 3rd Edition, Pearson Education India; 2013.
3. 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).

22ITE07 **CLOUD COMPUTING**

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 and 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-PSO Articulation Matrix

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

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.

22CSE10N

SOFTWARE PROJECT MANAGEMENT

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

Prerequisite: Software engineering

COURSE OBJECTIVES: This course aims to
1. Develop a comprehensive understanding of software project management frameworks
2. Build practical skills in planning, risk management, and quality assurance
3. Understand and apply organizational and human resource management principles

COURSE OUTCOMES: Upon completion of this course, students will be able to
1. Aanalyze and apply software process maturity models and frameworks
2. Develop and manage effective project activity plans and risk management strategies
3. Analyze and apply organizational structures and project control mechanisms
4. Effectively manage human resources in software projects
5. Plan, execute, and control software projects by applying principles of software configuration management, quality assurance, and risk analysis.

CO-PO-PSO Articulation Matrix

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

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

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 - III

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, metrics automation.

UNIT - IV

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.

UNIT - V

Software configuration management, Software Quality assurance, Risk Analysis, Instream activities- Project Initiation, Project planning and tracking, Project closure.

TEXT BOOKS:

1. Software Project Management, Walker Royce, Pearson Education ,2014
2. Managing Global Software Projects , Gopalaswamy Ramesh, Tata McGraw-Hill ,2002

SUGGESTED READING:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000
2. Process Improvement essentials, James R. Persse, O'Reilly, 2006
3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
4. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.
5. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007
6. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.
7. Agile Project Management, Jim Highsmith, 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

22ITE22 **INFORMATION RETRIEVAL SYSTEMS**

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

Prerequisite: Knowledge on Statistics and Machine Learning.

COURSE OBJECTIVES: This course aims to
1. Understand indexing, querying, and retrieval mechanisms in Information Retrieval Systems (IRS).
2. Study different IR models, ranking, compression, and evaluation techniques.
3. Explore text classification and clustering methods applied to information retrieval.
4. Introduce practical web search technologies including crawling and link analysis.

COURSE OUTCOMES: Upon completion of the course, students will be able to
1. Understand core concepts, algorithms, and architectures of information retrieval systems.
2. Apply indexing, compression, scoring, and query processing techniques.
3. Evaluate retrieval systems quantitatively using standard metrics.
4. Apply text classification and clustering techniques to organize and retrieve information.
5. Analyze real-world web search applications including crawling, indexing, and ranking

CO-PO-PSO Articulation Matrix

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

UNIT - I

Introduction to Information Retrieval Systems: Definition, Objectives, Functional Overview, Relation to Database Systems, Digital Libraries, and Data Warehouses. **Boolean Retrieval:** Inverted Index Building, Processing Boolean Queries, Extended Boolean Models vs Ranked Retrieval. **Term Vocabulary and Postings Lists:** Vocabulary Terms, Skip Pointers, Positional Postings, Phrase Queries. **Dictionaries and Tolerant Retrieval:** Dictionary Search Structures, Wildcard Queries, Spelling Correction Techniques.

UNIT – II

Index Construction: Blocked Sort-Based Indexing, Single-Pass In-Memory Indexing, Distributed Indexing, Dynamic Indexing. **Index Compression:** Statistical Term Properties, Dictionary Compression, Postings File Compression. **Cataloging and Indexing:** History, Objectives, Process of Automatic Indexing, Basics of Information Extraction. **Scoring and Vector Space Model:** Zone Indexes, Term Frequency Weighting, TF-IDF, Vector Space Scoring.

UNIT – III

Evaluation in Information Retrieval: Standard Test Collections, Evaluating Unranked and Ranked Retrieval Results, Precision-Recall Analysis. **Relevance Feedback and Query Expansion:** User Feedback Models, Pseudo Relevance Feedback, Query Reformulation Techniques. **Probabilistic Information Retrieval:** Binary Independence Model, Probability Ranking Principle, Relevance Models. **Language Models for IR:**Query Likelihood Models, Language Modeling Approaches to IR.

UNIT - IV

Text Classification and Naïve Bayes: Text Categorization, Naïve Bayes Classifier, Bernoulli and Multinomial Models, Feature Selection. **Vector Space Classification:** Document Representation, Similarity Measures, Rocchio Algorithm, k-Nearest Neighbor, Linear vs Nonlinear Classifiers. **Flat and Hierarchical Clustering:** k-Means, Evaluation of Clustering, Agglomerative and Divisive Clustering Techniques.

UNIT - V

Matrix Decompositions and Latent Semantic Indexing: Term-Document Matrices, Singular Value Decomposition (SVD), Low-Rank Approximations, LSI. **Web Search Basics:** Web Structure, Web Indexing Challenges, Advertising Models, User Behavior in Web Search. **Web Crawling and Indexing:** Web Crawling Techniques, Distributed Crawling, Connectivity Servers. **Link Analysis:**PageRank Algorithm, Hubs and Authorities, Web as a Graph.

TEXT BOOKS:

1. **Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze**, *An Introduction to Information Retrieval*, Cambridge University Press, 2008.
2. **David A. Grossman, Ophir Frieder**, *Information Retrieval – Algorithms and Heuristics*, 2nd Edition, Springer, 2004.

SUGGESTED READING:

1. **Gerald J. Kowalski, Mark T. Maybury**, *Information Storage and Retrieval Systems*, Springer, 2000.
2. **Soumen Chakrabarti**, *Mining the Web: Discovering Knowledge from Hypertext Data*, Morgan Kaufmann Publishers, 2002.

ONLINE RESOURCES:

1. https://web.stanford.edu/class/cs276/
2. https://nlp.stanford.edu/IR-book/
3. https://www.coursera.org/learn/text-retrieval
4. https://trec.nist.gov/
5. https://github.com/dorianbrown/rank_bm25

22ITE23

CYBER SECURITY ESSENTIALS

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

Prerequisite: Computer Networks, Information Security.

COURSE OBJECTIVES: This course aims to
1. Familiarize fundamental concepts, origins, and legal aspects of cybercrime.
2. Make students learn about various cyber offenses and methods employed by cybercriminals.
3. Enable students to understand the security challenges in mobile, wireless, and cloud computing environments
4. Equip students with knowledge of tools, methods, and countermeasures used to detect and prevent cyberattacks and identity theft.

COURSE OUTCOMES: Upon completion of this course, students will be able to
1. Explain the fundamental concepts and classifications of cybercrime and their legal implications.
2. Analyze various cyber offenses and the strategies used by attackers.
3. Evaluate security threats related to mobile and wireless devices in cybercrime contexts.
4. Identify tools, techniques, and methods used in executing cyberattacks.
5. Apply appropriate countermeasures to prevent phishing and identity theft.

CO-PO Articulation Matrix

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

UNIT - I

Introduction to Cyber Crime: Cyber Crime - Definition and Origins of the Word, Cyber-crime and Information Security, who are Cyber Criminals? Classification of Cyber Crimes. Cyber Crime and Indian ITA 2000, A Global Perspective on Cyber Crimes.

UNIT - II

Cyber Offenses: Introduction, How Criminals Plan Attacks, Social Engineering, Cyber stalking, Cybercafé and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector. Cloud Computing: Why Cloud Computing, Types of Services, Cyber Crime and Cloud Computing.

UNIT - III

Cyber Crime- Mobile and Wireless Devices: Introduction, 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/ Cell phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices Related Security Issues.

UNIT - IV

Tools and Methods used in Cybercrime: Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on wireless Networks.

UNIT – V

Phishing and Identity Theft: Phishing- Methods of Phishing, Phishing Techniques, Spear Phishing, Types of Phishing Scams, Phishing Toolkits and Spy Phishing, Phishing Countermeasures. **Identity Theft**- Personally Identifiable Information (PII), Types of Identity Theft Techniques of ID Theft, Identity Theft Countermeasures, How to Efface your Online Identity.

TEXT BOOK:

1. Sunit Belpre and Nina Godbole, ―Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives‖, Wiley India Pvt.Ltd, 2018.

REFERENCE BOOKS:

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

WEB 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

22ADE65N

SOCIAL NETWORK ANALYTICS

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

Pre-Requisites:

A course on "Web Technologies";
A course on "Computer Networks";
A course on "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. By the end of this course, students should be able to:
2. Design the social networks
3. Gain skills in tracking the social networks and its tools.
4. Use Open source tools to perform social network analysis.
5. Visualize social networks and analysis.
6. Predict human behavior in social network and related communities

CO-PO-PSO Articulation Matrix

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

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, Modelling and aggregating social network data- State-of-the-art in network data representation, Aggregating and reasoning with social network data.

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, Semantic-based Social Network Analysis in the sciences- Case study .

TEXT BOKS:
1. David Easley, Jon Kleinberg, Networks, Crowds and Markets, Cambridge Press, 2010.
2. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.

SUGGESTED READINGS:
1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting and Using Metrics, 1st 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 Shneiderman, Marc Smith, Analysing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 2011.

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

22CSC552

SOFTWARE ENGINEERING LAB

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

Prerequisite: 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-PSO Articulation Matrix

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

TEXT BOOKS:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: "The Unified Modeling Language User Guide", Pearson Education, 2010.
2. Roger S. Pressman "Software Engineering: A practitioner's approach", McGraw Hill, 8th Edition, 2014.

ONLINE RESOURCES:

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

22ITC04N

OPERATING SYSTEMS AND COMPUTER NETWORKS 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. Familiarize with various system calls of LINUX and IPC.
2. Introduce CPU scheduling algorithms and deadlocks and use of semaphores.
3. Acquire knowledge on Configuring Peer to Peer networks, Cyclic Redundancy Check.
4. Learn the basic Simulation tools and their installation.
5. Explore the concepts of network topologies, routing algorithms and packet sniffer tool.

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

1. Describe the concepts of system calls of LINUX and IPC.
2. Implement the CPU scheduling algorithms, Deadlocks and Semaphores.
3. Configure the peer-to-peer networks and implement Cyclic Redundancy Check method.
4. Install the various Simulation Tools in Networks.
5. Implement Stop and wait protocol, routing algorithms and Packet sniffer tool.

CO-PO-PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	0	0	0	0	0	0	0	0	0	1	0	0
CO 2	3	2	1	0	0	0	0	0	0	0	0	2	0	2
CO 3	3	3	1	0	1	0	0	0	0	0	0	2	0	2
CO 4	3	2	0	0	0	0	0	0	0	0	0	2	0	3
CO 5	3	1	0	0	0	0	0	0	0	0	0	2	0	3

LIST OF EXPERIMENTS:

PART-A

1. Demonstrate the system calls. a) fork b) execvp c) stat d) setenv & getenv
2. Implement Inter process communication between a server and multiple clients
3. Implement CPU scheduling algorithms
4. Implement Banker‘s algorithm for Deadlock Avoidance.
5. Implement Producer-Consumer Problem using semaphores.

PART-B

1. Configure Peer to Peer Network with at least three hosts.
2. Implement Cyclic Redundancy Check method.
3. Installation setup of Network simulator software (NS2/NS3/ NetSim /OPNET/ QualNet/ OMNet++ / J-Sim and Cisco Packet Tracer).
4. Simulation of Star topology.
5. Simulation of Stop and Wait Protocol,

6. Simulation of Distance Vector Routing Algorithm.
7. Use Wireshark Packet sniffer software and captures TCP, UDP, IP, ARP, ICMP, Telnet, FTP packets.

TEXT BOOKS:

1. An Introduction to Operating Systems, P.C.P Bhatt, 2nd edition, PHI.
2. Modern Operating Systems, Andrew S Tanenbaum, 3rd Edition, PHI
3. Andrew S. Tanenbaum, Computer Networks, Pearson Education,6th Edition,2021.

SUGGESTED READING:

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

WEB RESOURCES:

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

22CAC22N

MACHINE LEARNING LAB

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO Articulation Matrix

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

LIST OF EXPERIMENTS:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import scikitlearn, keras and tensorflows etc.
2. Implement Dimensionality Reduction Using Feature Extraction and Feature Selection
3. 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.
4. Demonstration of Logistic Regression for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
5. Demonstration of decision tree based ID3 algorithm, Random Forest.
6. Build the decision tree classifier compare its performance with ensemble techniques like random forest, bagging, boosting and voting Demonstrate it with different decision trees.
7. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file.
8. Implementation of SVM, KNN and NN using Tensor flow.
9. Demonstration of clustering algorithms- k-Means, Agglomerative and DBSCAN to classify for the standard datasets.
10. Implementation of case studies using supervised learning algorithms.

TEXT BOOKS:

1. Guiseppe Bonaccarco,"Machine Learning Algorithms", 2nd Edition,Packt,2018

SUGGESTED READING:

1. Marsland, S. "Machine Learning: An Algorithmic Perspective" 1st Edition Chapman and Hall/CRC 2009

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_cs51/preview
2. https://www.holehouse.org/mlclass

22ITI02

INDUSTRIAL / RURAL INTERNSHIP – II

Instruction/Demonstration/Training	3-4 Weeks/90 Hours
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Knowledge of Basic Sciences and Engineering Sciences/Knowledge about rural environment

COURSE OBJECTIVES: This course aims to

1. Exposing the students to the industrial environment/ rural environment
2. Create awareness on the current industrial technological developments in the domain of IT
3. Provide opportunity to understand the social, economic feasibility aspects in the process of product/prototype development

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

1. Understand Engineer's responsibilities and ethics
2. Use state of the art Tools and technologies
3. Provide innovative solutions to solve real world problems
4. Acquire knowledge in technical reports writing and presentation
5. Apply technical knowledge to real world industrial/rural situations

.

CO-PO Articulation Matrix

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

For implementation procedures and letter formats, annexures I and III of Internship document may be referred.

Evaluation of Internship: The industrial training/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 by the constituted committee (25 marks)

Evaluation through Seminar presentation/Viva-Voce at the institute: Students shall give a seminar before an E*xpert Committee* constituted by college (Director, HoD/Senior faculty, mentor and faculty expert from the same department) based on his/her training/internship carried out
The evaluation will be based on the following criteria:

- Quality of content presented
- Proper planning for presentation
- Effectiveness of presentation
- Depth of knowledge and skills

- Attendance record, daily diary, departmental reports shall be analyzed along with the internship Report

Monitoring/ Surprise Visits: During the internship program, the faculty mentor makes a surprise visit to the internship site, to check the student's presence physically. If the student is found to be absent without prior intimation to the concerned industry, entire training/internship may be canceled. Students should inform through email to the faculty mentor as well as the industry supervisor at least one day prior to avail leave.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY
(Inline with AICTE Model Curriculum with effect from AY 2026-27)
(R-22A Regulation)

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		CIE	SEE	
THEORY									
1	22ITC30N	Big Data Analytics and Applications	3	-	-	3	40	60	3
2	22CAC08N	Deep Learning	3	-	-	3	40	60	3
3	22CSC24N	Compiler Design	3	-	-	3	40	60	3
4	22ADC61N	Artificial Intelligence	3	-	-	3	40	60	3
5	22EEM01	Universal Human Values II: Understanding Harmony	-	1	-	-	50	-	1
6		**Professional Elective - 3**	3	-	-	3	40	60	3
PRACTICALS									
8	22ITC31N	Big Data Analytics and Applications Lab	-	-	3	3	50	50	1.5
9	22CAC10N	Deep Learning Lab	-	-	3	3	50	50	1.5
10	22ITC15	Mini Project II	-	-	2	3	50	50	1
11	22EGC03	Employability Skills	-	-	2	3	50	-	1
12	22ITU02	Up-Skill Certification Course-II	-				25	-	0.5
Total			**15**	**1**	**10**	**-**	**475**	**450**	**21.5**
Clock Hours per Week: 26									

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

Professional Elective -3	
22ITE17	Serverless Computing
22CSE09N	High performance Computing
22CIE07	Ethical Hacking
22ITE10	Scalable Web Application Development
22CAE16N	Natural Language Processing

22ITC30N **BIG DATA ANALYTICS AND APPLICATIONS**

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 fundamental concepts, characteristics, and significance of Big Data.
2. Demonstrate the use of Hadoop ecosystem tools such as HDFS, MapReduce, and Hive for processing large datasets.
3. Explore Apache Spark components and their use in building scalable data analytics solutions.
4. Enable students to design and implement machine learning algorithms using Spark MLlib.
5. Illustrate real-time data streaming techniques through Kafka and Spark Structured Streaming.

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

1. Describe the key aspects of Big Data and construct basic data processing solutions using Hadoop and Hive.
2. Develop distributed applications using Apache Spark, including RDDs and Spark SQL queries.
3. Implement and evaluate machine learning models such as classification, regression, and clustering with Spark MLlib.
4. Design real-time streaming pipelines by integrating Apache Kafka with Spark Structured Streaming.
5. Assess advanced data architectures like Data Lakehouses and apply ETL techniques using open table formats.

CO-PO-PSO Articulation Matrix

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

UNIT-I

Introduction to Big Data: Introduction, importance of big data, characteristics of big data.

The Hadoop Distributed Files system: Overview, The Design of HDFS, HDFS Concepts, Hadoop File systems.

MapReduce: Overview, Developing a MapReduce Application, How MapReduce works, MapReduce Types and Formats, MapReduce Features, MapReduce Examples.

Hive: Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function.

UNIT-II

Spark Framework: Introduction to Apache Spark, Understanding Resilient Distributed Datasets (RDD), Creating RDDs from external data sources, **Transforming RDDs**: Basic Transformations, Advanced Transformations, Implementing basic text processing, Understanding Spark's execution model and DAG (Directed Acyclic Graph), Partitioning in Spark and its impact on performance, RDD Persistence, RDD vs. DataFrame vs. Dataset, **Spark SQL:** Overview, Big Data and SQL – Spark

SQL, Creating DataFrames, Dataframes Operations, Spark SQL Queries, Tables, Views, Databases, Select Statements.

UNIT-III

Machine Learning with Spark:

Designing a Machine Learning System, and Preprocessing with Spark, Feature Engineering and Transformation for ML Models, Building a Collaborative Filtering Recommendation Engine with Spark, Developing a Classification Models ., Logistic Regression, Decision Trees using Spark MLlib Implementing a Regression Models Linear Regression, Random Forest with Spark, Building a Clustering Models ., K-Means, Hierarchical Clustering with Spark.

UNIT-IV

Real-time Streaming: Introduction to Stream Processing, Batch processing vs. stream processing, Spark structured streaming API, use cases using Spark structured streaming

Apache Kafka Fundamentals: Architecture, Brokers, Topics, Partitions, Producers, Consumers, Kafka Connect and Kafka Streams

UNIT-V

Advanced Kafka Features: Exactly-Once Semantics, Kafka Transactions, Tiered Storage, Integrating Kafka with Apache Spark and Apache Flink, Integrating Kafka with Spark structured Streaming, Real-time Analytics Use Cases with Kafka - such as Fraud Detection, Clickstream Analysis, Real-time Monitoring,

Data Lakehouses: Concepts, architecture, and evolution from data lakes, ACID properties and their implementation, Open table formats: Apache Iceberg, Delta Lake, and Apache Hudi (features, architecture, and use cases), Lakehouse implementation: Integrating with Spark/SQL, data ingestion, ETL.

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2015..
2. Gwen Shapira, Todd Palino, Rajini Sivaram, Krit Petty, Kafka*:* The Definitive Guide: Real-Time Data and Stream Processing at Scale*,* 2nd Edition, O'Reilly Media, 2021.
3. Bill Inmon & Ranjeet Srivastava, Rise of the Data Lakehouse: Building the Data Lakehouse, 2nd Edition, Technics Publications, 2023

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.

WEB RESOURCES:

1. https://www.ibmbigdatahub.com/infographic/four-vs-big-data
2. https://hadoop.apache.org/docs/stable/
3. https://cwiki.apache.org/confluence/display/Hive/LanguageManual
4. https://spark.apache.org/docs/latest/
5. https://databricks.com/glossary/dag
6. https://github.com/apache/spark/tree/master/examples/src/main/python/ml
7. https://spark.apache.org/docs/latest/structured-streaming-programming-guide.html
8. https://hudi.apache.org/
9. https://iceberg.apache.org/

10. https://www.ibm.com/cloud/what-is-edge-computing

22CAC08N

DEEP LEARNING

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

Pre-requisites: Calculus, Probability and Statistics, Python Programming, Machine Learning.

COURSE OBJECTIVES: The objectives of this course are

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: On Successful completion of the 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	2	1	1	1	1	1	1	2	2	3
CO 2	3	3	2	2	3	1	1	1	1	1	1	3	3	3
CO 3	3	3	3	3	3	1	1	1	2	2	2	3	2	3
CO 4	3	3	3	3	3	1	1	1	2	2	2	2	2	3
CO 5	3	3	3	3	3	1	1	1	2	2	2	2	2	3

UNIT-I

Biological to Artificial Neurons: Biological Neurons, Logical Computations with Neurons, The Perceptron, Multilayer Perceptron (MLP).

Activation functions: Sigmoid, Linear, Tanh, ReLu, Leaky ReLu, Softmax. **Loss functions:** Loss Function Notation, Loss Functions for Regression, Loss Functions for Classification, Loss Functions for Reconstruction. **Weight initialization functions**: Glorot, He, LeCun. Fine-Tuning Neural Network Hyper parameters.

UNIT-II

Optimizers: Gradient Descent (GD), Momentum based Gradient Descent, Nesterov Accelerated Gradient, AdaGrad, RMSProp, Adam.

The Vanishing/Exploding Gradients Problems: Batch Normalization, Gradient Clipping.

Avoiding Overfitting through Regularization: ℓ1 and ℓ2 Regularization, Dropout, Dataset augmentation, early stopping.

UNIT-III

Convolutional Neural Networks: Convolutions for Images, Padding and Stride, Multiple Input and Multiple Output Channels, Pooling,

Pre-trained models: Introduction, LeNet. AlexNet, VGG16, GoogLeNet, ResNet50.

UNIT-IV

Recurrent Neural Networks (RNN): Introduction, Neural Networks without Hidden States, Recurrent Neural Networks with Hidden States, Converting Raw Text into Sequence Data, Backpropagation Through time, Long Short-Term Memory (LSTM), Gated Recurrent UNITs (GRU), Bidirectional RNN, Encoder-Decoder Architecture, Attention Mechanism.

UNIT-V

Transformers: The Transformer Architecture, Transformers for Vision (ViT), Bidirectional Encoder Representations from Transformers (BERT) models.

Generative Adversarial Networks (GANs): Introduction, Generator, Discriminator, Training, Applications.

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/

22CSC24N

COMPILER DESIGN

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

Prerequisite: 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 and optimize 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 translators, tokens, bootstrapping, and phases of the compiler.
2. Use grammar specifications and implement a lexical analyzer with 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, Code Optimization, and Code Generation processes, and understand error recovery strategies and advanced 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	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	-	-	-	-	-	-	3			
CO 2	2	2	1	2	3	-	-	-	-	--	-			
CO 3	2	2	1	1	3	-	-	-	-	-	1			
CO 4	2	2	1	2	-	-	-	-	-	-	1			
CO 5	2	2	1	2	3	-	-	-	-	-	2			

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 Regular Expressions, Review of Finite Automata, Recognition of Tokens, Design of Lexical Analyzer Generator (lex, flex).

UNIT - II

Syntax Analysis: Introduction to syntax analysis, Top-Down Parsing, Recursive descent parsing, Predictive parsing, LL (1) Grammars. **Bottom-Up Parsing:** Shift Reduce parsing, Operator precedence parsing (Concepts only), 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. **Introduction to 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, Basic Blocks and Flow Graphs, Optimization of basic blocks, Data Flow Analysis, Live Variable Analysis, Loops.

UNIT - V

Code Generation: Issues in the Design of a Code Generator, The Target Machine, a simple Code Generator, Addresses in Target Code, Machine-independent optimization**,** Peephole optimization, Overview of Register Allocation and Assignment, 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, 2023.
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 Kaufman, 3rd Edition, 2022.
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/.

22ADC61N

ARTIFICIAL INTELLIGENCE

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

COURSE OBJECTIVES:

1. To learn basics of AI and concept of Intelligent Agent.
2. To learn the various Searching techniques
3. To learn first order and second order predicate Logic to infer knowledge
4. To learn classical and real world planning approaches
5. To learn uncertainty and probabilistic reasoning models

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

1. Explain the fundamentals of Artificial Intelligence and the role of intelligent agents in diverse environments.
2. Compare and evaluate uninformed and informed search techniques for problem-solving in AI.
3. Apply propositional and first-order predicate logic to represent knowledge and infer conclusions.
4. Analyze classical and real-world planning strategies, and interpret knowledge representation approaches in complex domains.
5. Understand and apply probabilistic reasoning models to handle uncertainty in intelligent systems.

CO-PO Articulation Matrix:

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

UNIT-I

Introduction: AI Definition, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art ; Intelligent Agents : Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents; Solving Problems by Searching: ProblemSolving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

UNIT-II

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments, Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs; Alternative Approaches; Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs , Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

UNIT-III

Logical Agents : Knowledge-Based Agents, the Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic; First-Order Logic: Representation Revisited, Syntax and Semantics of First-Order Logic, Using FirstOrder Logic, Knowledge Engineering in First-Order Logic; Inference in First-Order Logic: Propositional Vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution

UNIT-IV

Classical Planning: Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches; Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multiagent Planning; Knowledge Representations: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The Internet Shopping World.

UNIT-V

Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes‘ Rule and Its Use, The Wumpus World: Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks, Probabilistic Reasoning over Time: Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Edition, 4th Edition

SUGGESTED READING:

1. Rich, Knight, Nair: ―Artificial intelligence‖, Tata McGraw Hill, Third Edition, 2009.
2. Nilsson, N., ―Artificial Intelligence: A New Synthesis‖, San Francisco, Morgan Kaufmann, 1998.
3. Kulkarni, Parag, Joshi, Prachi , ―Artificial Intelligence : Building Intelligent Systems‖, PHI, 2015
4. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs19/
2. https://www.coursera.org/learn/ai-for-everyone

22EEM01

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

Instruction	1Tutorial Hour per Week
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, 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	PSO 1	PSO 2	PSO 3
CO 1	-	-	1	-	-	1	-	1	-	-	1	1	-	-
CO 2	-	-	1	-	-	1	-	1	-	1	1	1	-	-
CO 3	--	-	-	-	-	1	-	-	1	-	-	1	1	1
CO 4	-	-	-	-	-	1	1	-	-	-	-	1	1	1
CO 5	-	-	-	-	-	1	1	-	-	-	-	1	1	1

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 to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to 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 40%. 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

22ITE17 **SERVERLESS COMPUTING**

(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. Introduce the Fundamentals of Serverless computing.
2. Learn Concepts of Faas and limitations of serverless computing.
3. Know the Concepts of event driven applications and Automation with Serverless.
4. Familiarize how AWS Lambda works, Execution environment and security.
5. Explore AWS lambda, its programming models and gateways, APIs, to build serverless applications.

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

1. Describe the evolution of computing and software architectures.
2. Summarize the key characteristics, benefits, and limitations of serverless computing.
3. Apply event-driven design principles to develop modern applications.
4. Demonstrate the use of AWS Lambda for building serverless applications.
5. Analyze AWS Lambda functions and deployment configurations for serverless solutions.

CO-PO-PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	2	1	0	0	0	1	1	1	2	3	2
CO 2	2	3	2	2	2	1	0	0	2	2	1	2	3	2
CO 3	3	3	2	3	3	1	0	2	1	3	2	2	3	3
CO 4	3	3	2	3	3	2	0	1	1	3	2	2	3	3
CO 5	3	3	2	3	3	2	0	1	1	3	2	2	3	3

UNIT – I

Introduction: Serverless computing, The Evolution of Compute, Understanding enterprise data centers, Exploring the units of compute, Understanding software architectures.

UNIT – II

Serverless and event-driven collision, Introduction to FaaS, FaaS states, benefits, Comparison with PaaS, Comparison with containers, #NoOps, Limitations of serverless computing.

UNIT – III

Event-Driven Applications, Understanding modern applications, Evolution of integration patterns, Automation with serverless.

UNIT – IV

AWS Lambda: Getting Started with AWS Lambda, How does AWS Lambda work, Execution environment, configuring options for AWS Lambda, Securing AWS Lambda using IAM.

UNIT – V

The Foundations of a Function in AWS, Fundamentals of a function, Use cases, Setting up security, Invoking Lambda functions, Anatomy of a Lambda function, The programming model, Writing your first Lambda function, Adding Amazon API Gateway, Introducing Amazon API Gateway, Serverless APIs, Securing an API, Building, deploying, and managing APIs.

TEXT BOOKS:

1. Learn AWS Serverless Computing: A beginner's guide to using AWS Lambda, Amazon API Gateway, and services from Amazon Web Services, Scott Patterson, 1st Edition, 2019, Packt Publishers.
2. Hands-On Serverless Computing: Build, run and orchestrate serverless applications using AWS Lambda, Microsoft Azure Functions, and Google Cloud Functions, Kuldeep Chowhan, 1st Edition, 2018, Packt Publishers

SUGGESTED READING:

1. Hands-On Serverless Computing with Google Cloud: Build, deploy, and containerize apps using Cloud Functions, Cloud Run, and cloud-native technologies, Richard Rose, 1st Edition, 2020, Packt Publishers.
2. Hands-On Serverless Applications with Kotlin: Develop scalable and cost-effective web applications using AWS Lambda and Kotlin, Hardik Trivedi, Ameya Kulkarni, 1st Edition, 2018, Packt Publishers

WEB RESOURCES:

1. https://journalofcloudcomputing.springeropen.com/articles/10.1186/s13677-021-00253-7
2. https://cacm.acm.org/magazines/2019/12/241054-the-rise-of-serverless-computing/fulltext
3. https://cloud.google.com/discover/what-is-serverless-computing
4. https://www.ibm.com/think/topics/serverless
5. https://aws.amazon.com/serverless/
6. https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-serverless-computing

22CSE09N

HIGH PERFORMANCE COMPUTING

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.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	1	2	1	-	-	-	1	-	-			
CO 2	2	2	3	1	1	-	-	-	1	-	-			
CO 3	2	1	1	1	1	-	-	-	1	-	-			
CO 4	2	1	2	1	1	-	-	1	1	2	-			
CO 5	2	2	-	2	1	-	-	-	1	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", 1st Edition, Morgan Kaufman Publishers, 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.

22CIE07

ETHICAL HACKING

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

Pre-Requisites

Programming and Problem Solving, Database Management System, Web Technologies, Operating System, Computer Networks, Fundamentals of Cyber Security and Tools.

COURSE OBJECTIVES: This course aims to

1. Understand the fundamental concepts and terminologies of ethical hacking, including reconnaissance and foot printing techniques.
2. Apply scanning methodologies to identify network vulnerabilities and perform enumeration.
3. Analyse web-based and wireless network vulnerabilities to understand potential attack vectors.
4. Evaluate different penetration testing methodologies and report writing techniques.
5. Create strategies for remote exploitation and post-exploitation activities to maintain access.

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

1. Explain various information-gathering methods and tools used in ethical hacking, such as passive and active foot printing.
2. Demonstrate the use of scanning tools to identify open ports and services, and perform enumeration to gather system information.
3. Assess the security weaknesses in web applications and wireless networks, and identify appropriate exploitation techniques.
4. Develop a comprehensive penetration testing report, including vulnerability assessment summaries and risk evaluations.
5. Apply remote exploitation techniques, such as privilege escalation and backdoor installation, utilizing tools like MSFVenom to gain unauthorized access to target systems.

CO-PO-PSO Articulation Matrix

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

UNIT – I

Introduction to Ethical Hacking: Hacking Terminology, The Ethical Hacker, Reconnaissance, Information Gathering for the Ethical Hacker, Footprinting, Passive and Active Footprinting, Footprinting Methods and Tools- Search Engines, Website and E-mail Footprinting, DNS Footprinting, Network Footprinting.

UNIT – II

TScanning and Enumeration: TCP/IP Networking, Subnetting, Scanning Methodology, Identifying Targets, Port Scanning, Evasion, Vulnerability Scanning, Enumeration, Sniffing, Network Knowledge for sniffing, Active and Passive Sniffing, Sniffing Tools and Techniques.

UNIT – III

Web-Based Hacking: Servers and Applications, Web servers, Attacking Web Applications, Wireless Network Hacking, Wireless Networking, Wireless Terminology, Architecture, and Standards, Wireless Hacking.

UNIT – IV

Penetration Testing, Categories of Penetration Test, Black Box, White Box, Fray Box, Types of Penetration Tests, Report Writing, Structure of a Penetration Testing Report, Vulnerability Assessment Summary, Risk Assessment, Methodology, Linux Basics.

UNIT – V

Remote Exploitation: Attacking Network Remote Services, Common Target Protocols, and Tools of the Trade, Client Side Exploitation, Methods, E-Mails with Malicious Attachments, Post exploitation, Acquiring Situation Awareness, Privilege Escalation, Maintaining Access, Backdoors, MSFPayload/MSFEncode, MSFVenom, Dumping the Hashes.

TEXT BOOKS:

1. "CEH Certified Ethical Hacker All-in-One Exam Guide" by Matt Walker, Fourth Edition, McGraw Hill, 2019.
2. Rafay Baloch “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2015.

SUGGESTED READINGS:

1. "The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing Made Easy” by Patrick Engebretson, Second Edition, Syngress publications, 2013.
2. "Penetration Testing: A Hands-On Introduction to Hacking" by Georgia Weidman, No Starch Press, US, 2014.
3. "Hacking: The Art of Exploitation" by Jon Erickson, Second Edition, No Starch Press, US, 2008.

WEB REFERENCES:

1. OWASP (Open Web Application Security Project): https://owasp.org/
2. SANS Institute: https://www.sans.org/
3. Offensive Security: https://www.offensive-security.com/

22ITE10

SCALABLE WEB APPLICATION DEVELOPMENT

(Professional Elective –3)

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 the basic concepts of the Spring Framework
2. Provide basic knowledge of Web Application Development with Spring Boot and Restful APIs
3. Explore data access with Spring's DAO Module
4. Acquire Knowledge of Spring transaction management
5. Study Spring's unit testing framework and Introduce Spring Security with Rest API

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

1. Acquire the basic concepts of the Spring Framework
2. Interact with databases using Spring's support for JDBC and JPA.
3. Build spring boot applications using Dependency Injection concept
4. Apply Transaction Management concepts of spring in Enterprise Application Development and develop the Spring-MVC based Applications to solve the real-world problems.
5. Use Spring Unit testing framework and configure security on Spring MVC Applications

CO-PO/PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	2	2	-	-	1	2	1	1	3	0	3
CO 2	2	3	3	3	3	3	-	1	1	2	1	3	0	3
CO 3	2	3	3	3	3	3	-	1	1	2	1	3	0	3
CO 4	2	3	3	3	3	3	-	1	1	2	1	3	0	3
CO 5	2	3	3	3	3	3	-	1	1	2	1	3	0	3

UNIT-I

Spring Overview: Introduction to Spring Framework, The DI Container, Evolution of Spring Framework.

Java Configuration: Java configuration and the Spring application context, @Configuration and @Bean annotations, @Import: working with multiple configuration files, defining bean scopes, launching a Spring Application and obtaining Beans, External properties & Property sources, Environment abstraction, Using bean profiles, Spring Expression Language (SpEL).

Annotation and Component Scanning: Component scanning, Autowiring using @Autowired, Java configuration versus annotations mixing Lifecycle annotations: @PostConstruct and @PreDestroy, Stereotypes and meta-annotations.

UNIT-II

Web Applications with Spring Boot: Introduction to Spring MVC and request processing, Controller method signatures, Using @Controller, @RestController and @GetMapping annotations and Configuring Spring MVC with Spring Boot.

RESful Application with Spring Boot: An introduction to the REST architectural style, Controlling HTTP response codes with @ResponseStatus, Implementing REST with Spring MVC,

@RequestMapping, @RequestBody and @ResponseBody, Spring MVC's HttpMessageConverters and automatic content negotiation and Jakson library.

UNIT-III

Spring Boot Feature Introduction:

Introduction to Spring Boot Features, Value Proposition of Spring Boot and Creating a simple Boot application using Spring Initializer website.

Spring Boot – Dependency Management:

Dependency management using Spring Boot starters, how auto-configuration works, Configuration properties, overriding auto-configuration and Using Command Line Runner.

UNIT-IV

JDBC Simplification with JdbcTemplate: How Spring integrates with existing data access technologies, Spring's JdbcTemplate and DataAccess Exception hierarchy.

Spring Boot – Spring Data JPA: Quick introduction to ORM with JPA, Benefits of using Spring with JPA, JPA configuration in Spring, Configuring Spring JPA using Spring Boot, Spring Data JPA dynamic repositories.

Transaction Management with Spring: Transaction overview, Transaction management with Spring, Transaction propagation and rollback rules and Transactions and integration testing.

UNIT-V

Testing a Spring-based Application: Spring and Test-Driven Development, Spring 5 integration testing with JUnit 5, Application context caching and the @DirtiesContext annotation, Profile selection with @ActiveProfiles, Easy test data setup with @Sql.

Securing REST Application with Spring Security: What problems does Spring Security solve? , Configuring authentication, implementing authorization by intercepting URLs, Authorization at the Java method level, Understanding the Spring Security filter chain and Spring security testing.

Actuators, Metrics and Health Indicators: Exposing Spring Boot Actuator endpoints, Custom Metrics, Health Indicators, Creating custom Health Indicators and External monitoring systems.

TEXT BOOKS:

1. Mark Heckler, "Spring Boot Up and Running, 1st Edition", Oreilly, 2021.
2. Iuliana Cosmina, Rob Harrop, Chris Schaefer, Clarence Ho, " Pro String 5", 5th Edition, Apress, 2019

SUGGESTED READING:

1. Raja CSP Raman, Ludovic Dewailly, "Building A RESTful Web Service with Spring 5", Packt Publishing, 2018.

WEB RESOURCES:

1. https://spring.io/guides/gs/spring-boot/
2. https://docs.spring.io/spring-framework/docs/current/reference/html/index.htm

22CAE16N

NATURAL LANGUAGE PROCESSING

(Professional Elective-III)

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

COURSE OBJECTIVES: This course aims to

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

UNIT-I

Introduction to NLP: Definition, History, NLP in the real world, Approaches to NLP, NLP Pipeline. Accessing Text Corpora and Lexical Resources: Accessing Text Corpora, Conditional Frequency, Computing with Language: Simple Statistics.

UNIT-II

Basic Vectorization approaches of Text Representation: One-Hot Encoding, Bag of Words, Bag of N-Gram, TF-IDF; 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 Embedding's: Distributed universal text and handcrafted feature Representations, 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, 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

22ITC31N

BIG DATA ANALYTICS AND APPLICATIONS 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 introduce hands-on skills for processing large-scale data using Hadoop and Hive.
2. Gain expertise in using MapReduce and HiveQL for scalable data processing and analytics in the Hadoop ecosystem.
3. To provide practical knowledge of machine learning algorithms using Spark MLlib.
4. To demonstrate real-time data ingestion and processing with Kafka and Spark Streaming.
5. To implement advanced analytics and ETL workflows using open table formats like Delta Lake and Hudi.

COURSE OUTCOMES: Upon successful completion of the course, student will be able to

1. Set up and operate the Hadoop ecosystem including HDFS and Hive for Big Data processing.
2. Write and execute MapReduce jobs and HiveQL queries for data analytics.
3. Create and manage Spark RDDs, DataFrames, and perform SQL-based data transformations.
4. Develop basic machine learning models using Spark MLlib.
5. Build real-time streaming applications integrating Apache Kafka and Spark Structured Streaming.

CO-PO-PSO Articulation Matrix

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

LIST OF PROGRAMS:

1. Execute HDFS operations for file management and data storage.
2. Develop MapReduce applications for various use cases like word count, log file analysis, and temperature data processing.
3. Write and execute HiveQL queries, and design User-Defined Functions (UDFs) for custom data processing.
4. Implement basic and advanced Spark RDD transformations for data processing tasks.
5. Create and manipulate Spark DataFrames and Datasets for structured data analysis.
6. Build machine learning models using Spark MLlib, including classification (Logistic Regression, Decision Trees) and clustering (K-Means).
7. Design and develop real-time applications using Spark Structured Streaming, for retail data analysis and student marks analysis.
8. Process weather data with Kafka using a producer-consumer model for real-time data handling.
9. Apply Kafka's Exactly-Once Semantics to ensure data consistency and integrity.
10. Integrate Kafka with Spark for real-time data processing and analytics.
11. Integrate Kafka with Flink for efficient stream processing and real-time analytics.
12. Explore and implement advanced Kafka features and Data Lakehouse architectures using Delta Lake, Apache Hudi, or Iceberg.

13. Perform ETL operations using Delta Lake, Apache Hudi, and Apache Iceberg to manage large datasets and ensure data consistency.

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2015..
2. **Gwen Shapira, Todd Palino, Rajini Sivaram, Krit Petty**, *Kafka: The Definitive Guide: Real-Time Data and Stream Processing at Scale,* 2nd Edition, O'Reilly Media, 2021.
3. **Bill Inmon & Ranjeet Srivastava**, *Rise of the Data Lakehouse: Building the Data Lakehouse*, 2nd Edition, Technics Publications, 2023

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.

WEB RESOURCES:

1. https://www.ibmbigdatahub.com/infographic/four-vs-big-data
2. https://hadoop.apache.org/docs/stable/
3. https://cwiki.apache.org/confluence/display/Hive/LanguageManual
4. https://spark.apache.org/docs/latest/
5. https://databricks.com/glossary/dag
6. https://github.com/apache/spark/tree/master/examples/src/main/python/ml
7. https://spark.apache.org/docs/latest/structured-streaming-programming-guide.html

22CAC10N

DEEP LEARNING LAB

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

Pre-requisites: Artificial Intelligence, Machine Learning.

COURSE OBJECTIVES: The objectives of this course are
1. Understand basic concepts of Deep learning and their applications.
2. Evaluating Deep learning methods, models and algorithms.
3. Analyzing CNN, RNN, Transformers and GAN along with their applications.

COURSE OUTCOMES: On Successful completion of the course, students will be able to
1. Evaluate the performance various optimization techniques used in deep learning.
2. Analyze various Autoencoders and Regularization Techniques.
3. Design and Develop various Convolution Neural Networks architectures.
4. Analyze various RNNs and Encoder Decoder Models.
5. Understand the importance of Transformers and GANs to develop real-time applications.

CO-PO Articulation Matrix

PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO 1	3	3	2	2	3	1	1	2	1	1	1	3	2	3
CO 2	3	3	2	2	3	1	1	2	1	1	1	2	2	3
CO 3	3	3	3	3	3	1	1	2	1	1	1	3	3	3
CO 4	3	3	3	3	3	1	1	2	1	1	1	3	2	3
CO 5	3	3	3	3	3	1	1	2	1	1	1	3	2	3

LIST OF EXPERIMENTS:
1. Implementation of Perceptron for Boolean operations.
2. Implementation of Classification and regression problems with Multilayer Perceptron.
3. Compare the Performance of various Optimization techniques of Momentum Based GD, Stochastic GD, Adam.
4. Implementation of Denoising autoencoders.
5. Implementation of Regularization through L2, Dropout, and Early stopping Techniques and compare their Performance.
6. Implementation of VGG16, ResNet50 and compare their performance.
7. Implementation of LSTM for next word prediction.
8. Implementation of Encoder Decoder Models for Language translation.
9. Implementation of pretrained BERT Models.
10. Implementation of GANs for generating fake images.

TEXT BOOKS:
1. Goodfellow. I., Bengio. Y. and Courville. A., "Deep Learning ", MIT Press, 2016.
2. Learning Generative Adversarial Networks: Next-generation deep learning simplified by Kuntal Ganguly, Packt, 2017
3. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.

4. Hands-On Computer Vision with TensorFlow 2: Leverage deep learning to create powerful image processing apps with TensorFlow by Benjamin Planche, Eliot Andres, Packt Publishers, 2019
5. Huang, Shih-Chia, and Trung-Hieu Le. Principles and labs for deep learning. Academic Press, 2021.

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/

22ITC15

MINI PROJECT - II

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

Prerequisite: Knowledge on Problem Solving and Programming, Critical Thinking and Understanding of Problem Domain.

COURSE OBJECTIVES: This course aims to

1. Facilitate student learning through hands-on experience.
2. Cultivate the ability to analyze and address real-world problems effectively.
3. Foster innovative thinking and the generation of new ideas.
4. Develop team building and management skills among students.
5. Enhance writing and presentation abilities necessary for project completion.

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

1. Analyze literature effectively to formulate project proposals.
2. Strategize, analyze, design, and execute projects efficiently.
3. Employ modern technology to solve identified problems, prioritizing real-time scenarios.
4. Collaborate effectively within a team to achieve project completion within designated timelines.
5. Prepare comprehensive reports and deliver presentations to departmental committees.

CO-PO-PSO Articulation Matrix

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

SCHEDULE		
S No	**Description**	**Duration**
1	Problem Identification / Topic Selection	2 weeks
2	Abstract Preparation	1 week
3	Project Design, Implementation, and Testing	7 weeks
4	Documentation and Project Presentation	4 weeks

The project tasks are outlined as follows:

- Choose a Project Topic related to the Subjects of previous Semester or the Current Semester as decided by the CEG or DRC or Department or Project Coordinator. Preferably Choose topics related to Professional Electives or Latest Technologies offering solutions to Societal Problems.
- Adopt Personal Software Process (PSP) or Agile Model or DevOps or Lean Approach in developing a Project and use suitable Version Controlling Systems for effective project management.
- Develop a preliminary approach to address the problem associated with the assigned topic.
- Perform initial analysis, modelling, simulation, develop through implementation, experimentation, design, or feasibility study as appropriate.
- Demonstrate the progress of the project from time to times as scheduled by Project coordinator.
- Submit a Report in prescribed format detailing the conducted study, implementation, result analysis, findings and scope for enhancement. Cite the references as an essential ethical practice.
- Deliver a final presentation (PPTs) with learning outcomes orally to the Project Coordinator or DRC or Three Members Panel constituted by the department.

CRITERIA FOR EVALUATION AND AWARD OF CIE MARKS (Max.Marks:50)

S No	Description	Max. Marks
1	Weekly Assessment	20
2	Preparation of Presentation (PPT)	5
3	Project Presentation	10
4	Question and Answers	5
5	Report Preparation & Submission	10

Note: Follow the Rubrics while evaluating the performance and awarding the CIE marks to the students

22EGC03

EMPLOYABILITY SKILLS

(BE/BTech - Common to all Branches)

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

Prerequisites: 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. To 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-PSO Articulation Matrix

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

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- ntervention, 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.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY
(Inline with AICTE Model Curriculum with effect from AY 2027-28)
(R-22A Regulation)

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		CIE	SEE	
THEORY									
1	22ITC13N	Embedded Systems and Internet of Things	3	-	-	3	40	60	3
2		Professional Elective - 4	3	-	-	3	40	60	3
3		Professional Elective - 5	3	-	-	3	40	60	3
4		Professional Elective - 6	3	-	-	3	40	60	3
5		Open Elective – 1	3	-	-	3	40	60	3
PRACTICAL									
6	22ITC14N	Embedded Systems and Internet of Things Lab	-	-	3	3	50	50	1.5
7	22ITEXX	Professional Elective - 4 Lab	-	-	3	3	50	50	1.5
8	22ITC26	Project Part -I	-	-	4	-	50	-	2
TOTAL			**15**	**-**	**10**	**-**	**350**	**400**	**20**
Clock Hours per Week: 25									

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

Professional Elective -4			
22ITE24	Computer Vision	22ITE25	Computer Vision Lab
22ITE11N	DevOps Tools	22ITE12N	DevOps Tools Lab
22CIE23	Graphics design	22CIE60	UI Design Lab
22ADE74N	Blockchain Technology and Applications	22ADE75N	Blockchain Technology and applications Lab

22ITE13	Unmanned Aerial Vehicles	22ITE14N	Unmanned Aerial Vehicles Lab

Professional Elective – 5		**Professional Elective - 6**	
22ITE15	Mobile Computing	22CIE03N	Digital Forensics
22CIE24	Immersive Technologies	22ITE05	Service Oriented Architecture
22CSE23	Robotic Process Automation	22ADE76N	Generative AI
22ITE16	Fundamentals of Business Intelligence	22CAE08N	Reinforcement Learning
22ADE83N	Explainable Artificial Intelligence	22ITE27	Foundations in Quantum Computing

Open Elective -1	
22MEO05	Research Methodologies and Innovation
22ECO07	Neural Networks and Fuzzy Logic
22EEO07	Fundamentals of Electrical Vehicles
22BTO01	Biology for Engineers
22EGO02	Gender Sensitization

22ITC13N **EMBEDDED SYSTEMS AND INTERNET OF THINGS**

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

COURSE OBJECTIVES: This course aims to

1. To introduce the basic concepts of embedded system and 8051 Microcontroller fundamentals.
2. To provide an overview of Programming with 8051and Basics of Internet of Things
3. To explore various IoT enabling technologies and the design methodology for IoT.
4. To deal with the Raspberry Pi device, its interfaces and Django Framework.
5. To introduce systems and the utilities for case studies.

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

1. Understand Embedded system design process and 8051 Architecture.
2. Apply instruction set of 8051 and understand IoT Protocols, Communication models and APIs.
3. Interpret IoT enabling Technologies & levels and Design methodology.
4. Explore physical devices like Raspberry Pi3 and M2M and IoT .
5. Get acquainted with Industrial IoT with real time Scenarios

CO-PO/PSO Articulation Matrix

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

UNIT-I

Embedded Computing: Introduction Embedded System Design Process, Challenges and Characteristics of Embedded Systems, Applications of Embedded Systems.

The 8051 Architecture: Introduction, 8051 Microcontroller Hardware.

UNIT-II

Programming using 8051: Data Transfer and Logical Instructions, Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions.
Introduction: Introduction to Internet of Things- Definitions & Characteristics of IoT,
Physical Design of IoT- Things in IoT, IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs.

UNIT-III

IOT Enabling Technologies-Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication .Embedded Systems. **IOT Levels & Deployment Templates**. **IoT Platforms Design Methodology**: Introduction, **Steps-**Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-IV

IoT Physical Devices and End Points: Raspberry Pi About the board, Raspberry Pi interfaces-Serial, SPI, I2C. **Python Web Application Framework**: Django Framework-Roles of Model, Template and View. **Domain Specific IOTs**: Various types of IoT Applications in Home Automation- smart lighting, Smart appliance, smoke and gas detectors, Cities, Environment, Energy, Retail, Logistics Agriculture, Industry, Health & Life Style-Wearable Electronics. **IoT and M2M** – Introduction to M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

UNIT-V

Industrial IoT: Introduction to Industrial IoT, IIRA, Industry 4.0 Globalization and Emerging Issues, Cyber Security and Fog Computing**. Case studies:** Manufacturing Industry, Automotive Industry, Mining Industry.

TEXT BOOKS:

1. Wayne Wolf, “Computers as Components”, 1 st Edition, Academic press, 2001.
2. Kenneth J.Ayala, “The 8051 Microcontroller”, 3 rd Edition, Thomson, 2014.
3. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press,1st Edition.2014.
4. Misra, C. Roy, and A. Mukherjee, “Introduction to Industrial Internet of Things and Industry 4.0”. 1st Edition,CRC Press.2020

SUGGESTED READING:

1. Raj Kamal, “Embedded Systems”, 2 nd Edition, McGraw Hill, 2015.
2. Samuel Greengard, “The Internet of Things”, 1st Edition, MIT Press, 2015.
3. Peter Waher, Pradeeka Seneviratne, Brian Russell, Drew Van Duren, “IoT: Building Arduino-Based Projects”, 1st Edition, Packt Publishing Ltd, 2016.
4. Jeeva Jose, “Internet of Things”, Khanna Book Publishing Company, 2018.

22ITE24 **COMPUTER VISION**

(Professional Elective-4)

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

COURSE OBJECTIVES: This course aims to

1. To understand the fundamental concepts related to computer vision and Image formation.
2. To Learn feature detection, matching and detection.
3. To become familiar with feature based alignment.
4. To develop skills on 3D reconstruction.
5. To understand Object Detection Techniques.

COURSE OUTCOMES: Upon completing this Course, Students will be able to

1. Understand Fundamentals of computer vision and physics of colour.
2. Employ Image processing techniques.
3. Illustrate 2D Feature Based Image Alignment, Feature Detection and Segmentation.
4. Apply 3D Image Reconstruction Techniques.
5. Develop Innovative Computer Vision Applications.

CO-PO/PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	1	1	1	1	-	-	-	2	1	3	1	3	2
CO2	3	3	3	2	3	-	1	-	2	1	2	1	3	2
CO3	3	3	2	2	3	-	-	-	1	1	2	3	3	2
CO4	2	3	3	2	3	-	-	-	2	1	2	3	3	3
CO5	2	3	3	2	2	2	-	-	3	1	2	3	3	3

UNIT-I

Introduction to Computer Vision: Computer vision, Applications of computer vision, Computer vision pipeline, Image input, Image pre-processing, Feature extraction , Classifier learning algorithm. **Colour:** The Physics of Colour, Human Colour Perception , Representing Colour. **Application:** Finding Specularities, Surface Colour from Image Colour.

UNIT-II

Image Formation and Processing:

Geometric primitives and transformations, Photometric image formation, digital camera, Point operators, Linear filtering, neighbourhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations, Global optimization.

UNIT-III

Feature Detection, Matching and Segmentation: Points and patches, Edges - Lines, Segmentation, Active contours , Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods. **Feature-based Alignment:** 2D and 3D Feature Based Alignment, Pose estimation, Geometric intrinsic calibration.

UNIT-IV

3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, volumetric representations, Model-based reconstruction, Recovering texture maps and albedosos.

UNIT- V

Object detection: General object detection framework, Region-based convolutional neural networks (R-CNNs), Single-shot detector (SSD) , You only look once (YOLO). **Generative adversarial networks (GANs):** GAN architecture, Evaluating GAN models, Popular GAN applications.

TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015
3. Deep Learning for Vision Systems, Mohamed Elgendy, Manning Publications,2020.

SUGGESTED READING:

1. R. Hartley and A. Zisserman, "Multiple View geometry", Cambridge university Press, 2002.
2. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

WEB RESOURCES:

1. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline
2. https://nptel.ac.in/courses/108103174
3. https://opencv.org/opencv-free-course/
4. https://docs.opencv.org/4.x/d9/df8/tutorial_root.html

22ITE11N **DEVOPS TOOLS**

(Professional Elective-4)

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

COURSE OBJECTIVES: This course is designed to

1. Provide a comprehensive understanding of DevOps principles and their role in modern software development.
2. Explain the importance of version control systems, with a focus on Git.
3. Explore continuous integration and continuous deployment (CI/CD) using tools like Jenkins and Maven.
4. Introduce containerization concepts through Docker.
5. Explain the automation of software deployment processes using configuration management tools.

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

1. Explain the core concepts and benefits of DevOps in software engineering.
2. Analyze the role of version control systems in collaborative development.
3. Describe the CI/CD pipeline and evaluate tools like Jenkins and Maven.
4. Illustrate the use of Docker in containerizing applications.
5. Discuss automated deployment strategies using tools such as Puppet.

CO-PO/PSO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	1	0	1	2	1	2	1	2	2
CO2	1	2	1	1	2	1	0	1	2	1	2	1	2	2
CO3	1	1	1	1	2	1	0	1	2	1	3	1	2	2
CO4	1	2	1	1	2	1	0	1	2	1	3	1	2	2
CO5	1	2	1	2	3	1	0	1	2	1	3	1	2	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. Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet, Ryan Russell and Jason Southgate, Packet Publishing, 2018.
2. Joakim Verona, Practical DevOps, Packet Publishing, 2018.

22CIE23

GRAPHICS DESIGN

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

Pre-Requisites

Data Communication and Computer Networks.

Course Objectives

1. To develop the ability to conduct research and generate design concepts
2. To understand and apply the principles of composition in visual communication
3. To explore the fundamentals of typography and color theory in design
4. To gain hands-on proficiency in industry-standard design tools and technologies
5. To apply design skills in print production, presentations, and web design contexts

Course Outcomes

By the end of this course, students should be able to:

1. Analyse design problems and generate creative visual concepts through structured research and ideation processes.
2. Apply principles of visual composition, spatial organization, and layout to create balanced and engaging designs.
3. Demonstrate an understanding of typography and color theory in the context of effective visual communication.
4. Use industry-standard graphic design tools to develop digital and print-ready design solutions.
5. Design visually coherent and user-friendly interfaces for websites and screen-based media.

CO-PO Articulation Matrix

PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	2	3	2	-	-	-	-	1	2	-	3	-	-	-
CO2	2	2	3	-	-	-	-	-	2	-	2	-	-	-
CO3	2	-	3	-	-	-	-	-	2	-	2	-	-	-
CO4	1	-	3	-	3	-	-	2	2	-	3	-	-	-
CO5	2	2	3	-	3	-	-	2	3	-	3	-	-	-

Unit – I

Research And Concepts: Basics of research - Linear reasoning/lateral thinking - Exploratory drawing - Visualizing ideas - Theories of image and text - Audiences, markets, and concepts - Scheduling, organizing, and finalizing - **Fundamentals Of Composition**: Basics of composition - Form and space - Symmetry/asymmetry

Unit – II

Basic principles of design layout - Styles of layout - Pace and contrast- Size and format - Identity and extended systems - Photography and illustration - **FUNDAMENTALS OF TYPOGRAPHY** - Typography and meaning - The anatomy of type - Understanding and selecting typefaces - Spacing - Readability and legibility - Typographic emphasis and hierarchy - Typographic rules/boxes and ornaments - Text as image

Unit – III

Fundamentals Of Color: Color terminology - Color legibility, contrast, and harmony - Color associations - Color as information. **Tools And Technologies**: Photography basics and sourcing images

- InDesign - Photoshop - Illustrator - Animate and After Effects.

Unit – IV

Print Production And Presentations: Preparing files for print - Creating a convincing presentation - Paper stocks and finishing - Printed color - Print media - Digital printing - Correcting color proofs and press checks. **WEB DESIGN**: Project development process overview - Project structures - Web tools - Initial consultations - Information architecture (IA).

Unit – V

Flowcharts and wireframes - Common elements of a web layout - Designing for the Web - Mobile application design - Working with content management system - Search engine optimization (SEO).

Textbook:

1. Graphic Design School: The Principles and Practice of Graphic Design, 8th Edition, David Dabner, Sandra Stewart, Abbie Vickress, ISBN: 978-1-394-18568-9, November 2023.

Reference Books:

1. Making and Breaking the Grid: A Graphic Design Layout Workshop by Timothy Samara, Publisher: Rockport Pub, ISBN-10: 9781564968937
2. Interaction of Color, by Josef Albers & Nicholas Fox Weber, Publisher: Yale University Press, ISBN-13:978-0300179354
3. Adobe Photoshop Classroom in a Book, by Conrad Chavez, Publisher: Adobe Pr, ISBN-13: 978-0137965892
4. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability (Voices That Matter), by Steve Krug, Publisher: New Riders,3rd Ed, ISBN-13: 978-0321965516

Web References:

1. https://design.tutsplus.com/categories/design-fundamentals
2. https://thinkingwithtype.com/
3. https://color.adobe.com/
4. https://helpx.adobe.com/photoshop/tutorials.html
5. https://99designs.com/blog/tips/printing-basics/
6. https://university.webflow.com/
7. https://grow.google/certificates/ux-design/

22ADE74N

BLOCKCHAIN TECHNOLOGY AND APPLICATIONS
(Professional Elective-4)

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

COURSE OBJECTIVES: This course aims to

1. To develop a strong foundational understanding of blockchain technology and its core principles.
2. To examine the significance and operational structure of the Bitcoin ecosystem.
3. To explore Ethereum's supporting technologies, with a focus on consensus mechanisms and smart contract functionality.
4. To introduce the architecture and components of Hyperledger Fabric for enterprise blockchain solutions.
5. To familiarize students with real-world blockchain applications across diverse industry domains.

COURSE OUTCOMES: Upon Successful Completion Of This Course, Students will be able to

1. Explore the Fundamentals of Distributed Systems and Blockchain Technology.
2. Implement the Core Concepts of Bitcoin and the Consensus Mechanisms Involved in Bitcoin Mining.
3. Build the Consensus Protocols that Power the Ethereum Blockchain.
4. Examine Various Hyperledger Projects.
5. Analyze Real-World Blockchain Use Cases Across Multiple Industry 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	PSO 1	PSO 2	PSO3
CO 1	1	1	1	2	2	1	-	-	-	-	-	1	1	2
CO 2	-	1	1	1	1	1	-	1	-	-	-	-	1	-
CO 3	1	-	1	2	2	-	-	-	-	-	-	1	-	3
CO 4	-	-	1	1	2	1	2	-	1	-	-	-	-	2
CO 5	-	-	-	-	-	2	3	1	1	2	-	-	-	-

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, The

transaction life cycle, The transaction structure, Bitcoin payments, Consensus mechanism in bitcoin, Wallettypes, Non-deterministic wallets, Deterministic wallets, Alternative Coins- Namecoin, Litecoin, Zcash.

UNIT-III

Permissionless Blockchain Ethereum: Introducing Smart Contracts, Ethereum blockchain , The Ethereum stack, Ethereum virtual machine (EVM), Consensus mechanism in Ethereum, The Ethereum network, Ethereum Development, 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, Membership services, Hyperledger Projects- Fabric, Sawtooth lake, Iroha , Components of the Fabric, Peers or nodes, Applications on Blockchain, Alternate Blockchains- Ripple, Corda.

UNIT-V

Blockchain for Government and Case Studies: Digital identity, land records and other kinds of record-keeping between government entities, Cross border payments, Know Your Customer (KYC), Food supplychain, Blockchain in Insurance Industry, Education, Healthcare, realestate management and Metavers.

TEXTBOOKS:

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 BuildSmart Contracts for Ethereum and BlockChain”, Packt Publishing, 2019.
3. Ramchandra Sharad Mangrulkar, Pallavi Vijay Chavan, “Blockchain Essentials - Core Concepts and Implementations”, APress Publishing, 2024

WEB 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:
6. Blockchain and its Applications,
7. Blockchain Architecture Design and Use Cases

22ITE13

UNMANNED AERIAL VEHICLES
(Professional Elective-4)

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

COURSE OBJECTIVES: This course aims to

1. Familiarize basics of Autonomous vehicles and its various applications.
2. Learn the Basics of navigation and explain the components used to build the drone devices.
3. Acquaint with the concepts of UAV aircraft and basics of Robot Programming.
4. Provide the payload and Navigation of Autonomous Vehicles.
5. Introduce the benefits of combining AI and Drones.

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

1. Understand the types, characteristics, Applications of Autonomous systems.
2. Analyze the concepts of Aerodynamics, Propulsion & Structures of Model aircraft.
3. Know the UAV / UGV Elements and Robot Arm Kinematics & Dynamics.
4. Infer about Navigation and guidance of Autonomous vehicles.
5. Explore applications of Drones in Artificial Intelligence .

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	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	1	0	1	1	1	1	1	3	2
CO2	2	2	1	2	0	1	0	0	1	1	1	1	3	2
CO3	2	2	1	1	0	1	0	1	1	1	1	1	3	2
CO4	2	2	1	1	1	2	0	1	1	1	1	1	3	2
CO5	2	2	1	1	1	1	0	0	1	1	1	1	3	2

UNIT-I

Introduction to Autonomous systems: Definition, Characteristics, differences between non autonomous Vs autonomous, Types of vehicles, Introduction to navigation and communication.

UNIT-II

Basics of navigation (Aerial and Ground): Different types of flight vehicles; Components and functions of an airplane; Forces acting on Airplane; Physical properties and structure of the atmosphere; Aerodynamics – aerofoil nomenclature, aerofoil characteristics, Angle of attack, Mach number, Lift and Drag, Propulsion and airplane structures.

UNIT-III

UAV / UGV Elements: Introduction to UAV and UGV**,** DGCA Classification of UAVs; Types and Characteristics of Drones: Fixed, Multi-rotor, Flight controller Software, MAVLINK protocol, Robot

Arm Kinematics and Dynamics, Manipulator Trajectory planning and Motion Control, Robot Sensing, Robotic Operating System, Robotic Programming Languages.

UNIT-IV

Navigation and guidance: Data Link; Sensors and Payloads: GPS, IMU, Light Detection and Ranging (LiDAR), Imaging cameras, Classification of payload based on applications; Hyper-spectral sensors; Laser Detection and Range (LiDAR); cameras; ultra-sonic detectors; Introduction to navigation systems and types of guidance; Mission Planning and Control, Case studies: Autonomous Obstacle avoidance - Vision, Sonar and LiDAR.

UNIT-V

AI Drones: Benefits of Combining AI and Drones, Applications of AI-Powered Drones, Challenges and ethical considerations, Drone Swarm Technologies and Algorithms, Case Studies Drone Swarms, IoT Drones.

TEXT BOOKS:

1. K Valavanis; George J Vachtsevanos,"Handbook of Unmanned Aerial Vehicles", Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.
2. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence
3. John J. Craig, Introduction to Robotics: Mechanics and Control, Addison Wesley publication, 3rd Edition.
4. Reg Austin"Unmanned Aircraft Systems: UAVS Design, Development and Deployment" John Wiley & Sons, Ltd.2011.
5. Fahlstrom P, Gleason T (2012) "Introduction to UAV systems", 4th edn. Wiley, UK
6. Yang, L. J., & Esakki, B. (2021). Flapping Wing Vehicles: Numerical and Experimental Approach. CRC Press.
7. Sebbane, Y. B. (2022). A first course in aerial robots and drones. CRC Press.

SUGGESTED READING:

1. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal DGCA RPAS Guidance Manual, Revision 3 – 2020
2. Aaron Martinez, Enrique Fernandez, Learning ROS for Robotics Programming: A practical, instructive, and comprehensive guide to introduce yourself to ROS, the top-notch, leading robotics framework, PACKT publishing, Open Source.
3. Andy Lennon, "Basics of R/C Model Aircraft Design" Model Airplane News Publication
4. John Baichtal, Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs.
5. DGCA RPAS Guidance Manual, Revision 3 - 2020

Web Resources:

1. https://onlinecourses.swayam2.ac.in/ntr24_ed12/preview
2. https://archive.nptel.ac.in/courses/101/104/101104073/
3. https://onlinecourses.nptel.ac.in/noc21_ae14/preview

22ITE15

MOBILE COMPUTING

(Professional Elective – 5)

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

COURSE OBJECTIVES: This course aims to

1. Introduce applications of Mobile Computing and GSM.
2. Familiarize students with MAC protocols and Mobile Communication Access Technologies.
3. Communicate information about Mobile IP and Tunnelling.
4. Provide insights on Mobile Transport Layer Concepts.
5. Empower students to gain knowledge on Data hoarding techniques and QoS Issues.

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

1. Illustrate Applications of Mobile Communication and GSM Technologies in real time.
2. Describe challenges in MAC protocols in wireless and Access Methods.
3. Investigate the need for mobile IP and its associated functionalities in Mobile Networks.
4. Evaluate the protocols in terms of their usage in Mobile Transport Layer.
5. Categorize and Solve Database Issues in Mobile Environment.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	1	2	0	0	0	0	0	0	0	2	3	3
CO2	3	3	3	2	2	0	0	0	1	0	0	3	3	2
CO3	3	3	1	2	2	0	0	0	1	0	0	3	3	3
CO4	2	3	3	2	2	0	0	1	0	0	0	3	3	2
CO5	0	1	1	1	2	3	3	1	3	3	3	2	0	0

UNIT-I

Introduction: Introduction to Mobile Computing, Applications, A Short history of Wireless Communication, Some Open Research Topics , Frequencies for Radio Transmission.

GSM - GSM System Architecture, Radio Interface, Protocols, Localization and Calling, Handover, Security, New Data Services.

UNIT-II

Medium Access Control: Motivation for a Specialized MAC, Hidden and exposed terminals, Near and far terminals, SDMA, FDMA, TDMA, CDMA.

UNIT-III

Mobile Network Layer: Mobile IP, Goals, assumptions and requirements, Entities and Terminology, IP Packet Delivery, Agent Discovery, Registration, Tunnelling and encapsulation, Optimizations, IPv6, Dynamic host configuration protocol.

UNIT-IV

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit and Fast Recovery, Transmission /Time-Out Freezing, Selective Retransmission, Transaction Oriented TCP.

UNIT-V

Data Management Issues: Impact of Mobile Computing in the area of Data Management, Mobile Database, Data Replication Strategies, Data Hoarding Techniques, Cache Invalidation Mechanisms, Context Aware Computing,

Evolution of wearable technology, Wearable IoT use cases- Smart watches, Android wear, Smart glasses, fitness trackers, health care devices, cameras, smart clothing, Digital Pen and Paper, Smart Mobiles, Cards and Device Networks Smart Mobile Devices, Smart Card Devices, Device Networks

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", Second edition Addison-Wesley, 2008
2. Rishabh Sharma, Sanjay Sharma "Mobile Computing", S.K. Kataria & Sons Publication,2014.
3. Stefan Poslad ," Ubiquitous Computing Smart Devices, Environments and Interactions" , Wiley, 2009.

SUGGESTED READING:

1. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge University Press, October 2004.
2. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional, 2005.
3. Hansmann, Merk, Nickolas, Stober, "Principles of Mobile Computing", second edition, Springer, 2003.Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003.
4. Ivan Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.
5. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.

22CIE24

IMMERSIVE TECHNOLOGIES
(Professional Elective-5)

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

PRE-REQUISITES:
Basic knowledge on XR devices (Oculus Quest, HoloLens, HTC Vive), linear algebra, vectors, and 3D geometry and Python, C++, C#, or JavaScript — especially for Unity or Unreal Engine development

COURSE OBJECTIVES: This course aims to

1. To provide an understanding of Virtual Reality, its core concepts, and its role as a medium for immersive communication and interaction.
2. To explore the role of human perception, interaction, and presence in virtual environments, emphasizing the concept of the human-in-the-loop in immersive systems.
3. To understand the methods and technologies used to interface participants with virtual environments and effectively present immersive experiences.
4. To examine interaction techniques and system components that enable dynamic engagement and realism within virtual environments.
5. To understand the principles of designing meaningful VR experiences for real-world applications and to explore the evolution and future potential of virtual reality technology.

COURSE OUTCOMES:
Upon Completion of this Course, students should be able to:

1. Describe the fundamental principles of Virtual Reality and analyse its role as a medium for immersive communication and interaction.
2. Evaluate the impact of human perception, presence, and interaction in virtual environments with a focus on the human-in-the-loop paradigm.
3. Identify and explain the technologies used for interfacing users with virtual environments, including output presentation techniques.
4. Apply interaction models and system components to create responsive and engaging virtual experiences.
5. Design context-based VR solutions for real-world problems and assess the past developments and future scope of VR technologies.

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

UNIT – I

Introduction to Virtual Reality: Definition – Elements of VR experience-VR, Telepresence, AR and Cyberspace. **VR: The Medium:** A Mediums content – Communication: Conveyance of Ideas – Common Issues of Human Communication media- The study of the medium of VR.

UNIT – II

The Human in the Loop: Connecting humans to simulation – The Human perceptual system – Presence and Embodiment: Self perceptions within the virtual world. **Input: Interfacing the Participant(s) With the Virtual World:** Input Technologies – Using inputs within a VR system

UNIT – III

Output: Interfacing the Virtual World with the Participant(s): Visual Displays – Aural Displays – Haptic Displays- Vestibular and other Sensory Displays. **Presenting the Virtual World:** Representation of Virtual world – Visual representation in VR – Aural representation in VR - Haptic representation in VR – Representation of other senses – Visual rendering systems – Sonic Rendering systems – Haptic Rendering systems – Rendering of other senses.

UNIT – IV

Interacting With the Virtual World: Interaction design Basics – User Interface Metaphors – Manipulating and Navigating in a virtual world – Interacting with others and with VR system (Meta commands). **Bringing the Virtual World to Life:** Immersion – Providing the context – The virtual world – Rules of the virtual world: Physics – S/w to manifest the VR experience – The experience creation process.

UNIT – V

Experience Conception and Design: Applying VR to a Problem: Conceiving a New VR applications – Exemplary VR Experience – Designing a VR experience – The past and the future of VR design. **Virtual Reality: Past, Present, Future:** The state of VR – The maturation of VR – Trends – Technology the future and past predictions.

TEXT BOOK:

1. "Understanding Virtual Reality: Interface, Application, and Design", Authors: William R. Sherman & Alan B. Craig, Publisher: Morgan Kaufmann, Edition: 2nd Edition (latest)

SUGGESTED READING:

1. Immersive Realm of Extended Reality, Author Suman Dutta, First Edition 2024, Copyright © BPB Publications, India, ISBN: 978-93-55517-227.
2. VIRTUAL REALITY, Steven M. LaValle, University of Oulu, Cambridge University Press.
3. Virtual and Augmented Reality- An Educational Handbook, By Zeynep Tacgin, Cambridge Scholars Publishing Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK
4. Virtual Reality Technology, Grigore C. Burdea, Philippe Coiffet, John Wiley & Sons, 30 Jun 2003 - Computers - 464 pages
5. Handbook of Augmented Reality, Borko Furht, Springer New York, NY, Hardcover ISBN 978-1-4614-0063-9, eBook ISBN 978-1-4614-0064-6

WEB REFERENCE:

1. https://www.edx.org/certificates/professional-certificate/ucsandiegox-virtual-reality-app-development

22CSE23

ROBOTIC PROCESS AUTOMATION
(Professional Elective-5)

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

COURSE OBJECTIVES: This course aims to

1. Provide insights on robotic process automation (RPA) technology and its value proposition
2. Introduce different platforms for RPA
3. Learn different types of variables, control flow and data manipulation techniques
4. Familiarize with Image, Text and data Tables Automation
5. Describe various types of Exceptions and strategies to handle them.

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

1. Gain insights into Robotic Process Automation Technology
2. Acquire knowledge of RPA Platforms and components
3. Identify and understand Image, Text and Data Tables Automation
4. Understand various control techniques and OCR in RPA
5. Describe Exception Handling and Debugging techniques

CO-PO Articulation Matrix

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

UNIT– I

RPA Foundations- What is RPA - flavors of RPA- history of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA - Consumer Willingness for Automation- The Workforce of the Future- RPA Skills- On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code OCR-Databases-APIs- Al- Cognitive Automation-Agile, Scrum, Kanban and Waterfall Devops Flowcharts.

UNIT–II

RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and PIay - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step by step examples using the recorder.

UNIT–III

Sequence, Flowchart, and Control Flow-sequencing the workflow- Activities-Control flow, various types of loops, and decision making-Step-by step example using Sequence and Flowchart-Step-by-step example using Sequence and Control Flow-Data Manipulation-Variables and Scope Collections-Arguments – Purpose and use Data table usage with examples Clipboard Management-File operation with step-by-step exampleCSV/Excel to data table and vice versa [with a step-by-step example).

UNIT–IV

Handling Events -Taking Control of the Controls- Finding and attaching windows- Finding the 08 control Techniques for waiting for a control- Act on controls - mouse and keyboard activities- Working with Ui Explorer- Handling events Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available How to use OCR- Avoiding typical failure points.

UNIT–V

Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots Debugging techniques- Collecting crash dumps- Error reporting, Industry Use case, Future of RPA.

TEXT BOOKS:

1. Tom Taulli, ―The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems‖, Apress Publishing, 2020
2. Alok Mani Tripathi, ―Learning Robotic Process Automation‖, Packt Publishing, 2018.

SUGGESTED READING:

1. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant, Independently Published, 1st Edition 2018.
2. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, ―Introduction to Robotic Process Automation: a Primer‖, Institute of Robotic Process Automation,1st Edition 2015.
3. Srikanth Merianda,‖Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation‖, Consulting Opportunity Holdings LLC, 1st Edition, 2018

ONLINE RESOURCES:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

22ITE16

FUNDAMENTALS OF BUSINESS INTELLIGENCE
(Professional Elective – 5)

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

COURSE OBJECTIVES: This course aims to

1. Introduce the basic rudiments of a business intelligence system.
2. Understand the architectural aspects of Data warehousing and Cubes and Multidimensional Analysis.
3. Prepare the student to explore the OLAP operations.
4. Learn the BI tool and concepts used in it.
5. Familiarize with different DAX concepts.

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

1. Understand the concepts and components of Business Intelligence (BI)
2. Analyze how Data Warehouse and Cubes and Multidimensional Analysis will help an organization.
3. Identify the technological architecture that makes up the OLAP System.
4. Apply the Power BI tool for Business Intelligent Systems.
5. Design the different use cases of a BI system using DAX concepts.

CO-PO Articulation Matrix

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

UNIT-I

Business Intelligence Introduction: Business Intelligence Definition, BI Concepts, Historical Evolution of BI: From Decision Support Systems to Modern BI, BI Architecture, BI Components, BI Applications.

UNIT-II

Understanding Data Warehousing : Understanding Data Warehousing : Definition of data warehouse, Data marts, Data warehouse architecture, ETL Definition and ETL Process.

Introduction to Cubes and Multidimensional Analysis: Cube Concepts- Dimensions, Measures, Structure of a Cube, Multidimensional Data Representation - Fact Tables, Dimension Tables, Hierarchies, Star Schema and Snowflake schema models.

UNIT-III

OLAP : Introduction to OLAP, OLAP versus OLTP, OLAP operations (Drill-down, Drill-up, Slice, Dice, Pivot), Types of OLAP - MOLAP(Multidimensional OLAP), ROLAP(Relational OLAP), HOLAP(Hybrid OLAP), Advantages and Limitations of OLAP.

UNIT-IV

Power BI Basics: Power BI Tool Introduction, Basic Components of Power BI, Data Connectivity and Import, Graphs, Charts, Filters and Slicers, Drill up, Drill Down, Drill through ,Reports and Dashboards, **Case Study**- Sales dashboard.

UNIT-V

Power BI DAX **(**Data Analysis Expressions): **Introduction to DAX, Data Types in DAX,** DAX Calculation Types**- Calculated Columns, Measures, and Calculated Tables,** DAX Functions**- Aggregation Functions, Ranking and Row Number Functions, Filter Functions, Iterator functions -SUMX, AVERAGEX,** Case Study**- Sales Analysis and Performance Dashboard.**

TEXT BOOKS:

1. Nogués, Albert, and Juan Valladares. "Business Intelligence Tools for Small Companies." Business Intelligence Tools for Small Companies (2017).
2. Business intelligence: data mining and optimization for decision making. Vercellis, Carlo, John Wiley & Sons, 2011.
3. Jablonski, Dan**.** *Mastering Microsoft Power BI: Expert techniques for effective data analytics and business intelligence.* Packt Publishing, 2021.
4. Russo, Marco, and Alberto Ferrari. *The Definitive Guide to DAX: Business intelligence for Microsoft Power BI, SQL Server Analysis Services, and Excel.* Microsoft Press, 2019.

SUGGESTED READING:

1. “Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT” by Hans-Georg Kemper and Henning Baars
2. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager‟s Guide”, Second Edition, 2012.
3. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, 2003

22ADE83N

EXPLAINABLE ARTIFICIAL INTELLIGENCE

(Professional Elective-5)

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

PREREQUISITE:
1. Fundamentals of Probability & statistics
2. Machine Learning and Deep Learning basics

COURSE OBJECTIVES: This course aims to
1. Understand the need for Explainable Artificial Intelligence (XAI) in engineering applications and its central concepts.
2. Impart knowledge on mathematical concepts like ensemble models and nonlinear models to analyze the problems.
3. Illustrate tools and techniques of XAI for design and building solutions.
4. Evaluate common Explainable AI methods.
5. Explore evaluation methods and metrics, ethical, legal, and social issues, and applications and examples of XAI.

COURSE OUTCOMES: After completion of the course, students will be able to
1. Understand the fundamental concepts and types of Explainable AI (XAI), and evaluate methods for bias and reliability using SHAP, LIME, and Skater.
2. Apply SHAP, LIME, and Skater to interpret predictions of linear models and enhance trust in model outcomes.
3. Utilize SHAP, PDP, LIME, or Skope-Rules to interpret non-linear model behavior and decision-making processes effectively.
4. Apply SHAP to ensemble models to understand the contributions of individual models within the ensemble and explain model predictions.
5. Analyze fairness and transparency in AI models using Counterfactual Explanation (CFE) concepts.

CO-PO Articulation Matrix

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

UNIT – I

Introduction to Explainable Artificial Intelligence: Artificial Intelligence, Need for XAI, Explainability vs. Interpretability, Explainability Types**, Tools for Model Explainability:** SHAP, LIME, Skater, Skope_rules. Methods of XAI for ML, XAI Compatible Models, XAI Meets Responsible AI, Evaluation of XAI, Biasness, and Reliability.

UNIT – II

Explainability for Linear Models: Linear Models, Linear Regression. **VIF and the Problems It Can Generate**: Final Model, Model Explainability. **Trust in ML Model:** SHAP - Local Explanation and Individual Predictions in a ML Model, Global Explanation and Overall Predictions in ML Model, LIME Explanation and ML Model, Skater, Explanation and ML Model, Logistic Regression: Interpretation, LIME Inference.

UNIT – III

Explainability for Non-Linear Models Non-Linear Models, Decision Tree Explanation, **Data Preparation for the Decision Tree Model**: Creating the Model, Decision Tree – SHAP, Partial Dependency Plot, PDP Using Scikit-Learn, Non-Linear Model Explanation – LIME, Non-Linear Explanation – Skope-Rules

UNIT – IV

Explainability for Ensemble Models: Types of Ensemble Models, Why Ensemble Models, Using SHAP for Ensemble Models, Using the Interpret Explaining, Boosting Model, **Ensemble Classification Model:** SHAP, Using SHAP to Explain Categorical Boosting Models, Using SHAP Multiclass Categorical Boosting Model, Using SHAP for Light GBM Model Explanation

UNIT – V

Counterfactual Explanations for XAI Models: AI Model Fairness Using a What-If Scenario: WIT (Google Tool), Evaluation Metric. **Counterfactual Explanations for XAI Models:** What Are CFEs, Implementation of CFEs, CFEs Using Alibi, Counterfactual for Regression Tasks.

TEXT BOOKS:

1. Practical Explainable AI Using Python: Artificial Intelligence Model Explanations Using Python-based Libraries, Extensions, and Frameworks, Pradeepta Mishra, 2020, Apress Publishers.
2. Hands-On Explainable AI (XAI) with Python: Interpret, visualize, explain, and integrate reliable AI for fair, secure, and trustworthy AI apps, Denis Rothman, 1st Edition, 2020. Packt Publishers

SUGGESTED READING:

1. Explainable AI: Interpreting Machine Learning with XAI, Knime, Keerthan Shetty & Paolo Tamagnini
2. Explainable AI: Foundations, Methodologies and Applications, Mayuri Mehta, Vasile Palade , Indranath Chatterjee, Springer.

WEB RESOURCES:

1. https://cloud.google.com/explainable-ai/
2. https://interpretable-ml-class.github.io/
3. https://www.coursera.org/projects/scene-classification-gradcam
4. https://dl.acm.org/doi/book/10.1007/978-3-030-28954-6
5. https://alison.com/course/explainable-ai-explained

22CIE03N

DIGITAL FORENSICS
(Professional Elective – 6)

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

PRE-REQUISITES:
Fundamentals of cybersecurity and tools, operating systems, Programming, and problem solving, Cryptography, and Network Security.

COURSE OBJECTIVES: This course aims to
1. Understand the foundational concepts of digital forensics, including the evolution and principles guiding digital evidence handling.
2. Analyze various digital investigation models and apply the scientific method in the digital investigative process.
3. Demonstrate the ability to handle and process a digital crime scene, including preservation and reconstruction using digital evidence.
4. Evaluate the role of digital evidence in violent crimes and understand the legal and ethical considerations in digital investigations.
5. Develop strategies for conducting network forensics by applying forensic science techniques to identify, collect, and analyze digital network evidence.

COURSE OUTCOMES: By the end of this course, students should be able to
1. Explain the significance and challenges of digital evidence in modern forensic investigations.
2. Apply standardized investigation models to solve real-world digital crime scenarios.
3. Analyze digital crime scenes using forensic tools and reconstruct criminal events based on digital traces.
4. Assess the methods and techniques used to investigate cybercrimes involving violent or sexual offenses, incorporating legal considerations.
5. Design and document a complete network forensic investigation, from evidence collection to reporting.

CO-PO Articulation Matrix

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

UNIT – I
Digital Forensics: Foundations of Digital Forensics- Digital Evidence, increasing Awareness of Digital Evidence, Digital Forensics: past, present, and Future, principles of Digital Forensics, Challenging Aspects of Digital Evidence, Following the Cybertrail.

UNIT – II

Digital Investigations: Conducting Digital investigations, Digital investigation process models, Scaffolding for Digital investigations, Applying the Scientific Method in Digital investigations.

UNIT – III

Handling a Digital Crime scene: Preparing to handle Digital Crime scenes, Surveying the Digital Crime scene, Preserving the Digital Crime scene, **Investigative reconstruction with Digital Evidence**: Equivocal Forensic Analysis, Victimology, Crime scene Characteristics, Threshold Assessments.

UNIT – IV

Apprehending Offenders: Violent Crime and Digital Evidence, the role of Computers in Violent Crime, Processing the Digital Crime Scene, Investigative Reconstruction, **Sex offenders on the Internet-** Old behaviours, New medium, Legal Considerations, Identifying and processing Digital Evidence, Investigating online sexual offenders, Investigative reconstruction.

UNIT – V

Network Forensics: Network Basics for Digital investigators, technical overview of networks, connecting networks using Internet protocols, **Applying Forensic Science to Networks:** Preparation and Authorization, Identification, Documentation, Collection, and preservation, Filtering and Data reduction, Class/individual Characteristics and Evaluation of source, Evidence recovery, Investigative reconstruction, Reporting results.

TEXTBOOKS:

1. "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", Eoghan Casey, 3rd Edition, 2011, ISBN: 978-0123742681, Academic Press, an imprint of Elsevier.
2. "Digital Forensics with Open Source Tools", Cory Altheide and Harlan Carvey, Elsevier publication, 3rd Edition, April 2011.

SUGGESTED READING:

1. "Handbook of Digital Forensics and Investigation", edited by Eoghan Casey, 1st Edition, 2010, ISBN: 978-0-12-374267-4, Academic Press, an imprint of Elsevier.
2. "Information Security: Guide to Computer Forensics and Investigations", Bill Nelson, Amelia Phillips, Christopher Steuart, Cengage Learning, 6th Edition, 2019. ".

WEB REFERENCES:

1. https://www.forensicnotes.com/dfir-articles-software/
2. https://www.ncjrs.gov/app/publications/alphalist.aspx.
3. https://www.cisco.com
4. https://www.kaspersky.co.in
5. www.cyberforensics.in
6. https://resources.infosecinstitute.com/category/computerforensics/
7. https://www.classcentral.com/course/edx-computer-forensics-7857

22ITE05

SERVICE ORIENTED ARCHITECTURE
(Professional Elective 6)

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

COURSE OBJECTIVES: This course aims to

1. Provide Knowledge on service-oriented architecture and evolution of web services.
2. Learn Web Service architecture and its characteristics.
3. Learn various web services like SOAP, UDDI, WSDL.
4. Familiarize with UDDI data models, interfaces, and implementation methods.
5. Learn security considerations of web services.

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

1. Understand the knowledge of service-oriented computing paradigm, its evolution and the emergence of web services.
2. Explain web service architecture, characteristics and WSDL elements, tools.
3. Analyze XML, SOAP architecture, descriptions suitable for implementing message exchange patterns.
4. Describe UDDI architecture, data models, service addressing and service notification.
5. Understand web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services

CO-PO Articulation Matrix

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

UNIT – I

Evolution and Emergence of Web Services - Evolution of distributed computing, Core distributed computing technologies – client/server, CORBA, JAVA RMI, Microsoft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

UNIT – II

Web Services Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services. Describing Web Services – WSDL introduction, nonfunctional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

UNIT – III

Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP: Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP.

UNIT – IV

Registering and Discovering Services: The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

UNIT – V

SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS Metadata Exchange

TEXT BOOKS:

1. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India, 2003.
2. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou,2008
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education, 2004.

SUGGESTED READING:

1. Java Web Service Architecture, James McGovern, Sameer Tyagi etal., Elsevier , 2004.
2. Building Web Services with Java, 2 Edition, S. Graham and others, Pearson Edition.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly,SPD.
4. Web Services, G. Alonso, F. Casati and others, Springer.Outcomes .
5. Basic details of WSDL, UDDI, SOAP 6. Implement WS client and server with interoperable systems.

22ADE76N **GENERATIVE AI**
(Professional Elective 6)

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

PRE-Requisites: Python Programming, Deep Learning

COURSE OBJECTIVES: This course aims to:
1. Introduce the fundamentals of generative modeling and deep learning.
2. Explore key architectures including VAEs, GANs, and Diffusion Models.
3. Apply TensorFlow/Keras to build generative models
4. Understand applications of generative AI in text, image, music, and multimodal domains.
5. Examine current and future trends in generative AI and its real-world impact.

COURSE OUTCOMES: Upon completion of this course, students will be able to
1. Understand foundational concepts of generative modelling, probability theory, and Variational Autoencoders.
2. Analyze and implement various GAN architectures for generating synthetic data and images.
3. Explore and evaluate diffusion models including training, sampling, and analysis processes.
4. Apply transformer-based architectures for language modelling and fine-tune encoder/decoder models.
5. Develop effective prompting strategies to control and enhance outputs from generative language 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	PSO 1	PSO 2	PSO 3
CO 1	2	1	1			-	-	-	-	-	-	2	1	3
CO 2	2	3	2	3	3	-	-	-	-	-	-	3	1	3
CO 3	2	3	2	3	3	-	-	-	-	-	-	2	1	3
CO 4	2	3	2	3	3	-	-	-	-	-	-	2	1	3
CO 5	1	2	2	3	3	-	-	-	-	-	-	2	1	3

UNIT - I
Generative Modelling: What is Generative Modelling, Generative vs. Discriminative Models, The Rise of Generative Modelling, Generative Modelling Framework, **Core Probability Theory**: Sample Space, Probability Density Function, Parametric Modeling, Likelihood, Maximum Likelihood Estimation, **Variational Autoencoder**: Architecture, Exploring the Latent Space,

UNIT- II
Generative Adversarial network : Introduction, Deep Convolution GAN, Wasserstein GAN with Gradient Penalty (WGAN-GP), Conditional GAN (CGAN), **Advanced GAN**: Progressive GAN, StyleGAN, StyleGAN2

UNIT- III

Diffusion Models: Introduction, Denoising Diffusion Models (DDM) and its process, Diffusion Schedules, The Reverse Diffusion Process,The U-Net Denoising Model- Training, Sampling and Analysis, Stable Diffusion, DALL.E 2- Architecture, training Process, GLIDE, ImageGen

UNIT - IV

Transformers: Introduction, Architecture- Attention, Multi head Attention, Masking, Transformer Block, Encoder Based only Transformers Architectures and Fine Tuning : BERT, **Generative LLMs**: Introduction to LLMs, Decoder-only Transformers, Training LLMs, Fine-tuning LLMs, Introduction to various LLM: GPT, Falcon, LLaMA2

UNIT- V

Prompt Engineering: Introduction, Prompt Engineering Strategies, **Advanced Prompting Methods**: Chain of Thought, Problem Decomposition, Self-refinement, Ensembling, RAG and Tool Use, **Learning to Prompt:** Prompt Optimization,Soft Prompts

TEXT BOOKS:

1. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, Second Edition, O'Reilly Media, 2023.
2. Tong Xiao, Jingbo Zhu. *Foundations of Large Language Models*. arXiv:2501.09223 [cs.CL], January 16, 2025.

SUGGESTED READING:

1. Joseph Babcock Raghav Bali, Generative AI with Python and Tensor flow 2, Packt Publishing Ltd. UK, 2021

WEB RESOURCES:

1. https://paperswithcode.com
2. https://huggingface.co/
3. https://arxiv.org/pdf/2501.09223

22CAE08N

REINFORCEMENT LEARNING
(Professional Elective-6)

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

PRE-REQUISITES: 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: After completion of the 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	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	1	2	2	3
CO2	3	3	2	2	-	-	-	-	-	-	1	3	2	3
CO3	3	3	2	3	2	-	-	2	-	-	1	3	2	3
CO4	3	3	3	3	2	-	2	3	-	-	2	3	2	3
CO5	3	2	3	3	2	-	2	3	-	-	2	3	2	3

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.
Casestudies: 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

22ITE27

FOUNDATIONS IN QUANTUM COMPUTING
(Professional Elective-6)

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

PRE-REQUISITES: Theory of computation and algorithms, linear algebra and probability.

COURSE OBJECTIVES: This course aims to
1. Understand the principles of quantum mechanics that enable quantum computation.
2. Compare classical and quantum computational models (bits vs. qubits).
3. Design basic quantum circuits using fundamental gates.
4. Analyse simple quantum algorithms (Deutsch-Jozsa, Grover's search).
5. Evaluate challenges in quantum hardware and real-world applications.

COURSE OUTCOMES: Upon completion of this course, students will be able to
1. Represent qubits mathematically using Dirac notation and Bloch spheres.
2. Construct and simulate quantum circuits (e.g., entanglement, teleportation).
3. Explain quantum parallelism and its advantages over classical methods.
4. Implement foundational algorithms using quantum circuit models.
5. Discuss ethical and practical limits of quantum computing.

CO-PO/PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	2	2	-	-	-	-	-	-	3	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	2	-	-	-	-	-	-	3	3	2
CO5	2	1	1	1	2	3	3	7	3	3	3	-	-	-

UNIT–I

Quantum Basics & Qubits: Introduction, Classical vs. quantum information, Superposition, measurement, and no-cloning theorem, Bloch sphere representation, Stern-Gerlach experiment.

UNIT–II

Quantum Gates & Circuits: Single-qubit gates (Pauli, Hadamard), Multi-qubit gates (CNOT, Toffoli), Quantum circuit diagrams, Universality of quantum gates

UNIT–III

Quantum Algorithms I: Hadamard transform, Quantum parallelism, Deutsch-Jozsa algorithm, Power of quantum computation, Oracle model and phase kickback.

UNIT–IV

Quantum Algorithms II: Grover's search algorithm, Quantum search: a two-bit example, Quantum Fourier Transform, Applications in cryptography (Shor's algorithm overview).
Computational complexity, Decision problems and the Complexity classes P and NP

UNIT–V

Applications & Limitations: Quantum teleportation, Error correction basics, Physical implementations (NMR, ion traps), Scalability challenges. case Study:

TEXT BOOKS:

1. Michael A. Nielsen, **"Quantum Computation and Quantum Information",** Cambridge University Press, 2000.

SUGGESTED READING:

1. David McMahon, "**Quantum Computing Explained**", Wiley, 2008
2. Mermin N.D. (2007). **Quantum Computer Science: An Introduction**. Cambridge University Press.
3. https://www.cse.iitm.ac.in/~shwetaag/CS6846-24.html

22MEO05

RESEARCH METHODOLOGIES AND INNOVATION
(Open Elective-1)

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 Make the students to formulate the research problem
2 Identify various sources for literature review and data collection.
3 Prepare the research design
4 Equip the students with good methods to analyze the collected data
5 Introduce students to the concepts of innovation

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

Define research problem
1 Review and assess the quality of literature from various sources.
2 Understand and develop various research designs.
3 Collect and analyze the data using statistical techniques.
4 Apply creative thinking and innovative 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	PSO 1	PSO 2	PSO 3
CO1	1	2	1	1	-	1	-	1	2	2	2			
CO2	-	2	1	2	1	1	1	1	3	2	2			
CO3	1	2	3	2	2	1	-	1	2	-	1			
CO4	2	2	-	3	2	-	-	-	2	1	1			
CO5	2	2	3	2	3	1	-	-	-	-	3			

UNIT – I

Research Methodology: Objectives, Motivation and Significance of Research, Types of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–II

Literature Survey: Importance of Literature Survey, Sources of Information Primary, Secondary and tertiary, Assessment of Quality of Journals and Articles, Information through Internet

Research writing: Format of the Research report, Writing a Synopsis, Dissertation, Research Proposal and Research Report

UNIT – III

Research Design: Meaning and Need of Research Design, Terminology used in Research Design, Features of a Good Research Design, Formulation of hypothesis, **O**perationalizing the research question, Different Research Designs – exploratory, descriptive, diagnostic and hypothesis testing research studies, Basic Principles of Experimental Design, Steps in Sample design

UNIT-IV

Data Collection and Analysis: Collection of primary data Observation, Interview and Questionnaire methods, Secondary data, Measures of central tendency, Measures of dispersion, Measures of asymmetry, Important parametric testsz, t, F, ChiSquare, ANOVA significance.

UNIT – V

Innovation: Creativity, Innovation and its difference, Blocks for creativity and innovation, overcoming obstacles, Examples of innovation, Being innovative, Steps for Innovation, right climate for innovation, Design led innovation, Gross root innovation, Frugal and flexible approach to innovation.

TEXT BOOKS:

1 C.R Kothari, "Research Methodology Methods & Technique", New Age International Publishers, 2004.
2 R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3 The Art of Innovation, Tom Kelley & Jonathan Littman, Profile Books Ltd, UK, 2008

SUGGESTED READING:

1 Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., New Delhi, 2009.
2 G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, Hyderabad, 2012.
3 JUGAAD Innovation, Navi Radjou, Jaideep Prabhu, Simone Ahuja Random house India, Noida, 2012.

WEB RESOURCES:

1 https://archive.nptel.ac.in/courses/127/106/127106227/
2 https://archive.nptel.ac.in/courses/107/101/107101088/

22ECO07

NEURAL NETWORKS AND FUZZY LOGIC
(Open Elective-1)

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

PRE-REQUISITE: The student should have knowledge on fundamentals of computing.

COURSE OBJECTIVES: This course aims to

1. Study the learning strategies of artificial neural networks and their training algorithms.
2. Acquire knowledge about associate memory and training algorithms of various associate memory networks.
3. Study the fuzzy rule base system, decision making system, different methods of defuzzification and applications of fuzzy logic.

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

1. To differentiate Biological system, intelligent systems and the concepts of crisp and fuzzy set theory
2. To analyze the learning strategies of Artificial Neural networks and learning rules
3. To understand training algorithms and are able to provide adequate knowledge about feed forward and feedback neural networks.
4. To design training algorithms for associative memory network for pattern recognition problems
5. To demonstrate knowledge and understanding of fuzzy system as they apply in real time systems and apply different methodologies to solve the problem related to the problem related to defuzzification.

CO-PO Articulation Matrix

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

UNIT-I

Artificial Neural Networks:

Introduction, Biological Neuron, Artificial Neuron, Basic concepts of Neural Networks, Basic Models of ANN Connections, McCulloch-Pitts Model, Characteristics of ANN, Applications of ANN.

UNIT-II

Essentials of Artificial Neural Networks:

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity,
Learning, Strategies (Supervised, Unsupervised, Reinforcement), Learning Rules, Numerical problems, Types of Application

UNIT-III

Supervised Learning Networks:

Perceptron Network, Perceptron Learning Rule, Architecture, Perceptron Training Algorithm, ADALINE, MADALINE, Back Propagation Network, BP Learning Rule, Input Layer Computation, Hidden Layer Computation, Output Layer Computation, Radial Basis Function Demonstration through MATLAB- Introduction to Associate Memory Network

UNIT-IV

Classical & Fuzzy Sets:

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT-V

Fuzzy Logic System Components:

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods, Applications.

TEXT BOOKS:

1. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.
2. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Pai – PHI Publications.
3. Fundamental of Artificial Neural Network and Fuzzy Logic-by Rajesh Kumar, Lakshmi publications

SUGGESTED READING:

1. Neural Networks – James A Freeman and Davis Skapura, Pearson Education.
2. Neural Networks – Simon Hakins , Pearson Education

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ge07/preview#:~:text=This%20course%20will%20start%20with,help%20of%20some%20numerical%20examples.

22EEO07

FUNDAMENTALS OF ELECTRIC VEHICLES

(Open Elective-1)

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. Basics of Electric Vehicle history and components.
2. Various types of Electric Vehicles.
3. Different storage methods.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the basics of electric vehicle and environmental impact.
2. Understand the various types of Electric Vehicles and their properties
3. Understand the functioning of BEV.
4. Understand the difference between HEV and FCEV.
5. Understand the various methods of energy storage.

CO-PO Articulation Matrix

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

UNIT-I

Introduction to Electric vehicles: Present scenario of electric vehicles, Need of Electric Vehicles, Economic and environmental impacts of using Electrical vehicles. Challenges faced by electric vehicles to replace ICE. Major requirements of electric vehicles.

UNIT-II

Types of Electric Vehicle and their challenges: Types of Electric Vehicle - Pure Electric Vehicle (PEV): Battery Electric Vehicle (BEV), Fuel Cell Electric Vehicle (FCEV), and Hybrid Electric Vehicle (HEV). Challenges of Battery Electric Vehicle, Hybrid Electric Vehicle and Fuel Cell Electric Vehicle

UNIT -III

Battery Electrical Vehicle: Components of BEV drive train, The electric propulsion subsystem - Driving wheels , Suspension system, Driveshaft, Mechanical transmission , Electric Motor. The energy source subsystem -Battery pack with Battery Management System, On board charger, The auxiliary subsystem -Power steering unit, Common parts between ICE drive train and EV drive train, Differences (modifications/parts to be removed/added) between ICE and EV drive train.

UNIT-IV

Hybrid Electrical Vehicle and Fuel Cell Electric Vehicle: Hybrid Electric vehicle (HEV) -Basic architecture of hybrid drive trains, Components of HEV drive train system. Classification of HEV: Grid -Able HEV (Plug in hybrid, Range extended).Fuel efficiency in HEV. Fuel Cell Electric Vehicle (FCEV) - Basic architecture of FCEV. Components of FCEV drive train system.

UNIT-V

Energy Storage: Battery based energy storage, Overview of batteries, Battery Parameters, Battery Charging, regenerative braking, alternative novel energy sources-solar photovoltaic cells, fuel cells, super capacitors, and flywheels.

TEXT BOOKS:

1. A.K. Babu, “Electric & Hybrid Vehicles” , Khanna Publishing House, New Delhi, 2018.
2. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals” , CRCPress, Second Edition, 2011.

SUGGESTED READING:

1. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.
2. Mehrdad Ehsani,Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.
3. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2000.

22BTO01

BIOLOGY FOR ENGINEERS

(Open Elective-1)

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

PRE-REQUISITES: The school level basic knowledge in Fundamental science is required

COURSE OBJECTIVES: The 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 Successful completion of the 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
CO1	1	0	0	0	0	2	0	0	0	0	2
CO2	1	0	0	0	2	1	0	0	0	0	0
CO3	1	0	1	0	2	1	1	0	0	0	0
CO4	2	1	1	0	2	2	0	0	1	0	0
CO5	1	1	1	0	1	1	0	0	1	0	1

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.

22EGO02

GENDER SENSITIZATION
(Open Elective – 1)

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

PRE-REQUISITE:
No specific prerequisite is required.

COURSE OBJECTIVES: This course will introduce the students 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: After successful completion of the course the 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/PSO ARTICULATION MATRIX

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	-	-	1	-	-	2	1	1	-	-	1	2	1	2
CO2	-	-	1	-	-	2	1	1	-	-	1	2	1	2
CO3	-	-	1	-	-	2	2	2	1	1	1	2	1	2
CO4	-	-	1	-	-	3	2	2	1	1	1	2	1	2
CO5	-	-	1	-	-	2	2	3	1	1	1	2	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 BOOK:

1. A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, 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/

WEB 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.

22ITC14

EMBEDDED SYSTEMS AND IOT 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 familiarize students with Embedded Programming.
2. To Experiment with On-Boarding Raspberry Pi / Arduino.
3. To Programming with Raspberry Pi Pins / Arduino Pins using sensors.
4. To introduce the concept of cloud data in the IoT environment.
5. To Understand IoT Applications in real time scenarios.

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

1. Design Embedded System using 8051 in Embedded 'c'
2. Write python programs that run on Raspberry Pi/Arduino.
3. Implement Applications using sensors for Raspberry Pi / Arduino.
4. Demonstrate Read and write cloud data using Thingspeak.
5. Develop simple IoT systems for different Case studies.

CO-PO / PSO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	0	2	3	3	0	0	0	0	0	3	3	2
CO2	2	1	1	2	3	3	0	0	0	0	0	3	3	2
CO3	2	1	0	2	3	3	0	0	0	0	0	3	3	2
CO4	2	1	0	2	3	3	2	1	1	1	2	3	3	2
CO5	2	1	1	2	3	3	2	1	1	1	1	3	0	0

LIST OF PROGRAMS

1. Interface Input-Output and other units such as: Relays, LEDs, Switches, Stepper Motors using 8051 Micro controllers.
2. Study and Configure Raspberry Pi.
3. Write programs using Raspberry Pi to blink LED.
4. a).using loops b) using conditional & control statements
5. Write program using Raspberry Pi to interface LEDs, Switch and Buzzer.
6. Interface different Sensors using Raspberry Pi.
7. IR b) PIR c) GAS d) LDR d) Rain e) Soil moisture.
8. Write a program to monitor temperature and humidity using DHT (Digital Humidity and Temperature) sensor using Raspberry Pi / Arduino.
9. Uploading and reading the Cloud data using ThingSpeak platform.
10. MiniProject Implementation:
    1. Home Automation (e.g., Smart Lighting),

2. City Applications (e.g., Smart Parking , Traffic Lighting)
3. Environment (e.g., Pollution Monitoring, Weather Monitoring)
4. Agriculture (e.g., Smart Irrigation) etc.

TEXT BOOKS:

1. Kenneth J.Ayala, "The 8051 Microcontroller", 3 rd Edition, Thomson, 2014.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.
3. Misra, C. Roy, and A. Mukherjee, 2020 "Introduction to Industrial Internet of Things and Industry 4.0". CRC Press.

SUGGESTED READING:

1. Raj Kamal, "Embedded Systems", 2 nd Edition, McGraw Hill, 2015.
2. Samuel Greengard, "The Internet of Things", 1st Edition, MIT Press, 2015.
3. Peter Waher, Pradeeka Seneviratne, Brian Russell, Drew Van Duren, "IoT: Building Arduino-Based Projects", 1st Edition, Packt Publishing Ltd, 2016.
4. Jeeva Jose, "Internet of Things", Khanna Book Publishing Company, 2018.

22ITE25

COMPUTER VISION LAB
(Professional Elective-4)

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

COURSE OBJECTIVES: This course aims to

1. To understand the fundamental concepts related to computer vision and Image formation.
2. To learn feature detection, matching and detection.
3. To become familiar with feature-based alignment.
4. To develop skills on 3D reconstruction.
5. To understand Object detection Techniques.

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

1. Use Methods in Image Processing and Computer Vision.
2. Implement Image Preprocessing Techniques.
3. Apply 2D Feature Based Image Segmentation Methods.
4. Employ Object Detection Techniques.
5. Apply Generative Adversarial Networks for Real World Scenarios or Use Cases.

CO-PO Articulation Matrix

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

LIST OF PROGRAMS

1. Implementation of Basic Image Processing - loading images, Cropping, Resizing, Histogram Equalization.
2. Implementation of Colour Spaces- Understanding Color spaces, color space conversion.
3. Implementation of Color detection and Invisibility cloak.
4. Implementation of Image Enhancement -Convolution, Image smoothing, Gradients.
5. Implementation of Edge & Contour Detection.
6. Implementation of Image transformations – Fourier and wavelet Transformations.
7. Implementation of Image segmentation using Thresholding and Graph cut method.

8. Implementation of Human Pose Detection.
9. Implementation of YOLO Algorithm.
10. Implementation of SSD Algorithm.
11. Implementation of R-CNN Model
12. Implementation of Generative adversarial networks (GANs)

TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015
3. Deep Learning for Vision Systems, Mohamed Elgendy, Manning Publications,2020

SUGGESTED READING:

1. R. Hartley and A. Zisserman, "Multiple View geometry", Cambridge university Press, 2002.
2. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

WEB RESOURCES:

1. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline
2. https://nptel.ac.in/courses/108103174
3. https://opencv.org/opencv-free-course/
4. https://opencv.org/opencv-free-course/
5. https://docs.opencv.org/4.x/
6. https://neptune.ai/blog/15-computer-visions-projects

22ITE12N

DEVOPS TOOLS LAB
(Professional Elective-4)

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

COURSE OBJECTIVES: The objective of this lab is to

1. Understand the fundamentals of DevOps in the context of software development.
2. Learn version control using Git for efficient code management.
3. Build, test, and deploy applications using Jenkins and Maven.
4. Utilize Docker for containerization of applications.
5. Develop and manage an end-to-end software deployment process.

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

1. Apply DevOps principles to streamline software development and delivery.
2. Use version control tools such as Git for collaborative coding and tracking changes.
3. Implement continuous integration and delivery using Jenkins and Maven.
4. Demonstrate containerization techniques using Docker.
5. Describe and execute deployment processes using automation tools like Puppet.

CO-PO/PSO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	3	3	3	1	0	1	2	1	2	1	2	2
CO2	1	1	3	3	3	1	0	1	2	1	2	1	2	2
CO3	1	1	3	3	3	1	0	1	2	1	3	1	2	2
CO4	1	1	3	3	3	1	0	1	2	1	3	1	2	2
CO5	1	1	3	3	3	1	0	1	2	1	3	1	2	2

LIST OF PROGRAMS

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, 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. Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet, Ryan Russell and Jason Southgate, Packt Publishing ,2018.
2. Joakim Verona, Practical DevOps, Packt Publishing , 2018.

22CIE60

UI DESIGN LAB
(Professional Elective-4)

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

PRE-REQUISITE: Basic Design Principles or Introduction to Digital Media

COURSE OBJECTIVES : This Course aims to
1. Apply the UI/UX design process to create user-centered interfaces.
2. Design reusable UI components and apply visual design principles.
3. Implement HCI principles for intuitive interfaces.
4. Create micro interactions and feedback mechanisms.
5. Develop accessible, responsive, and mobile-first interfaces.

COURSE OUTCOMES: Upon completion of this course, students will be able to
1. Conduct user research and create personas and wireframes to initiate the UI/UX design process.
2. Develop a design system with reusable UI components, applying typography and color principlesf for consistency.
3. Design intuitive interfaces using HCI principles to ensure usability and error prevention.
4. Implement micro-interactions and feedback mechanisms in prototypes to enhance user experience.
5. Create and test accessible, responsive, and mobile-first UI prototypes, incorporating usability feedback.

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

LIST OF EXPERIMENTS

1. **User Research and Personas**

   Task: Create a user persona and journey for a budgeting app in Figma

2. **Low-Fidelity Wireframing**

   Task: Create 3-screen wireframes (home, profile, settings) using a 12-column grid

3. **Design System – UI Components**

   Task: Create a component library (buttons, cards, modals) in Figma.

4. **Typography for UI**

   Task: Design a news feed screen with UI-appropriate fonts and hierarchy.

5. **Color and Accessibility**

   Task: Develop a WCAG-compliant palette and apply it to Experiment 4 screen.

6. **HCI-Based Form Design**

   Task: Design a login form with clear affordances and error prevention.

7. **High-Fidelity Prototyping**

   Task: Convert Experiment 2 wireframes into a high-fidelity prototype with interactions.

8. **Microinteractions**

   Task: Create a button hover or form validation animation

9. **Responsive Design**

   Task: Adapt Experiment 7 prototype for desktop/tablet breakpoints.

10. **Usability Testing and Final Project**

    Task: Test Experiment 9 prototype, revise for accessibility/responsiveness, and present.

Software Resources: Figma, Adobe XD, Photoshop, Illustrator

Online Tools: Adobe Color, WAVE, Google Fonts

TEXT BOOKS:

1. Designing Interfaces, Jenifer Tidwell, 3rd Edition, O'Reilly, ISBN: 978-1492051961, 2020.
2. The Design of Everyday Things, Don Norman, ISBN: 978-0465050659, 2013.
3. Accessibility for Everyone, Laura Kalbag, A Book Apart, ISBN: 978-1937557614, 2017.
4. Figma Design Handbook (Online), https://www.figma.com/resources/learn-design/.

WEB REFERENCES:

1. https://www.nngroup.com/articles/ (HCI and usability).
2. https://www.w3.org/WAI/standards-guidelines/wcag/ (accessibility guidelines).
3. https://material.io/design (UI components, responsive design).
4. https://helpx.adobe.com/xd/tutorials.html (Adobe XD tutorials).

22ADE75N

BLOCKCHAIN TECHNOLOGY AND APPLICATIONS LAB
(Professional Elective-4)

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

COURSE OBJECTIVES: This course is aims to:

1. Understand the core principles of Blockchain Technology.
2. Explore the role of Ethereum in the blockchain ecosystem.
3. Introduce the basics of Solidity Programming used for developing blockchain applications.
4. Explore the development Environment used for smart contract development.
5. Examine the Key Features of Hyperledger 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. Develop a DApp using smart contracts.
5. Analyze 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	PSO 1	PSO 2	PSO 3
CO1	1	1	1	2	2	1	-	-	-	-	-	1	1	2
CO2	-	1	1	1	1	1	-	1	-	-	-	-	1	-
CO3	-	2	1	2	2	-	-	-	-	-	-	1	-	3
CO4	-	1	2	1	2	1	2	-	1	-	-	-	-	2
CO5	2	-	2	-	-	2	3	1	1	2	-	-	-	-

LIST OF EXPERIMENTS

1. Learn the functionality and use cases of Remix IDE, Truffle, and Ganache for Ethereum smart contract development.
2. Create a Crypto-currency Wallet.
3. Connect to the Public/Testnet Ethereum Blockchain network using popular wallets (Metamask or Brave browser) and understand various terminologies like gas, gas fee, gas price, priority fee.
4. Write a Solidity smart contract that stores a number and allows anyone to update it.
5. Create a Solidity program to facilitate Ether transfers between MetaMask accounts using a smart contract.
6. Develop a Full-fledged DApp using Ethereum/Hyperledger.
7. Explore a live demo showcasing the architecture, functionality, and enterprise capabilities of Hyperledger Fabric.

TEXT BOOKS:

1. Imran Bashir “Mastering Blockchain”, Second Edition, Packt Publishers, 2018.
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", First Edition O'Reilly, 2018.

SUGGESTED READING:

1. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, st Edition, Apress, 2017.
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to BuildSmart Contracts for Ethereum and BlockChain”, Packt Publishing, 2019.
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.

WEB 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

22ITE14N

UNMANNED AERIAL VEHICLES LAB
(Professional Elective-4)

Instruction	3P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	30 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

1. Understand the basic components of Unmanned aerial vehicles (Drones) and its various applications.
2. Provide hands-on experience on design, fabrication and flying of UAV-category aircraft.
3. Integration of drones with other hardware and software applications.

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

1. Know the parts and functions of Quad copter.
2. Demonstrate Calibration of UAV(Quadcopter) using Ardupilot Mission planner.
3. Write and test Various commands to communicate for successfully fly the drone.
4. Explore Object Avoidance using sensors and test them on UGV(Robot).
5. Design/Simulate to communicate UAV/UGV using BLE/WiFi/UHF/Cellular devices and IOT-UAV/UGV using text & voice commands.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	0	0	0	0	0	0	1	1	1	1	3	2
CO2	1	2	0	0	1	0	0	0	0	2	1	0	3	2
CO3	1	1	1	1	1	0	0	0	1	1	0	1	3	2
CO4	1	1	0	0	1	0	0	0	0	2	0	0	3	2
CO5	1	1	1	1	1	2	0	0	0	0	1	2	3	2

LIST OF EXPERIMENTS

1. Assemble, integrate and demonstrate the Quad copter with all necessary parts.
2. Calibration of UAV(Quadcopter) using Ardupilot Mission planner and demonstrate the calibrated IMU parameters
3. Write a program to read Telemetry parameters using Serial Port using TTC device.
4. Write a program to read GPS coordinates on Raspberry Pi and Arduino micro controller
5. Write a program to send MAVLINK commands to Pixhawk version of Flight Controller
6. Write a program to connect Dronekit for communication and testing various commands
7. Use Mission planner for flight path panning and demonstrate the transfer of planning transects to flight controller
8. Write object avoidance program using the following sensors and test them on UGV(Robot)
9. Sonar b) LiDAR c) Camera
10. Write a Program to communicate UAV/UGV using BLE/WiFi/UHF/Cellular devices

11. Write a program to communicate IOT-UAV/UGV using text & voice commanding for Swarm

PROGRAMMING LANGUAGES:
Python, C

SOFTWARE TOOLS:
Ardupilot Mission Planner, SITL / MAVproxy, ROS : Robotic Operating System, ChibiOS or latest Embedded RTOS

TEXT BOOKS:
1. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence
2. John J. Craig, Introduction to Robotics: Mechanics and Control, Addison Wesley publication, 3rd Edition.
3. Reg Austin"Unmanned Aircraft Systems: UAVS Design, Development and Deployment" John Wiley & Sons, Ltd.2011.
4. Fahlstrom P, Gleason T (2012) "Introduction to UAV systems", 4th edn. Wiley, UK
5. Yang, L. J., & Esakki, B. (2021). Flapping Wing Vehicles: Numerical and Experimental Approach. CRC Press.
6. Sebbane, Y. B. (2022). A first course in aerial robots and drones. CRC Press.

SUGGESTED READING:
1. J.A.M. Mendoza, V.J.G. Villela, G.S. Cervantes, M.M. Martinez, H.S. Azuela, Advanced Robotic Vehicles Programming: An Ardupilot and Pixhawk Approach, First Edition, A Press, 2020
2. Ty Audronis, Designing Purpose-Built Drones for Ardupilot Pixhawk 2.1: Build drones with Ardupilot, First Edition, CBS Publishers and Distributers, 2017
3. J. Ranga, J. Saiteja, M. Seshu, Speed Control of BLDC Motor with RPM Display, First Edition, LAP Lambert Academic Publishing, 2020
4. D. Hanselman, Brushless Motors: Magnetic Design, Performance, and Control of Brushless DC and Permanent Magnet Synchronous Motors, First Edition, E-Man Press LLC, 2012
5. A. Frazier, K. Singh, Fundamentals of Capturing and Processing Drone Imagery and Data, First Edition, CRC Press, 2021
6. J. Baichtal, Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, First Edition, QUE Publishers, 2015

WEB RESOURCES:
1. https://robu.in/understanding-various-components-used-for-quadcopter-2/
2. https://ardupilot.org/copter/docs/common-imutempcal.html
3. https://ardupilot.org/copter/docs/common-telemetry-port-setup.html
4. https://www.youtube.com/watch?v=OeTxaClOEWs
5. https://www.youtube.com/watch?v=zxjO9q34RLs
6. https://www.youtube.com/watch?v=t4rwKoLmgVI

22ITC26

PROJECT PART- I

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

PRE-REQUISITE: Fundamental Knowledge on Core Courses like Problem Solving and Programming, Algorithms, Data Structures, Database, Software Engineering. Technical Skills for Developing a Project Web Technologies, Programming Languages, Tools and Software. Domain knowledge.

COURSE OBJECTIVES: This course aims to

1. Conduct an extensive literature survey to explore existing research, methodologies, and technologies relevant to the chosen project topic.
2. Define the problem statement and project scope based on the findings from the literature review and prepare a questionnaire for the project.
3. Develop a conceptual design and draft a detailed project plan that outlines the proposed solution.
4. Prepare a state of the art paper for publication and devise a plan for the Project Part-II.
5. Motivate the students towards research and innovation.

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

1. Identify problems within their area of interest through comprehensive literature surveys.
2. Formulate potential solutions for identified problems and compare them with existing approaches.
3. Develop a synopsis outlining the selected problem and proposed solutions.
4. Gather necessary information to establish the environment for preliminary experimentation and implementation.
5. Effectively communicate project work through both oral presentations and written documentation.

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
CO1	3	3	2	1	-	-	1	-	3	1	1	3	3	3	2
CO2	3	3	2	1	1	-	1	-	3	2	1	3	3	3	2
CO3	3	3	3	3	3	-	1	-	3	3	2	3	3	3	3
CO4	3	3	2	3	3	-	1	-	3	3	2	3	3	3	3
CO5	3	2	2	2	1	-	1	2	3	3	2	3	3	3	3

The project tasks are outlined as follows:

- Conduct a comprehensive survey and study of published literature relevant to the assigned topic.
- Develop a preliminary approach to address the problem associated with the assigned topic.
- Perform initial analysis, modelling, simulation, experimentation, design, or feasibility study as appropriate.
- Prepare a written report detailing the conducted study for presentation to the department.

- Deliver a final seminar, presenting findings and outcomes orally to the Departmental Review Committee (DRC).
- Initiate the publication of state-of-the-art study in a reputed conference or journal.

CRITERIA FOR EVALUATION AND AWARD OF CIE MARKS (Max. Marks:50)

The DRC/Supervisor/Coordinator will allocate marks by referencing the Evaluation Rubrics for PROJECT PART-I

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor (20)	5	Regularity and Punctuality
	5	Work Progress
	5	Quality of the work
	5	Report on Project Part-1
Project Coordinator (15)	5	Technical Content
	5	Presentation
	5	Partial Implementation
Department Review Committee (15)	10	Project Review
	5	Conference/Journal Publication

Note:

Students are advised to:

- Develop an Action Plan outlining project work timelines.
- Submit weekly project status reports signed by the supervisor.
- Prepare the report in the designated format.
- Deliver project seminars according to the provided schedules.
- Draft a Survey Paper for potential conference presentations or publication in journals.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)
DEPARTMENT OF INFORMATION TECHNOLOGY
(Inline with AICTE Model Curriculum with effect from AY 2027-28)
(R-22A Regulation)

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		CIE	SEE	
	THEORY								
1		**Open Elective – 2**	3	-	-	3	40	60	3
2		**Open Elective – 3**	3	-	-	3	40	60	3
	PRACTICAL								
3	22ITC27	Technical Seminar	-	-	2	-	50	-	1
4	22ITC28	Project Part-2	-	-	8	-	100	100	4
		TOTAL	**6**	**-**	**10**	**-**	**230**	**220**	**11**
Clock Hours per Week: 16									

D: Drawing **CIE: Continuous Internal Evaluation**

P: Practical/Project Seminar/Dissertation **SEE: Semester End Examination**

Open Elective – 2		
1	22MEO01	principles of Design Thinking
2	22MEO04	Introduction to Operations Research
3	22EEO02	Energy Conservation
4	22BTO04	Bioinformatics
5	22EGO01	Technical Writing Skills

Open Elective – 3		
1	22MEO06	Principles of Entrepreneurship and Startups
2	22ECO02	Remote Sensing and GIS
3	22CEO02	Disaster Risk Reduction and Management
4	22BTO05	Cognitive Neuroscience
5	22EGO03	Indian Traditional Knowledge

22MEO01

PRINCIPLES OF DESIGN THINKING
(Open Elective-2)

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

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

COURSE OUTCOMES: 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	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	2	2	2	2	2	2			
CO 2	1	1	2	1	2	2	2	1	2	2	2			
CO 3	1	1	2	2	1	2	2	1	2	2	1			
CO 4	2	1	2	2	1	2	2	1	2	2	2			
CO 5	2	1	2	2	1	2	2	1	2	2	2			

UNIT – I

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

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

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

TEXT BOOKS:

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

22MEO04

INTRODUCTION TO OPERATIONS RESEARCH

(Open Elective – 2)

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

PRE-REQUISITE: Knowledge on basics of Mathematics

COURSE OBJECTIVES: This course aims to

1 Make the students come to know the formulation of LPP models.
2 Familiarize the students with the Algorithms of Graphical and Simplex Methods.
3 Make the students understand the Transportation and Assignment techniques.
4 Familiarize the students with the procedure of Project Management along with CPM and PERT techniques.
5 Make the students understand the concepts of sequencing and queuing theory

COURSE OUTCOMES: Upon completion of this course, the students are able to

1 Understand the concepts of linear programming problems and Solve
2 Solve the given transportation problem.
3 Develop optimum pair of operations and resources by using Assignment technique.
4 Analyze project management techniques like CPM and PERT to plan and execute projects successfully.
5 Apply sequencing and queuing theory concepts for industry 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	2	1	-	1	-	-	1	1	-	-	1			
CO 2	2	1	1	-	1	-	-	1	-	-	-	1			
CO 3	1	1	1	-	-	2	-	-	-	-	2	1			
CO 4	3	-	-	-	-	-	-	1	-	-	-	2			
CO 5	2	1	1	-	-	2	1	-	1	-	2	1			

UNIT-I

Introduction: Definition and scope of operations research.

Linear programming: Introduction, formulation of linear programming problems, graphical method of solving LP problem, simplex method, degeneracy in simplex, duality in simplex.

UNIT-II

Transportation models: Finding an initial feasible solution north west corner method, least cost method, Vogel's approximation method, finding the optimal solution, special cases in transportation problems unbalanced transportation problem, degeneracy in transportation, profit maximization in transportation.

UNIT-III

Assignment techniques: Introduction, Hungarian technique of assignment techniques, unbalanced

problems, problems with restrictions, maximization in assignment problems, travelling salesman problems.

UNIT-IV

Project management: Definition, procedure and objectives of project management, differences between PERT and CPM, rules for drawing network diagram, scheduling the activities, Fulkerson's rule, earliest and latest times, determination of ES and EF times in forward path, LS & LF times in backward path, determination of critical path, duration of the project, free float, independent float and total float, crashing of network.

UNIT-V

Sequencing models: Introduction, General assumptions, processing 'n'jobs through two machines, processing 'n' jobs through three machines.

Queuing theory: Introduction, Kendall's notation, single channel Poisson arrivalsexponential service times.

TEXT BOOKS:

1 Hamdy A. Taha, Operations ResearchAn Introduction, 10th edition, Pearson education India, 2017.
2 S.D. Sharma, Operations Research, Kedarnath, Ramnath& Co., Meerut,2009.
3 V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi, 2004.

SUGGESTED READING:

1 R. PaneerSelvam, Operations Research, 2nd edition, PHI Learning Pvt. Ltd., New Delhi,2008.
2 Nita H. Shah, Ravi M. Gor, HardikSoni, Operations Research, PHI Learning Private Limited, 2013.

22EEO02

ENERGY CONSERVATION

(Open Elective-2)

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

PRE-REQUISITES: None

COURSE OBJECTIVES: This course aims to
1. Know the concept of Energy conservation
2. Understand the formulation of efficiency for various engineering systems
3. Explore the different ways to design various technologies for efficient engineering systems.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Know the current Energy Scenario and importance of Energy Conservation. [EC].
2. Understand the necessity of EC in domestic sector.
3. Comprehend the significance of EC in Industrial sector.
4. Explore the Energy Efficient Technologies in Mechanical and Civil Engineering domain.
5. Explore the Energy Efficient Technologies in Electrical and Chemical Engineering domain.

CO-PO Articulation Matrix

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

UNIT-I

Basics of various Energy forms : Overview of Engineering elements , Solar energy, Electricity generation methods using Solar energy, PV cell, elements of wind energy, electricity generation using wind energy, sources of chemical energy, fuel cells; Hydrogen Cell , Energy Scenario in India.

UNIT-II

Energy Conservation-I: Domestic Sector: Energy conservation needs and objectives, Energy Conservation strategies in domestic sector, Energy Conservation tips in the kitchen, other energy saving tips in the domestic house, Energy Conservation measures in office, energy conservation processes/activities for a building. HVAC (heating, ventilation, air conditioning), components of HVAC, energy conservation opportunities in HVAC systems.

UNIT-III

Energy Conservation-II: Industrial Sector: Energy Conservation in Indian industrial sector, Energy saving potential in industry: boiler, furnaces, air compressors, refrigeration systems, heat exchanger, heat pump, turbines, electric drives, pumps, cooling towers, fans and blowers. Energy Conservation in agriculture sector: Energy Conservation opportunities in pumps used in agriculture sector**.**

UNIT-IV

Energy Efficient Technologies-I: Importance of Energy Efficiency for engineers**,**

Energy Efficient Technology in Mechanical engineering: Heating, ventilation and air-conditioning, boiler and steam distribution systems. Energy

Efficient Technology in civil engineering: future of roads, harnessing road and transport infrastructure; Energy Efficient Technology in Agriculture: IoT and Drone Technology.

UNIT-V

Energy Efficient Technologies-II: Energy Efficient Technologies-II: Energy efficient technology in electrical engineering: Electricity billing, Electrical load management and, power factor improvement and its benefit, selection and location of capacitors ; Energy efficient technology in Chemical engineering: green chemistry, low carbon cements, recycling paper. Green buildings concept, introduction to SCADA

TEXT BOOKS:

1 Umesh Rathore,'energy management', Katarina publications, 2nd edition, 2014.
2 G Harihara Ayer, “Green Building Fundamentals”, Notion press.com
3 S. C. Tripathy, “Utilization of Electrical Energy and Conservation”, McGrawHill, 1991

SUGGESTED READING:

1 Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
2 Guidebooks for National Certification Examination for Energy Manager/Energy Auditors Book-1, General Aspects

WEB RESOURCES:

1 https://publicservice.vermont.gov/efficiency/energy-saving-resources
2 https://www.graygroupintl.com/blog/energy-conservation

22BTO04

BIOINFORMATICS

(Open Elective-2)

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

PRE-REQUISITES: 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 completing 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	1	0	0	0	0	0	0	0	1	0	1
CO 2	1	1	0	1	1	0	0	0	1	0	1
CO 3	2	0	0	1	1	0	0	0	1	0	1
CO 4	2	0	0	1	1	0	0	0	1	0	1
CO 5	2	1	0	1	1	0	0	0	1	0	1

***The above table is applicable for biotechnology department. Respective departments opting for this subject may prepare similar table**

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 database

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

JiXiong, “Essential Bioinformatics”, Cambridge University Press, 2006

22EGO01

TECHNICAL WRITING SKILLS
(Open Elective-BE/B.Tech - Common to all Branches)

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

PRE-REQUISITE: Language proficiency and the ability to simplify complex technical concepts for a diverse audience.

COURSE OBJECTIVES: The course will introduce the students to

1. Process of communicationand channels of communicationin 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: After successful completion of the 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	PSO 1	PSO 2	PSO 3
CO 1	-	2	1	1	-	1	2	3	3	2	3	1	1	1
CO 2	-	1	-	1	-	-	1	2	2	1	2	-	1	1
CO 3	-	2	-	2	-	1	1	2	3	2	2	1	1	2
CO 4	2	2	1	3	-	2	1	3	3	2	2	1	1	2
CO 5	1	1	1	1	-	1	1	3	3	2	2	1	1	2

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

WEB 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

22MEO06

PRINCIPLES OF ENTREPRENEURSHIP AND STARTUPS

(Open Elective-3)

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

22ECO02

REMOTE SENSING AND GIS

(Open Elective-3)

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

PRE-REQUISITE: Basic knowledge of Geography is required

COURSE OBJECTIVES: This course is aims to

1. Explain the fundamental concepts of remote sensing and digital imaging techniques.
2. Make the students to understand the principles of thermal and microwave remote sensing.
3. Make the students understand the significance of GIS and the process of GIS.

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

1. Demonstrate the understanding of basic concepts of remote sensing and interpreting energy interactions.
2. Choose an appropriate technique for a given scenario by appreciating the types of remote sensing.
3. Distinguish the principle behind the working of microwave and LiDAR sensing.
4. Apply Microwave remote sensing techniques
5. Explain the procedure for encoding data and geospatial data analysis.

Course Articulation Matrix

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

UNIT-I

Concept of Remote Sensing: Remote sensing definition, data, process, EM bands used in remote sensing, Interactions and recording of energy: interaction with atmosphere, interaction with earth surface features (soil, water, vegetation), recording of energy by sensors, Transmission, reception and processing, Image interpretation and analysis, Applications, Advantages, and limitations of Remote sensing.

UNIT-II

Digital Imaging: Types of Remote sensing, Sensor resolutions, Digital Image, Sensor components, Principle of a long-track and across-track scanning, Hyperspectral Imaging, Thermal Remote Sensing.

UNIT-III

Microwave Remote Sensing: Active and Passive Microwave Remote Sensing, Radar Imaging: Key components of imaging radar, viewing geometry, spatial resolution, principle of RAR, SAR and their range resolution, Satellite Radar Imaging, LIDAR.

UNIT-IV

Concept of Geographic Information Systems: Key components of GIS, joining spatial and attribute data, functions, advantages and applications of GIS, Spatial data model, Raster data model, Vector data model.

UNIT-V

Process of GIS and Geospatial analysis: Data sources, encoding raster data, encoding vector data, encoding attribute data, linking spatial and attribute data, Geospatial data analysis methods database query, geospatial measurement, overlay operations, network analysis and surface analysis. Integration of GIS and remote sensing.

TEXT BOOKS:

1. Basudeb Bhatta, "Remote Sensing and GIS", 2/e, Oxford University Press, 2012.
2. Lillesand T.M., and Kiefer R.W. "Remote Sensing and Image Interpretation", 6/e, John Wiley &Sons, 2000.

SUGGESTED READING:

1. James B. Campbell and Randolph H. Wynne, "Introduction to Remote Sensing", the Guilford Press, 2011.
2. Michael N DeMers, "Fundamentals of GIS", 2/e, John Wiley, 2008.

22CEO02

DISASTER RISK REDUCTION AND MANAGEMENT
(Open Elective-3)

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

COURSE OBJECTIVES: To enable the students to

1. To learn about the types, causes, impacts and management concept of disaster.
2. To learn about the disaster management cycle and early warning systems
3. To make the students become aware of stress and trauma management during a disastér.
4. To identify the role of technology and institutional framework behind disaster management in India.
5. To identify the structural and non-structural measures of disaster mitigation and learn about the provisions of Disaster management Act.

COURSE OUTCOMES: Upon completion of this course, the student 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	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO2	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO3	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO4	2	-	-	-	2	3	-	-	-	-	-	1	-	-
CO5	2	-	-	-	-	3	-	-	-	-	-	1	-	-

UNIT-I

Fundamental concepts in disaster management: Hazard and disaster-concepts, vulnerability and risk, Hazard and disaster type – Natural, Water- related, pandemic and Human induced hazards disasters. Causes and Impacts of 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 and Tsunami". 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 Press Pvt. Ltd

WEB RESOURCES:

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

22BTO05

COGNITIVE NEUROSCIENCE

(Open Elective-3)

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

PRE-REQUISITES: The school level basic knowledge in Fundamental science is required

COURSE OBJECTIVES: This course aims to

1. Understanding the brain effects that give rise to our abilities to perceive, act and think
2. Gain skills on the way that cognition is associated with neural activity
3. Compare and contrast the organization and function of numerous systems within the brain

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

1. Gain familiarity and basic knowledge about brain systems and functions.
2. Understand brain's neuro-transimitter system.
3. Understanding the brain's methods gives rise to behaviour whether we engage in any activity (e.g., walking, talking, etc.).
4. Identify the patterns of varied activities in neurons that correspond to a person's attempts to move in particular ways.
5. Understand the feedback system and brain disorders.

CO-PO Articulation Matrix:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	0	2	0	0	2	0	3			
CO 2	1	1	1	1	0	2	0	0	2	0	3			
CO 3	1	1	1	1	0	2	0	0	2	0	3			
CO 4	1	2	2	3	3	3	3	1	3	0	3			
CO 5	1	1	2	3	3	3	3	1	3	0	3			

***The above table is applicable for biotechnology department. Respective departments opting for this subject may prepare similar table**

UNIT-I

Introduction to neuroscience: Outline of neuroanatomical; Neurogenesis, migration Axon path-finding; cell death; Role of neural activity in development; Membranes and membrane potentials.

UNIT-II

Action potential: Conductance mechanisms; Chemical and electrical transmission; Postsynaptic potentials; neural integration; Energy consumption in the brain; Attention; Methods jigsaw; Executive Control; Evolution/development; Sheep's brain dissection.

UNIT-III

Neurotransmitter systems: Visual information processing; Visual cortex; Visual plasticity; critical periods; Somatosensory system; Pain; Chemoreception; Auditory system; Spinal mechanisms; Brain mechanisms.

UNIT-IV

Human and Animal Memory: Pattern completion and separation; LTP and synapses; Spatial cognition; Social cognition; Cellular mechanisms of neural plasticity.

UNIT-V

Feedback System and Brain Disorders: Endocrine systems; feeding behaviour, Stress, Addiction, Depression, Schizophrenia, Alzheimer's, Huntington's disease, Parkinson's disease.

TEXT BOOKS:

1. Principles of Neural Science, 6th Edition (2021) Eric R. Kandel, James Harris Schwartz, Thomas M. Jessell, McGraw Hill.
2. Principles of Cognitive Neuroscience, 2nd Edition (2013) Dale Purves, Roberto Cabeza, Scott A. Huettel, Kevin S. LaBar, Michael L. Platt, and Marty G. Woldorff. Sinauer Associates, Inc.
3. Mark Bear, Brian Connors, and Michael Paradiso (2007) Neuroscience: Exploring the Brain. 3rd ed. Baltimore: Lippincott, Williams & Wilkins.

22EGO03

INDIAN TRADITIONAL KNOWLEDGE

(Open Elective-3)

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

PRE-REQUISITE: Knowledge of Indian Culture.

COURSE OBJECTIVES: This course aims to

1. To get a knowledge in Indian Culture.
2. To know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India.

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

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval, and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.

CO-PO-PSO Articulation Matrix

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

UNIT I

Culture and Civilization: Culture, Civilization and heritage, general characteristics of culture, importance of culture in human life, Cultural diversity, Aesthetics, Women seers, Indus culture, Indian Cuisine, Martial arts.

UNIT II

Education System: Education in ancient, medieval and modern India, aims of education, subjects, Languages, Science and Scientists of ancient. Medieval and modern India. Concepts of Sciences in Indian Knowledge Systems.

UNIT III

Linguistic Wealth: Indian languages and Literature: The role of Sanskrit, Morphology and brevity of Sanskrit, Concepts of NLP in IKS. Paleography, Fundamentals of Vedic Mathematics, Significance of scriptures to current society, Indian semantics and lexicography, Darshanas.

UNIT IV

Art, Technology & Engineering: Sculpture, Painting and Handicrafts, Indian Music, Dance Drama and Theatre, introduction to Mayamatam, Iron and Steel technology, Use of metals in medicinal preparations.

UNIT-V

Science and Logic: Heliocentric system, Sulbasutras, Katapayadi, Engineering in Vedas, Adaptability of Sanskrit in Computer languages, Related commands Hindu calendar, 6 Pramanas in Indian logic, Scientific method applied to therapeutics, Fallacies, Tarka- Induction and deduction, Ayurvedic biology, Definition of health.

TEXT BOOKS:

1. B. Madhavan, Nagendra Pavana, Vinayak Rajat Bhat, "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning, June 2022.
2. Kapil Kapoor, "Text and Interpretation: The Indian Tradition", D K Print World Ltd., 2005.
3. Samskrita Bharati, "Science in Sanskrit",2017.
4. Satya Prakash, "Founders of sciences in Ancient India", Govindram Hasanand, 1986.

SUGGESTED READING:

1. Brajendranath Seal**, "**The Positive Sciences of the Ancient Hindus", Motilal Banarasidass, 2016.
2. Kancha Ilaiah, "Turning the Pot, Tilling the Land: Dignity of Labour in Our Times", Navayana, 2019.
3. Balram Singh and others, "Science & Technology in Ancient Indian Texts", D.K. Print World Ltd, 1st edition, 2012.
4. Smt. Kalpama Paranjepe, "Ancient Indian insight and Modern Science"**,** Bhandarkar Oriental Research Institute, 1996.
5. Pradeep Parihar, "Vedic World and Ancient Science", World House Book Publishing, 2021.

22ITC27

TECHNICAL SEMINAR

Instruction	2 P/D Hours per Week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

PRE-REQUISITE: Students should possess foundational skills in comprehending the topic under study, including the ability to conduct appropriate research, analyze information critically, and think analytically. Effective communication and oral presentation skills are essential for conveying the topic clearly and engaging the audience. Additionally, strong writing skills are necessary to compile a comprehensive report summarizing the findings and insights derived from the study.

COURSE OBJECTIVES: This course aims to

1. Familiarize students with current advancements, trends, and emerging technologies in the field of Information Technology.
2. Develop students' ability to critically read, understand, and analyze technical literature, including research papers, articles, and reports.
3. Enhance students' oral communication and presentation abilities by requiring them to effectively communicate complex technical concepts to their peers and instructors.
4. Cultivate research skills by encouraging students to explore in-depth a specific topic within their area of interest, synthesize relevant information, and present their findings in a coherent and structured manner.
5. Foster a sense of autonomy and initiative among students by allowing them to choose seminar topics based on their interests and career aspirations, with guidance from faculty mentors.

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

1. Collect, organize, analyze, and consolidate information about emerging technologies from relevant literature sources.
2. Exhibit effective communication skills, including stage presence, courage, and confidence, during seminar presentations.
3. Demonstrate intrapersonal skills such as self-confidence, adaptability, and professionalism in engaging with peers and faculty.
4. Explain new innovations and inventions in the relevant field, demonstrating a comprehensive understanding of technological advancements.
5. Prepare a seminar report in a prescribed format, summarizing key findings and insights derived from the study, and presenting them coherently and concisely.

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

The seminar should have a clear structure, and the PowerPoint presentation should cover the following points:

1. Introduction.
2. Literature review.
3. Problem Statement.
4. Models / Techniques / Algorithms / Methodology used in the Solution to a Problem.
5. Results Analysis, Discussion on applications, Conclusion, and further scope for improvement.
6. References and Bibliography.
7. Question and Answers.

Seminars will be scheduled from the 3rd week to the last week of the semester, and changes to the schedule should be avoided.

For CIE marks, students will be evaluated by three expert and experienced faculty members based on their oral and written presentations, as well as their participation in discussions during the presentation.

Note: It is preferable for seminar topics to be chosen from recent journals indexed in SCI, Scopus, Web of Science, or UGC-CARE list, from CBIT listed publishers. Students are encouraged to write and publish articles on the seminar topic in national and international blogs, newspapers, and journals.

CRITERIA FOR EVALUATION AND AWARDING CIE MARKS AS PER THE RUBRICS (MAX. MARKS: 50)

S.No	Description	Max Marks
1	Contents and Relevance	10
2	Presentation Skills	10
3	Preparation of PPT slides	5
4	Questions and Answers	5
5	Report in a prescribed format	20

22ITC28

PROJECT PART- II

Instruction	8P Hours per Week
Duration of SEE	-
SEE	100 Marks
CIE	100 Marks
Credits	4

Pre- requisite: Fundamental Knowledge on Core Courses like Problem Solving and Programming, Algorithms, Data Structures, Database, Software Engineering. Technical Skills for Developing a Project Web Technologies, Programming Languages, Tools and Software. Domain knowledge and Completion of Project Part – I.

COURSE OBJECTIVES: This course aims to

1. Facilitate students in expanding their investigative study, encompassing theoretical, practical, or a combination of both aspects.
2. Conduct the project under the supervision of a departmental supervisor or in collaboration with a supervisor from an R&D laboratory/Industry/Other Premier Educational Institution, ensuring guidance and support throughout the project duration.
3. Develop an action plan outlining the investigation process, including considerations for teamwork and collaboration for effective implementation of the project.

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

1. Demonstrate proficient technical knowledge relevant to their chosen domain and topic in the field of Information Technology and Computer Science.
2. Conduct thorough investigations using research-based methodologies to derive valid conclusions.
3. Offer solutions to complex societal problems by applying engineering principles either independently or through collaborative teamwork.
4. Employ contemporary software tools and technologies to address the challenges associated with complex engineering and IT solutions.
5. Effectively communicate with engineering professionals and the wider community through both written and oral mediums.

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

The project tasks are outlined as follows:

- Build, develop, or simulate the proposed model or solution based on the outcomes of Project Part-I.
- Write comprehensive test cases and conduct thorough project testing using appropriate tools and methodologies to ensure the robustness and reliability of the project.
- Analyze and compare the results and performance of the implemented solution using suitable metrics against proposed models or existing benchmarks.

- Prepare a detailed written report documenting the entire project, including methodology, findings, analysis, and conclusions, adhering to specified formatting guidelines, for presentation to the Departmental Review Committee (DRC).
- Deliver a final seminar presentation to the Departmental Review Committee (DRC), orally presenting the project findings, outcomes, and insights gained during the course of the project.

CRITERIAFOR EVALUATION AND AWARD OF CIE MARKS (Max. Marks: 100)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
DRC – Department Review Committee (50)	10	Review-I
	15	Review-II
	25	Pre Submission Review
Supervisor (50)	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the Work
	10	Report
	10	Analytical / Programming / Experimental Skills

CRITERIA FOR EVALUATION AND AWARD OF SEE MARKS (Max.Marks:100)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
External and Internal Examiners (100)	20	PowerPoint Presentation
	40	Thesis Evaluation
	20	• Quality of the project • Innovation • Practical applications • Integration with ongoing research projects • Potential for future study • Societal impact
	20	Viva-Voce

Note:
Students are instructed to:

- Based on the outcome of Project Part-II, Design a Solutions to a Problem.
- Conduct comprehensive analysis, modelling, simulation, design, problem-solving, and experimentation as required.
- Submit a project report in the designated format.
- Deliver project seminars according to the provided schedules.

- Publish a paper in a conference, journal with appropriate results, or obtain a patent before the external viva voce.

TEXT BOOKS:

1. Bioterrorism: Guidelines for Medical and Public Health Management, Henderson, Donald, American Medical Association, 1st Edition, 2002.
2. Biological Weapons: Limiting the Threat (BCSIA Studies in International Security), Lederberg, Joshua (Editor), MIT Press, 1999.
3. Bioterrorism and Infectious Agents: A New Dilemma for the 21st Century (Emerging Infectious Diseases of the 21st Century), I.W. Fong and Kenneth Alibek, Springer, 2005.

REFERENCE BOOKS:

1. The Demon in the Freezer: A True Story, Preston, Richard, Fawcett Books, 2003.
2. The Anthrax Letters: A Medical Detective Story, Cole, Leonard A., Joseph Henry Press, 2003.
3. Biotechnology research in an age of terrorism: confronting the dual use dilemma, National Academies of Science, 2003.