UG-R22 Curriculum
With effective from 2022-23

Information Technology

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institute | Affiliated to Osmania University)
Accreditated by NBA & NAAC (A++)
Kokapet Village, Gandipet Mandal, Hyderabad -500075, Telanagana.
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SCHEME OF INSTRUCTION AND SYLLABI

OF

B.E. / B. TECH. I TO VIII SEMESTERS

FOR
INFORMATION TECHNOLOGY

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

(R–22 Regulation)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

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

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

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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.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

DEPARTMENT OF INFORMATION TECHNOLOGY

(R22 Regulation)

SEMESTER – I

S. No.	Course Code	Title of the Course	Category	Hours per Week			Credits	Assessment Marks		
				L	T	P/D		CIE	SEE	Total
THEORY										
1	22MTC01	Linear Algebra & Calculus	BSc	3	1	0	4	40	60	100
2	22PYC01	Optics and Semiconductor Physics	BSc	3	0	0	3	40	60	100
3	22CSC01	Problem Solving and Programming	ESc	2	1	0	3	40	60	100
4	22EGC01	English	HSS	2	0	0	2	40	60	100
PRACTICALS										
5	22PYC03	Optics and Semiconductor Physics Lab	BSc	0	0	3	1.5	50	50	100
6	22EGC02	English lab	HSS	0	0	2	1	50	50	100
7	22CSC02	Problem Solving and Programming Lab	ESc	0	0	3	1.5	50	50	100
8	22MEC01	CAD and Drafting	ESc	0	1	3	2.5	50	50	100
9	22MEC38	Digital Fabrication Lab	ESc	0	0	3	1.5	50	50	100
Total				**10**	**3**	**14**	**20**	**410**	**490**	**900**

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

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

22MTC01

LINEAR ALGEBRA & CALCULUS

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

COURSE OBJECTIVES:

This course aims to

1. Explain the Partial Derivatives and the extreme values of functions of two variables.
2. Discuss Physical interpretations of scalar and vector functions.
3. Discuss vector 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:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22PYC01

OPTICS AND SEMICONDUCTOR PHYSICS

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

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

UNIT-I

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

UNIT-II

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

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTD READING:

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

22CSC01

PROBLEM SOLVING AND PROGRAMMING

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

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TEXT BOOKS AND REFERENCES:

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

NPTEL/SWAYAM COURSES:

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

22EGC01

ENGLISH

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

PREREQUISITE: Basic knowledge of English grammar and vocabulary.

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, 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/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	1	1	1	2	3	3	2	3
CO 2	1	1	1	1	1	1	1	1	1	2	1	3
CO 3	1	2	1	1	-	1	1	1	1	3	1	3
CO 4	1	2	1	1	-	1	1	2	2	2	2	3
CO 5	1	2	1	2	1	2	2	2	3	3	2	3

UNIT-I Communication Skills:

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

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

Reading Task I.

UNIT-II Reading Skills:
The Reading process, purpose, different kinds of texts; Reading Comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Practice in Critical Reading passages
Vocabulary and Grammar: Determiners. Use of Synonyms and Antonyms, Construction of Sentences.
Reading Task II.

UNIT-III Writing Skills II:
Paragraph Writing. – Structure and features of a paragraph; Essay writing, Cohesion and coherence. Techniques of writing précis.
Vocabulary & Grammar: Use of connectors and linkers, Tenses, Punctuation.
Reading Task III.

UNIT-IV Professional Writing Skills-1:
Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails, Email and Mobile etiquette.
Vocabulary and Grammar: Phrasal verbs, Misplaced modifiers, Subject-verb agreement.
Reading Task IV

UNIT-V Professional Writing Skills-2:
Report writing – Importance, structure, elements & style of formal reports; Writing a formal report. Writing for Blogs.
Vocabulary and Grammar: Words often Confused, Common Errors. Avoiding Ambiguity & Redundancy.
Reading Task V.

Text Books:

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

Suggested Readings:

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

22PYC03

OPTICS AND SEMICONDUCTOR PHYSICS LAB

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

COURSE OBJECTIVES:

This course aims to

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the conduction behaviour of semiconductor materials and optoelectronic devices

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally
3. Make use of lasers and optical fibers for engineering applications
4. Explain the V-I characteristics of some optoelectronic and semiconductor devices
5. Find the applications of thermistor

CO-PO ARTICULATION MATRIX

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

LIST OF EXPERIMENTS:

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

NOTE: A minimum of TWELVE experiments should be done.

22EGC02

ENGLISH LAB

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

PREREQUISITE: Basic Knowledge of English Communication.

COURSE OBJECTIVES:

This course aims to

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

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

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

CO-PO-PSO ARTICULATION MATRIX

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

LIST OF EXERCISES:

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

SUGGESTED READING:

1. T Balasubramanian, "A Textbook of English Phonetics for Indian Students", Macmillan, 2008.

2. J Sethi et al., "A Practical Course in English Pronunciation (with CD)", Prentice Hall India, 2005.
3. Priyadarshi Patnaik, "Group Discussions and Interviews", Cambridge University Press Pvt. Ltd., 2011.
4. Aruna Koneru, "Professional Speaking Skills", Oxford University Press, 2016.

22CSC02

PROBLEM SOLVING AND PROGRAMMING LAB

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

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

LABORATORY / PRACTICAL EXPERIMENTS:

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

TEXT BOOKS AND REFERENCES:

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

NPTEL/SWAYAM Courses:

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

22MEC01

CAD AND DRAFTING

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

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

CO-PO ARTICULATION MATRIX

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

LIST OF EXERCISES:

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

TEXT BOOKS:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt.Ltd, 2011.

3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

SUGGESTED READING:

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

22MEC38

DIGITAL FABRICATION LAB

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

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

LIST OF EXERCISES:

GROUP-1

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

5. To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings & bends.
6. To connect the GI pipes as per the given diagram using, couplings, unions, reducer & bends.
7. To connect the GI pipes as per the given diagram using shower, tap & valves and Demonstrate by giving water connection

GROUP- 2

1. To Study the method of Additive Manufacturing process using a 3D printer
2. To create a 3D CAD model of a door bracket using a modeling software
3. To print a door bracket using an extruder type 3D Printer.
4. To create a 3D CAD model by reverse Engineering
5. To Design an innovative component using the CAD software
6. To Print the selected innovative component by the students using a 3D printer

TEXT BOOKS:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Elements of Workshop Technology, Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Kalpakjian S. And Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
3. Sachidanand Jha, 3D PRINTING PROJECTS: 200 3D Practice Drawings For 3D Printing On Your 3D Printer, June 7, 2019.

SUGGESTED READING:

1. Gowri P. Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Oliver Bothmann , 3D Printers: A Beginner's Guide , January 1, 2015

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

DEPARTMENT OF INFORMATION TECHNOLOGY

(R22 Regulation)

SEMESTER – II

S. No.	Course Code	Title of the Course	Category	Hours per Week			Credits	Assessment Marks		
				L	T	P		CIE	SEE	Total
THEORY										
1	22MTC04	Differential Equations & Numerical Methods	BSc	3	1	0	4	40	60	100
2	22CYC01	Chemistry	BSc	3	0	0	3	40	60	100
3	22EEC01	Basic Electrical Engineering	ESc	2	1	0	3	40	60	100
4	22CSC03	Object Oriented Programming	ESc	2	1	0	3	40	60	100
PRACTICALS										
5	22CYC02	Chemistry Lab	BSc	0	0	3	1.5	50	50	100
6	22MBC02	Community Engagement	HSS	0	0	3	1.5	50	-	50
7	22CSC04	Object Oriented Programming Lab	ESc	0	0	2	1	50	50	100
8	22MEC37	Robotics and Drones Lab	ESc	0	2	2	3	100	-	100
9	22EEC02	Basic Electrical Engineering Lab	ESc	0	0	2	1	50	50	100
Total				**10**	**5**	**12**	**21**	**460**	**390**	**850**

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

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

22MTC04

DIFFERENTIAL EQUATIONS & NUMERICAL METHODS

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

COURSE OBJECTIVES:

This course aims to

1. 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:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
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 interpolation, Numerical differentiation at the tabulated points with forward, backward and central differences.

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22CYC01

CHEMISTRY

Instruction	3L Hours per Week
Duration of 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. Teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

COURSE OUTCOMES:

After completion of this course, students will be able to

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

UNIT-I Atomic and molecular structure and Chemical Kinetics:

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

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

UNIT-II Use of free energy in chemical equilibria

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

Battery technology: Rechargeable batteries & Fuel cells.

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

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

UNIT- III Stereochemistry and Organic reactions

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

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

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

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

UNIT–IV Water Chemistry:

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

UNIT-V Engineering Materials and Drugs:

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

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

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

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22EEC01

BASIC ELECTRICAL ENGINEERING

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

COURSE OBJECTIVES:

This course aims to

1. 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. Iinfer about different types of electrical wires and cables, domestic and industrial wiring, safety rules and methods of earthing.

COURSE OUTCOMES:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22CSC03

OBJECT ORIENTED PROGRAMMING

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

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

UNIT I:

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

UNIT II:

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

UNIT III:

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

UNIT IV:

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

UNIT V:

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

TEXT BOOKS AND REFERENCES:

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

NPTEL/SWAYAM Courses:

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

22CYC02

CHEMISTRY LAB

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

COURSE OBJECTIVES:

This course aims to

1. 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:

At the end of the course, student will be able to

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

CO-PO ARTICULATION MATRIX

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

LIST OF EXPERIMENTS

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2} & Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

TEXT BOOKS:

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

SUGGESTED READINGS

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

22MBC02

COMMUNITY ENGAGEMENT

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

COURSE OBJECTIVES:

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:

After completion of this course, students will be able to

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

Module I

Appreciation of Rural Society

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

Module II

Understanding Rural Economy and Livelihood

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

Module III

Rural Institutions

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

Module IV

Rural Development Programmes

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

TEXT BOOKS:

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

JOURNALS:

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

22CSC04

OBJECT ORIENTED PROGRAMMING LAB

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

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

LIST OF EXPERIMENTS:

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

Note: Programs need to be on OOPS concepts.

TEXT BOOK:

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

WEB RESOURCES:

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

22MEC37

ROBOTICS AND DRONES LAB

(Common to All Branches)

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

COURSE OBJECTIVES:

This course aims to

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

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

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

CO-PO ARTICULATION MATRIX

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

Lab Experiments:

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

Suggested readings

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

22EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	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:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

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

List of Laboratory Experiments/Demonstrations:

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

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

DEPARTMENT OF INFORMATION TECHNOLOGY

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22ITC01	Digital Logic and Computer Architecture	3	-	-	3	40	60	3
2	22CSC05	Data Structures	3	-	-	3	40	60	3
3	22CSC32	Discrete Mathematics	3	-	-	3	40	60	3
4	22ITC02	Java Programming	3	-	-	3	40	60	3
5	22CSC15	Operating systems	3	-	-	3	40	60	3
6	22EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	50	NC
PRACTICALS									
7	22CSC31	Data Structures Lab	-	-	2	3	50	50	1
8	22ITC03	Java Programming Lab	-	-	2	3	50	50	1
9	22ITC04	Operating Systems Lab	-	-	2	3	50	50	1
10	22ITC05	IT Workshop	-	-	2	-	50	-	1
11	22ITI01	MOOCs/Training/ Internship	2-3 Weeks / 90 Hours				50	-	2
TOTAL			17	0	8	-	450	500	21
Clock Hours per Week: 25									

L: Lecture D: Drawing **CIE: Continuous Internal Evaluation**

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

22ITC01

DIGITAL LOGIC AND COMPUTER ARCHITECTURE

(Common to IT, AI&DS and CET 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 Familiarize with logic gates, combinational and Sequential logic circuits.
2 Provide understanding of Digital Counters, registers and Data representation.
3 Present the operation of the Central Processing Unit.
4 Facilitate the techniques that computers use to communicate with input and output devices.
5 Introduce the concept of memory hierarchy and memory management.

COURSE OUTCOMES:

After completion of 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 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	2	2	1	0	1	0	0	0	1	0	0	1	2	0	3
CO2	2	1	1	0	1	0	0	0	0	0	0	1	1	0	3
CO3	2	2	1	0	0	0	0	0	0	0	2	2	0	0	3
CO4	2	1	0	0	0	0	0	0	0	0	0	2	0	0	3
CO5	2	2	1	0	0	0	1	0	1	0	2	2	1	0	3

UNIT–I

Data Representation: Number Systems, Octal and Hexadecimal Numbers, Decimal Representation, Complements: (r-1)'s Complement, r's Complement, Subtraction of Unsigned Numbers, Fixed–Point Representation, and Floating –Point Representation.

Digital Logic Circuits : Digital Computers, Logic Gates, Boolean Algebra, Map simplification, 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: General register Organization, Instruction Formats: Three Address Instructions, Two-Address Instructions, One-Address Instructions, and Zero-Address Instructions. Addressing Modes: Data Transfer and Manipulation, Program Control, Multi core Processors and their Performance.232

UNIT–IV

Input-Output Organization: Peripheral Devices: ASCII Alphanumeric Characters, Input-output Interface: I/O Bus and Interface Modules, Asynchronous Data Transfer: Strobe Control, Handshaking, Asynchronous Communication Interface, First-In- First-Out Buffer, Modes of Transfer: Interrupt-Initiated I/O, Priority Interrupt: Daisy Chaining, 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, Solid State Drive, Associative Memory: Hardware Organization, Read and Write Operations, Cache Memory: Associative Mapping, Direct Mapping, Set-Associative Mapping, Virtual Memory: Address Space and Memory Space, Address Mapping using Pages, Associative Memory Page Table.

Text Book:

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

Suggested Reading:

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/117106114Week1%20Slides1.1Introduction.pdf
2. https://ece.gmu.edu/coursewebpages/ECE/ECE545/F10/viewgraphs/ ECE545_lecture1_digital_logic_review.ppt
3. http://www.nptelvideos.in/2012/11/computer-organization.html

22CSC05

DATA STRUCTURES
(Common to CSE, CSE-AIML, AIML, CET, IT and AI&DS branches)

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

Pre-requisite: Basic knowledge of programming language such as python

COURSE OBJECTIVES:

This course aims to

1. Study various linear and non-linear data structures.
2. Understand the performance of operations on data structures.
3. Explore various searching and sorting techniques.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Understand the basic concepts and types of data structures.
2. Analyze various linear and nonlinear data structures.
3. Identify the applications of stacks, queues, trees and graphs.
4. Identify the significance of balanced search trees, graphs and hashing.
5. Evaluate various searching and sorting techniques.
6. Use appropriate data structures to design efficient algorithms.

CO-PO ARTICULATION MATRIX

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	2	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	1	2	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO6	3	3	1	-	-	-	-	-	-	-	-	-	-	2	-

UNIT-I

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

UNIT–II

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

UNIT-III

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

UNIT-IV

Trees: General Trees, Binary Trees, Implementing Trees, Tree traversals.

Search Trees: Binary Search Trees, Balanced search trees- AVL trees, B- trees.

Priority queue and Heaps: Priority queue ADT, Priority queue applications, Heap trees, implementing a priority queue with a Heap, Heap Sort.

UNIT-V

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

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

TEXT BOOKS:

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

SUGGESTED READING:

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

Web Resources:

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

22CSC32

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 and Predicate Logic
2. Introduce various proof techniques for validation of arguments.
3. Develop an understanding of counting, functions and relations.
4. Familiarize with fundamental notions and applicability of graph theory and algebraic systems

COURSE OUTCOMES:

After completion of this course, students will be able to

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

CO-PO ARTICULATION MATRIX

PO/PSO / CO	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	3	1	-	-	-	-	2	-	-	-	-	-
CO2	3	3	1	3	-	-	-	-	-	-	-	1	1	2	3
CO3	2	3	1	3	1	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	1	-	-	-	-	-	-	1	2	2	2
CO5	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I

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

UNIT-II

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

UNIT-III

Generating Functions: Generating Functions, Calculating Coefficient of generating functions.

Recurrence Relations: The First Order Linear Recurrence Relation, Second Order Linear. Homogeneous Recurrence relations with constant coefficients, Non Homogeneous Recurrence relations.

UNIT-IV

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

Trees: Definitions, Properties, Spanning Trees, **Minimum Spanning trees**: The Algorithms of Kruskal and 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. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", An Applied Introduction, 5th edition, Pearson Education, 2016. (latest edition)
2. Rosen, K. H. (2019). Discrete Mathematics and Its Applications. (8th Edition) ISBN10: 125967651X ISBN13: 9781259676512(latest edition)
3. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TATA Mc Graw-Hill Edition, 1995.

SUGGESTED READING:

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

WEB RESOURCES:

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

22ITC02

JAVA PROGRAMMING
(Common to IT, AI&DS and CET 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. Deliver the Object oriented programming features and principles for code development.
2. Explore the reusability of the code, coupling and cohesion.
3. Handle the exceptions and multiple flow of the execution.
4. Understand the collection framework.
5. Develop the database applications.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Apply the concept of OOP to design, implement and execute programs.
2. Use the strings, interfaces, packages and inner classes for application development.
3. Apply the exception handling mechanisms and multithreading for the development.
4. Develop applications using collection framework.
5. Develop database applications using SQL package.

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	2	2	3	3	2	2	-	1	2	1	2	2	2	2	2
CO2	2	2	3	2	2	1	-	1	2	1	2	2	2	2	2
CO3	2	2	3	2	2	1	-	1	2	1	2	2	2	2	2
CO4	2	2	3	2	2	1	-	1	2	1	2	2	2	2	2
CO5	2	2	3	2	3	1	-	1	2	1	2	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.

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.

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, legacy and class,

Iteration over Collections – Iterator and List Iterator, Enumeration interfaces, differentiate Comparable and Comparator interface, Introduction to Java 8 Features.

UNIT-V

Servlets, JSP and Databases: Introduction to Servlets, Servlet Life cycle, Request and Response methods-Servlet Collaboration. Servlet Config vs. Servlet Context, JSP, Databases: Connecting to Database - JDBC, Drivers, Connection, Statement and its types, Result set, CRUD operations.

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.
3. Bruce W.perry "Java Servlet and JSP Cookbook", O'reilly Media Inc., 2004.

SUGGESTED READING:

1. Sachin Malhotra, Saurabh Choudhary, "Programming in Java", Oxford University Press, 2nd Edition, 2014.
2. C.ThomasWu, "An Introduction to Object-Oriented Programming with Java", Tata McGraw-Hill, 4th Edition, 2010.
3. E Balaguruswamy "Programming with Java", Tata McGraw-Hill, 6th Edition, 2019.
4. Cay S. Horstmann, Gary Cornell,"Core Java, Volume I— Fundamentals", 8th Edition, Prentice Hall, 2008.
5. K Somasundaram "Introduction to Java Programming", Jaico Publishing House, 2016.
6. 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

22CSC15

OPERATING SYSTEMS
(Common to IT and AI&DS branches)

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

Pre-requisites: Computer Architecture and Programming Fundamentals.

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Understand the basics of Operating systems and its major components.
2. Illustrate the concepts related to process management.
3. Distinguish various memory management techniques.
4. Apply concepts of process synchronization and deadlocks to a given situation.
5. Evaluate various file allocation methods and Apply security as well as recovery features in the design Operating system.

CO-PO ARTICULATION MATRIX

PO/PSO / CO	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	2	1	1	-	-	-	-	-	-	-	-	-	-	2	3
CO2	3	3	-	3	1	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	1	-	-	-	-	-	-	-	1	1	3
CO4	3	3	1	3	-	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	3	1	-	-	-	-	-	-	-	1	2	3

UNIT–I

Introduction to Operating Systems: Computer System overview, Components of a computer system, functions of OS, Examples, different types of OS (RTOS vs. desktop vs. mobile etc.), OS distributions and versions.

OS architectures: Micro-kernel, Layered, Kernel Approaches and examples.

UNIT–II

Process management: Program vs. process, process states, Process Control Block (PCB), OS services and system calls (fork, wait, exec, getpid, getppid etc.), system calls vs. System programs, Process scheduling- Process context switching, Scheduling algorithms, scheduling criteria.

Inter Process Communication: Linux IPC Mechanisms, RPC, RPC exception handling, Security issues.

UNIT–III

Memory Management: Memory view of a process, Process memory usage requirements, virtual and physical memory related system calls (mmap, munmap, sbrk, mprotect). Address translation mechanisms --- static mapping, segmentation, paging, page faults, page replacement algorithms, page sharing, read/write permissions, swapping.

Secondary Memory Management: Disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels.

UNIT–IV

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

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

UNIT-V

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

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

TEXT BOOKS:

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

SUGGESTED READING:

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

WEB 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]
3. https://github.com/mit-pdos/xv6-riscv (RISC-V version) [T4-X] https://github.com/mit-pdos/xv6-public (x86 version)

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

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

Prerequisite: Basic awareness of Indian Constitution and Government.

COURSE OBJECTIVES:

This course aims 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 completion of this course, students will be able to

1. Understand the history of framing of the Indian Constitution and its features.
2. Assess the realization of Fundamental Rights and Directive Principles of State Policy.
3. 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	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	1	-	-	1	1	1	1	-	-	-	1	-	-
CO 2	-	-	2	-	-	3	2	2	1	-	-	-	1	1	-
CO 3	-	-	1	-	-	1	1	-	-	-	-	-		-	-
CO 4	-	-	1	-	-	1	1	-	-	-	-	-	1	-	-
CO 5	-	-	2	-	-	3	2	1	1	-	-	-	1	-	-

UNIT-I

Constitutional History and Framing of Indian Constitution

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

UNIT-II

Fundamental Rights, Duties and Directive Principles of State Policy

The Fundamental Rights**:** Features 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.

22CSC31

DATA STRUCTURES LAB

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

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

Pre-requisites: Any Programming Language

COURSE OBJECTIVES:

This course aims to

1. Understand the basic concepts of data structures and abstract data types.
2. Explore linear and non-linear data structures.
3. Study various searching, sorting and hashing techniques.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Implement non-linear data structures such as trees, graphs.
4. Evaluate various sorting techniques.
5. Analyze various algorithms of linear and nonlinear data structures.
6. Choose or create appropriate data structures to solve real world 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	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	1	2	2
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	2	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	1	1	2
CO5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

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

TEXT BOOKS:

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

22ITC03

JAVA PROGRAMMING LAB

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

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

COURSE OBJECTIVES:

This course aims to

1. Deliver the basic principles of OOP.
2. Explore the object-orientation process in creating classes, object, etc.,
3. Demonstrate the inheritances and polymorphism.
4. Handle the exceptions in runtime and multithreading.
5. Develop the database applications.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Practice the basics of OOPs to develop java applications.
2. Use the inheritance and interfaces for application development.
3. Apply the exception handling and multithreading to handle multiple flows of execution.
4. Develop applications using collection framework.
5. Apply the SQL concepts for application development.

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	2	2	3	3	2	2	-	1	2	1	2	2	2	2	2
CO2	3	3	3	2	2	1	-	1	2	2	2	3	2	2	2
CO3	2	2	3	2	2	1	-	1	2	1	2	2	2	2	2
CO4	2	2	3	2	2	1	-	1	2	1	2	2	2	2	2
CO5	3	3	3	2	3	1	-	1	2	2	2	3	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 dynamic method dispatch and constructor.
3. Develop a java program(s) to deal with different types of inheritances and interfaces.
4. Implement the program(s) to demonstrate the packages.
5. Develop a java program(s) to handle user defined exceptions with multiple catch blocks.
6. Implement program(s) to demonstrate Multithreading and thread synchronization.
7. Implement the collection framework classes with Iterator/List Iterator/Enum Interface.
8. Develop a java program(s) to implement the features of JDK8.
9. Implement a java program(s) to implement the concept of Servlets and JSP.
10. Create a web application to implement CRUD operations using Servlets, JSP and Databases.

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.
3. Bruce W.perry “Java Servlet and JSP Cookbook”, O’reilly Media Inc., 2004.

SUGGESTED READING:

1. Sachin Malhotra, Saurabh Choudhary, “Programming in Java”, Oxford University Press, 2nd Edition, 2014.
2. C.ThomasWu, “An Introduction to Object-Oriented Programming with Java”, TataMcGraw-Hill, 4th Edition, 2010.
3. E Balaguruswamy “Programming with Java”, TataMcGraw-Hill, 6th Edition, 2019.
4. Cay S. Horstmann, Gary Cornell,”Core Java, Volume I— Fundamentals”, 8th Edition, Prentice Hall, 2008.
5. K Somasundaram “Introduction to Java Programming”, Jaico Publishing House, 2016.
6. 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

22ITC04

OPERATING SYSTEMS LAB

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

COURSE OBJECTIVES:

This course aims to

1. Familiarize with Unix commands and the command-line interface.
2. Understand shell scripting and its applications in automating tasks and managing system resources.
3. Understand Process Creation and Inter-Process Communication using system calls.
4. Learn Process synchronization mechanisms and scheduling algorithms.
5. Learn various Page Replacement, deadlock detection, and Avoidance algorithms.

COURSE OUTCOMES:

After completion of this course, students will be able

1. Use the command-line interface and basic Unix commands.
2. Develop shell scripts for simple tasks.
3. Demonstrate inter-process communication (IPC) using Pipes, Shared Memory, and Message queues.
4. Compare the performance of various CPU Scheduling Algorithms and demonstrate Process Synchronization using semaphores.
5. Analyze the performance of the various Page Replacement, Deadlock detection, and avoidance algorithms.

CO-PO ARTICULATION MATRIX

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	2	2	0	0	0	1	0	0	0	3	0	1
CO2	2	1	1	1	2	0	0	0	0	0	0	0	3	1	1
CO3	2	2	1	2	3	0	0	0	1	0	0	0	1	0	0
CO4	2	3	2	2	3	0	0	0	1	0	0	0	1	0	2
CO5	3	3	0	1	3	1	0	0	1	0	0	0	1	0	2

LIST OF EXPERIMENTS:

1. Exploring the Unix commands for
   a. Files (ls, cd, mkdir, rmdir, cp, mv, rm, cat, cmp, diff, wc, chmod, chown, compress, uncompress, more, less, head, tail, cut, paste)
   b. Process (ps, kill, top, nice, fork system call)
   c. Networking (ping, ifconfig, netstat, route, ssh, scp, ping)

2. Developing shell scripts for the following.
   a. System resources Monitoring
   b. User accounts Creation

3. Demonstration of the following IPC mechanisms.
   a. Pipes
   b. Shared Memory
   c. Message Passing.

4. Implementation of the following CPU Scheduling Algorithm:
   a. FCFS
   b. SJF
   c. SRTF

   d. Round Robin

5. Implementation of the solution for Producer-Consumer Problem.
6. Implementation of the solution for Dining Philosophers Problem.
7. Implementation of the solution for Reader-Writers Problem.
8. Implementation of Banker's algorithm for Deadlock Avoidance.
9. Implementation of Deadlock Detection algorithm using Resource Allocation Graph.

10. Implementation of the following Page Replacement Algorithms.
    a. FIFO
    b. LRU
    c. OPTIMAL

TEXT BOOKS:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons publications, 2018.
2. Sumitabha Das, "UNIX: Concepts and Applications" Tata McGraw Hill Education (India) Private Limited; 4th edition, 2017.
3. W. Richard. Stevens (2005), Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India.

SUGGESTED READING:

1. William Stallings, "Operating Systems", Fifth Edition, Pearson Education, 2005.
2. A.Tanenbaum, "Modern Operating Systems", 4th Edition, Pearson Education, 2015.
3. Unix and shell Programming Behrouz A. Forouzan, Richard F. Gilberg, Thomson Asia, 2005.

WEB RESOURCES:

1. https://www.cse.iitb.ac.in/~mythili/os/
2. https://profile.iiita.ac.in/bibhas.ghoshal/teaching_os_lab.html

22ITC05

IT WORKSHOP

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

COURSE OBJECTIVES:

This course aims to

1. Introduce the basic components of a computer, assembling and disassembling a PC. Installation procedure of Operating Systems.
2. Facilitate knowledge on Internet Services, awareness of cyber hygiene, protecting the personal computer.
3. Impart knowledge on Latex and Ms -word.
4. Provide knowledge on how to create interactive presentations using PowerPoint.
5. Familiarize with the concepts of Ms-Excel.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Identify the basic components of a computer, gain knowledge on assembling and disassembling a PC and OS installations.
2. Inspect internet connectivity issues, secure a computer from cyber threats.
3. Make use of Latex and Ms-word for creating effective documents.
4. Create effective presentations using Ms-PowerPoint.
5. Create, Organize and analyze data within an Excel spreadsheet.

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	2	1	2	1	1	2	1	-	-	1	1	2	3	3	2
CO2	2	1	2	1	1	2	1	-	1	1	1	2	3	3	2
CO3	2	2	2	1	1	2	1	3	3	1	1	2	2	3	3
CO4	2	2	2	2	3	-	1	-	-	3	2	2	1	-	3
CO5	2	2	2	2	3	-	1	-	3	3	2	2	1	-	3

LIST OF EXPERIMENTS

PC HARDWARE:

Task 1: Identification of the peripherals of a computer, block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices, Introduction to Memory and Storage Devices , I/O Port, Device Drivers.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

INTERNET & WORLD WIDE WEB:
Task1 : Web Browser usage and advanced settings like LAN, proxy, content, privacy, security, cookies, extensions/plugins, Antivirus installation, configuring a firewall, blocking pop-ups, Google search techniques (text based, voice based), alexa website traffic statistics, Email creation and usage, google hangout/skype/gotomeeting video conferencing, archive.org for accessing archived resources on the web, Creating a Digital Profile on LinkedIn, Twitter, Github.

Task2: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD
Task 1 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

POWER POINT
Task 1: Students will be working on basic power point utilities and tools which help them create basic PowerPoint presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

EXCEL
Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2 :Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in excel – average, standard deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

TEXT BOOKS:

1. Peter Norton, “Introduction to Computers”, McGraw Hill Education, 7th edition,2017
2. Vikas Gupta, “Comdex Information Technology course tool kit” , WILEY Dreamtech
3. Cheryl A Schmidt, “The Complete Computer upgrade and repair book”, 3rd edition WILEY Dreamtech.

SUGGESTED READING:

1. ITL Education Solutions limited, “Introduction to Information Technology”, Pearson Education.
2. Kate J. Chase, “PC Hardware - A Handbook” PHI (Microsoft)
3. Leslie Lamport, “LaTeX Companion”, PHI/Pearson.
4. David Anfinson and Ken Quamme, “IT Essentials PC Hardware and Software Companion Guide”, Third Edition, CISCO Press, Pearson Education.
5. Patrick Regan, “IT Essentials PC Hardware and Software Labs and Study Guide”, Third Edition, CISCO Press, Pearson Education.

WEB RESOURCES:

1. https://www.overleaf.com/learn

22ITI01

MOOCs/Training/Internship

Instruction/Demonstration/Training	2-3 Weeks/90 Hours
Duration of SEE	-
SEE	-
Mid Term Evaluation	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 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	3	3	2	2	1	1	3	2	3	3	3	3	1
CO2	2	2	2	1	1	2	2	1	3	2	3	3	3	3	-
CO3	3	2	1	1	1	2	2	1	2	2	3	3	2	3	1
CO4	2	3	3	3	1	2	1	-	3	3	3	3	3	2	-
CO5	1	1	1	1	1	1	-	-	2	3	3	3	1	3	-

Process to be followed to undergo Internships for 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 based on the following criteria:

- Originality
- Adequacy and purposeful write-up
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience
- Practical applications, relationships with basic theory and concepts taught in the course

Evaluation of Internship: The internship of the students will be evaluated in three stages:

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

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

DEPARTMENT OF INFORMATION TECHNOLOGY

(R22 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	22ECC40	DC Circuits, Sensors and Transducers	3	-	-	3	40	60	3
3	22CSC11	Database Management Systems	3	-	-	3	40	60	3
4	22CSC14	Design and Analysis of Algorithms	3	-	-	3	40	60	3
5		Professional Elective – I	3	-	-	3	40	60	3
6	22MBC01	Engineering Economics & Accountancy	3	-	-	3	40	60	3
7	22CEM01	Environmental Science	2	-	-	2	-	50	NC
PRACTICALS									
8	22CSC33	Database Management Systems Lab	-	-	2	3	50	50	1
9	22ITC06	Algorithms Lab	-	-	2	3	50	50	1
10	22ITC07	Mini Project – I	-	-	2	-	50	-	1
TOTAL			**20**	**1**	**6**	**-**	**390**	**510**	**22**
Clock Hours per Week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

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

Professional Elective-1		
S.No.	**Course Code**	**Course Name**
1.	22ITE01	Data Mining
2.	22ITE02	Digital Image Processing
3.	22ITE03	Fundamentals of Cryptography
4.	22ITE04	Mobile Application Development
5.	22ADE01	Data Analysis and Visualization

22MTC15

PROBABILITY AND QUEUEING THEORY

Instruction	3 L+1T Hours per week
Duration of SEE	4 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. Students are 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:

After completion of this course, students 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 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	2	2	2	1	-	-	-	-	-	-	-	1	1	1	1
CO2	2	2	2	1	-	-	-	-	-	-	-	1	1	1	2
CO3	2	2	1	1	-	-	-	-	-	-	-	1	1	1	2
CO4	2	2	1	1	-	-	-	-	-	-	-	1	1	-	2
CO5	2	2	1	1	-	-	-	-	-	-	-	1	1	-	-

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):(∞/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.

22ECC40

DC CIRCUITS, SENSORS AND TRANSDUCERS

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

Prerequisite: Concepts of Semiconductor Physics and Applied Physics.

COURSE OBJECTIVES:

This course aims to

1. Describe semiconductor device's principles and understand the characteristics of junction diode and transistors.
2. Understand working principles of Sensors, and Transducers.
3. Understand Interfacing of various modules of sensors with myRIO.

COURSE OUTCOMES:

After 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	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	1	2	3	2	3	2	3	2	-	-	-
CO2	3	3	3	2	1	2	3	2	3	2	3	2	-	-	-
CO3	3	2	3	2	3	3	3	2	3	2	3	2	-	-	-
CO4	3	3	3	3	3	3	3	2	3	2	3	2	-	2	2
CO5	3	3	3	3	3	3	3	2	3	2	3	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.

22CSC11

DATABASE MANAGEMENT SYSTEMS

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

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

Pre-requisites: Discrete mathematics of computer science, Programming and Data Structures.

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

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

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	2	2	2	2	3	-	-	-	-	-	-	1	1	1	2
CO2	2	3	2	2	3	-	-	-	-	-	-	1	2	2	2
CO3	2	1	2	1	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	1	-	-	-	-	-	-	-	-	-	1	-	2
CO5	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I

Introduction: Motivation, Introduction to Data Models (Relational, Semi structured, ER).

Relational Data Bases: Relational Data Model, Relational Algebra, Relational Calculus.

UNIT-II

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

UNIT-III

Big Data: Key-value Stores and Semi structured Data, using JSON and MongoDB, or other combinations

Database Design: Introduction to ER model, Mapping from ER to relational model, Functional Dependencies, Normalization.

UNIT-IV

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

UNIT-V

Query Processing and Optimization: Query Processing, External sort, Joins using nested loops, indexed nested loops.
Overview of Query Optimization: Equivalent expressions, and concept of cost based optimization.
Transaction Processing: Concept of transactions and schedules, ACID properties, Conflict-serializability.
Concurrency control: locks, 2PL, Strict 2PL, optional: isolation levels, Recovery using undo and redo logs.

TEXT BOOKS:

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

SUGGESTED READING:

1. MySQL Explained: Your Step By Step Guide to Database Design, Andrew Comeau,23-NOV-2015
2. Pro SQL Server 2008 Relational Database Design and Implementation (Expert's Voice in SQL Server) 1st Edition

WEB RESOURCES:

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

22CSC14

DESIGN AND ANALYSIS OF ALGORITHMS

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

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

Pre-requisites: Basics of Data structures and algorithms.

COURSE OBJECTIVES:

This course aims to

1. 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:

After completion of this course, students will be able to

1. Analyze performance of algorithms using asymptotic notations.
2. Demonstrate familiarity with major algorithms and importance of algorithm design techniques.
3. Apply algorithm design techniques of different problems.
4. Analyze the efficiency of the algorithms
5. Understand limits of efficient computation with help of 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	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	2	1	-	-	-	-	-	-	1	1	2
CO2	3	3	2	-	1	-	-	-	1	-	1	1	-	-	2
CO3	3	2	2	2	2	-	-	-	1	-	1	-	1	-	2
CO4	3	3	2	2	2	-	1	-	1	-	-	-	-	-	-
CO5	3	2	2	2	2	1	1	-	1	-	-	-	1	1	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. **Analysis of recursive algorithms through recurrence relations**: Substitution method, Recursion tree method and Masters‟ theorem, Randomized Quicksort.

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Shortest Path Algorithms: Dijkstra‟s, Bellman-Ford, Floyd-Warshall and Johnson‟s algorithms**. Minimum Spanning Tree Algorithms:** Prim‟s and Kruskal‟s.

UNIT-V

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

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

TEXT BOOKS:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, “Introduction to Algorithms”, MIT Press/McGraw-Hill, 3rd Edition, 2009.
2. E. Horowitz, sartajsahni and sanguthevarRajasekaran, “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.

WEB RESOURCES:

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

22MBC01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

COURSE OUTCOMES:

After completion of this course, students will be able to

1 Apply fundamental knowledge of Managerial Economics Concepts and Tools.
2 Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3 Understand Production and Cost relationships to make 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/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	1	1	3	1	1	1	1	1	1	1	-	-	1	2	3
CO2	2	2	2	2	-	1	1	1	-	1	-	1	1	1	2
CO3	1	2	1	2	2	-	2	1	-	1	-	-	-	-	-
CO4	2	2	1	2	2	1	1	3	-	1	-	-	-	-	-
CO5	1	3	1	2	1	1	2	-	-	1	2	1	-	-	-

UNIT-I

Introduction to Managerial Economics: Introduction to Economics and Its Evolution - Managerial Economics - Its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic Concepts of Managerial Economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, 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 Isocosts, MRTS, Input - Output Relations; Laws of Returns. Cost Analysis: Cost Concepts – Types of Costs, Cost - Output Relationship – Short Run and Long Run; Market Structures – Types of Competition, Features of Perfect Competition, Price Output Determination under Perfect Competition, Features of Monopoly Competition, Price Output Determination under Monopoly Competition. Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READINGS:

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

22CEM01

ENVIRONMENTAL SCIENCE

Instruction	2L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	No Credits

COURSE OBJECTIVES:

This course aims to

1. Figure out a more sustainable way of living.
2. Understanding the behaviour exhibited by organisms under some natural conditions.
3. Educating and making people aware of different environmental issues and problems.
4. Using natural resources in an effective manner without actually causing any harm to the environment.
5. Exposing students to how science and the scientific method address environment systems and issues.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Identify the natural resources and realize the importance of water, food, forest, mineral, energy, land resources and effects of over utilization.
2. Understand the concept of ecosystems and realize the importance of interlinking food chains.
3. Contribute to the conservation of bio-diversity.
4. Suggest suitable remedial measures for the problems of environmental pollution and contribute for the framing of legislation for protection of the environment.
5. Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.

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	1	-	-	-	-	-	3	-	-	-	-	1	1	1	-
CO2	1	-	-	-	-	-	2	1	-	-	-	1	-	-	
CO3	1	-	-	-	-	-	2	1	-	-	-	1	-	-	-
CO4	1	-	-	-	-	1	2	1	-	-	-	1	-	-	-
CO5	1	-	-	-	-	1	2	1	-	-	-	1	2	3	-

UNIT-I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

TEXT BOOKS:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

SUGGESTED READING:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006

22CSC33

DATABASE MANAGEMENT SYSTEMS LAB

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

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

COURSE OBJECTIVES:

This course aims to

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

COURSE OUTCOMES:

After completion of this course, students will be able to

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

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	2	2	2	3	-	-	-	2	-	1	3	2	2	2
CO2	3	3	2	3	3	-	-	-	2	-	1	3	1	2	3
CO3	3	2	2	2	3	-	-	-	2	-	1	1	-	-	-
CO4	3	1	1	1	-	-	-	-	2	-	1	-	-	-	-
CO5	3	1	1	1	-	-	-	-	2	-	1	-	1	1	2
CO6	3	1	-	1	-	-	-	-	1	-	1	-	-	-	-

LIST OF EXPERIMENTS

SQL:

1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using operators in SQL.
3. Queries to Retrieve and Change Data: Select, Insert, Delete and Update.
4. Queries using Group By, Order By and Having Clauses.

5. Queries on Controlling Data: Commit, Rollback and Save point.
6. Queries to Build Report in SQL *PLUS.
7. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
8. Queries on Joins and Correlated Sub-Queries.
9. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update,
10. Creating Password and Security features.
11. Querying in NoSql

PL/SQL:

1. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
2. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/SQL.
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL.
4. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
5. Write a PL/SQL code using Procedures, Functions and Packages.

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

TEXT BOOKS:

1. “Oracle: The complete Reference”, by Oracle Press, BOB bryla, 2013.
2. Nilesh Shah, “Database Systems Using Oracle”, PHI, 2007.
3. Rick FVanderLans, “Introduction to SQL”, Fourth Edition, Pearson Education, 2007.

SUGGESTED READING:

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

WEB RESOURCES:

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

22ITC06

ALGORITHMS LAB

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

COURSE OBJECTIVES:

This course aims to

1. Introduce Divide and conquer algorithmic strategy.
2. Familiarize with the Greedy Paradigm.
3. Introduce Dynamic programming algorithms.
4. Gain knowledge of connected and disconnected components.
5. Introduce Backtracking technique.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Implement Divide and Conquer Strategy.
2. Build solutions using Greedy technique.
3. Apply Dynamic programming technique to solve problems.
4. Determine connected and biconnected components from a Graph.
5. Design solutions using Backtracking technique.

CO-PO ARTICULATION MATRIX

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	1	0	0	0	0	0	0	2	2	3	3
CO2	3	3	2	2	1	0	0	0	0	0	0	2	2	3	3
CO3	3	3	2	2	1	0	0	0	0	0	2	2	2	0	3
CO4	3	3	2	2	1	0	0	0	0	0	0	2	2	0	3
CO5	3	3	2	2	1	0	0	0	0	0	0	2	2	3	3

LIST OF EXPERIMENTS

1. Demonstrate the Divide and Conquer technique to determine the maximum and minimum elements from any given list of elements.
2. Implement Merge sort algorithm for sorting a list of integers in ascending order.
3. Implement greedy algorithm for job sequencing with deadlines.
4. Implement Prim's and Kruskal's algorithms to generate minimum cost spanning tree.
5. Implement Dijkstra's algorithm for the Single source shortest path problem.
6. Implement Dynamic Programming technique for the 0/1 Knapsack problem.
7. Implement Dynamic Programming technique for the Optimal Binary Search Tree Problem.
8. Implement an algorithm to determine whether any given graph has connected components or not, and identify any articulation points that may be present.
9. Implement backtracking algorithm for the N-queens problem.
10. Implement backtracking algorithm for the given graph problems.
    A. Hamiltonian Cycle problem.
    B. Graph Coloring problem.

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahani, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithm", 2nd Edition, Universities Press, 2011.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India Private Limited, 2006.

SUGGESTED READING:

1. Levitin A, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2008.

2. Goodrich M.T.R Tomassia, "Algorithm Design foundations Analysis and Internet Examples", John Wiley and Sons, 2006.
3. Base Sara, Allen Van Gelder, "Computer Algorithms Introduction to Design and Analysis", Pearson, 3rd Edition, 1999.

WEB RESOURCES:

1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. http://nptel.ac.in/courses/ 106101060
4. http://www.facweb.iitkgp.ernet.in/~sourav/daa.html

22ITC07

MINI PROJECT – I

Instruction	2P 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:

After completion of this course, students 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 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	3	3	3	3	2	1	2	3	3	2	3	3
CO2	3	3	3	3	3	3	3	2	1	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	-	2	3	3	3	3	3
CO4	2	2	2	3	3	3	3	2	3	3	2	3	2	3	3
CO5	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.

22ITE01

DATA MINING
(Professional Elective – I)

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 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:

After completion of this course, students 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 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	1	3	2	-	-	-	-	1	1	1	3	3	2
CO2	2	2	2	2	-	-	-	-	-	1	-	1	3	3	2
CO3	3	3	2	2	2	-	1	-	-	-	1	1	3	3	2
CO4	3	3	2	3	2	-	1	-	-	-	1	1	3	3	2
CO5	2	2	1	2	1	-	1	-	-	-	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 RESOURCES:

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

22ITE02

DIGITAL IMAGE PROCESSING

(Professional Elective – I)

(Common to IT and AI&DS 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 the fundamental concepts and applications of digital image processing.
2. Impart knowledge on the image processing concepts: intensity transformations, spatial filtering, smoothing, and sharpening both in spatial and frequency domain.
3. Familiarize the image analysis concepts: morphological image processing, image segmentation, image representation and description, and object recognition.
4. Introduce colour image processing techniques.
5. Understand various image compression methods.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Illuminate the fundamental concepts and applications of digital image processing techniques.
2. Demonstrate intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration concepts.
3. Demonstrate image restoration and morphological image processing methods.
4. Apply object recognition techniques by using image segmentation and image representation & description methods.
5. Illustrate the various colour models and Application of image compression methods.

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	2	1	1	1	1	-	1	-	-	-	-	1	2	3	3
CO2	2	2	2	1	-	2	1	-	-	1	-	1	2	3	3
CO3	2	2	2	1	-	2	1	-	-	1	-	1	2	3	3
CO4	2	1	1	2	1	-	1	-	-	-	-	1	2	3	3
CO5	2	2	2	1	-	2	1	-	-	1	-	1	2	3	3

UNIT-I

Introduction: Fundamental Steps in Digital Image Processing, Image Sampling and Quantization, Some Basic Relationships between Pixels; **Intensity Transformations:** Some Basic Intensity Transformation Functions, Histogram Processing - Histogram Equalization, Histogram Matching (Specification)

UNIT-II

Spatial Filtering: Fundamentals of Spatial Filtering, Smoothing Spatial Filters; Sharpening Spatial Filters; **Filtering in the Frequency Domain**: The 2-D Discrete Fourier Transform and its inverse; The Basics of Filtering in the Frequency Domain; Image Smoothing Using Frequency Domain Filters - Ideal, Butterworth and Gaussian Low pass Filters; Image Sharpening Using Frequency Domain Filters - Ideal, Butterworth and Gaussian High pass Filters.

UNIT-III

Image Restoration and Reconstruction: A Model of the Image Degradation/Restoration Process, Noise Models; Restoration in the Presence of Noise Only—Spatial Filtering; Periodic Noise Reduction by Frequency Domain Filtering; Estimating the Degradation Function; Inverse Filtering; Minimum Mean Square Error (Wiener) Filtering; **Morphological Image Processing**: Preliminaries; Erosion and Dilation; Opening and Closing, The Hit or Miss Transform

UNIT-IV

Image Segmentation: Fundamentals; Points, Line and Edge Detection, Thresholding; Segmentation by Region Growing, Region Splitting and Merging

Feature Extraction: Boundary Pre-processing, Boundary Feature Descriptors, Some Simple Region Descriptors.

Image Pattern Classification: Patterns and Pattern Classes, Pattern Classification by Prototype Matching

UNIT-V

Colour Image Processing: Colour Fundamentals; Colour Models, Pseudo Colour Image Processing, Basics of full Colour Image Processing;

Image Compression: Fundamentals, Huffman Coding, Arithmetic Coding, LZW Coding

TEXT BOOK:

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education, 4th Edition, 2020.

SUGGESTED READING:

1. Vipula Singh, ―Digital Image Processing with MatLab and lab View‖, Elsevier.
2. Thomas B. Moeslund, ―Introduction to Video and Image Processing: Building Real Systems and Applications‖, Springer, 2012.
3. Milan Sonka, Vaclav Halvac and Roger Boyle, ―Image Processing, Analysis, and Machine Vision‖, 2nd Edition, Thomson Learning Publishers.
4. Kenneth R.Castleman, ―Digital Image Processing‖, Pearson Education, 2006.

WEB RESOURCES:

1 www.imageprocessingplace.com
2 https://in.mathworks.com/discovery/digital-image-processing.html
3 https://imagemagick.org/
4 https://nptel.ac.in/courses/117105079/

22ITE03

FUNDAMENTALS OF CRYPTOGRAPHY
(Professional Elective – I)

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 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 and user authentication.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Demonstrate the key security concepts, security attacks and cryptography techniques.
2. Understand and apply various concepts of number theory in symmetric encryption algorithms.
3. Interpret operations of asymmetric key cryptography models and secure hash functions.
4. Make use of the concepts of message authentication codes and digital signatures in real time applications.
5. Understand concepts related to key distribution, user authentication.

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	2	2	2	2	1	3	1	1	1	0	1	1	2	3	3
CO2	2	3	3	2	1	3	1	1	1	1	1	1	2	3	3
CO3	2	3	3	2	1	3	1	1	1	1	1	1	2	3	3
CO4	2	3	3	2	1	3	1	1	1	1	1	1	2	3	3
CO5	2	3	3	2	1	3	1	1	1	1	1	1	2	3	3

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.

Bloc 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/

22ITE04

MOBILE APPLICATION DEVELOPMENT

(Professional Elective – I)

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

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Understand the benefits of using Kotlin for Mobile application development.
2. Design user interface for mobile applications.
3. Use Intent, Broadcast receivers and Internet services in Android App.
4. Use multimedia, camera and Location based services in Android App.
5. Apply best practices to implement databases and publish apps on Playstore.

CO-PO ARTICULATION MATRIX

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2	2	0	0	0	0	0	2	0	0	0	0	2
CO2	2	3	3	2	3	3	3	0	0	1	0	1	3	0	3
CO3	2	2	3	3	2	3	3	0	0	1	0	1	3	0	3
CO4	2	2	3	2	2	3	3	0	0	1	0	1	3	0	3
CO5	2	2	3	3	3	3	3	0	1	1	1	1	3	0	2

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

1. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012.
2. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD Publishers, 2015.

SUGGESTED READING:

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

WEB RESOURCES:

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

22ADE01

DATA ANALYSIS AND VISUALIZATION

(Professional Elective – I)

(Common to IT and AI&DS 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 the Numpy library in Python to support storage and operations on large multi-dimensional arrays and matrices.
2. Introduce large collection of mathematical functions to operate on multidimensional sequential data structures.
3. Demonstrate the functionality of the Pandas library in Python for open source data analysis and manipulation
4. Demonstrate Data Aggregation, Grouping and Time Series analysis with Pandas.
5. Introduce the Matplotlib library in Python for resting static, animated and interactive visualizations.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Use Numpy library utilities for various numerical operations.
2. Apply pandas library functions for handling data frames
3. Perform various preprocessing operations on datasets using Pandas Series and DataFrame objects.
4. Analyze the given dataset and derive conclusions using inferential statistics.
5. Apply 2-D and 3-D plotting techniques on datasets using matplotlib and seaborn.

CO-PO ARTICULATION MATRIX

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

WEB RESOURCES:

1. https://www.coursera.org/learn/python-data-analysis?specialization=data-science-python
2. https://www.coursera.org/learn/python-plotting

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

DEPARTMENT OF INFORMATION TECHNOLOGY

(R22 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	22CSC21	Software Engineering	3	-	-	3	40	60	3
2	22ITC08	Enterprise Application Development	3	-	-	3	40	60	3
3	22CAC17	Machine Learning	3	-	-	3	40	60	3
4	22ITC10	Computer Networks	3	-	-	3	40	60	3
5	22ITC12	Formal Languages and Automata Theory	3	-	-	3	40	60	3
6		Professional Elective - 2	3	-	-	3	40	60	3
PRACTICALS									
7	22CSC23	CASE Tools Lab	-	-	2	3	50	50	1
8	22ITC09	Enterprise Application Development Lab	-	-	2	3	50	50	1
9	22ITC11	Computer Networks Lab	-	-	2	3	50	50	1
10	22CAC18	Machine Learning Lab	-	-	2	3	50	50	1
11	22ITC16	Competitive Coding	-	-	2	-	50	-	1
12	22ITI02	Industrial / Rural Internship-II	3-4 weeks/ 90 Hours				50	-	2
Total			**18**	**-**	**10**	**-**	**540**	**560**	**25**

L: Lecture **D: Drawing**
T: Tutorial **P: Practical/Project Seminar/Dissertation**

CIE: Continuous Internal Evaluation
SEE: Semester End Examination

Professional Elective – 2	
22ITE05	Service oriented Architecture
22ITE06	Software Project Management
22ADE31	Information Retrieval Systems
22CIE55	Cyber Security
22CIE15	Extended Reality

22CSC21

SOFTWARE ENGINEERING

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

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

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

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

CO-PO Articulation Matrix

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

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

UNIT - V

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

Text Books:

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

Suggested Reading:

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

Web Resources:

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

22ITC08

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 Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	2	0	0	0	0	0	0	0	0	0	0	3
CO 2	2	2	3	3	3	2	2	2	0	1	0	2	3	0	3
CO 3	2	3	3	3	3	2	2	2	0	1	0	2	3	0	3
CO 4	2	3	3	3	3	2	2	2	0	1	0	2	3	0	3
CO 5	2	2	2	3	3	0	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/

22CAC17

MACHINE LEARNING

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 Concepts of Machine Learning.
2. Explore and study various machine learning techniques.
3. 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/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	1	-	-	-	-		-	-	1	2	2	-
CO 2	3	2	1	1	-	-	-	-	3	-	1	2	-	2	1
CO 3	3	3	2	2	-	-	-	-	3	-	1	2	2	1	1
CO 4	3	3	2	3	-	-	-	-	3	-	1	2	2	2	2
CO 5	3	3	3	3	-	-	-	-	3	3	2	3	3	3	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, Ada boosting Ada Boost, Random forest classification, Random Forest Regressor.

UNIT-V

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

Case Studies: House Price Prediction, Weather forecasting

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.

Web 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

22ITC10

COMPUTER NETWORKS

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

Course Objectives:

This course aims to:

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

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	1	1	0	0	0	0	0	0	1	3	3	3
CO 2	3	2	1	1	1	0	0	0	0	0	0	1	3	3	2
CO 3	3	2	1	1	1	0	0	0	0	0	0	1	3	3	3
CO 4	3	2	1	2	1	0	0	0	0	0	0	1	3	3	3
CO 5	2	2	1	2	1	0	0	1	0	0	0	1	3	3	3

UNIT-I

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

UNIT-II

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

UNIT III

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

UNIT-IV

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

UNIT-V

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

Text Books:

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

Suggested Reading:

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

Web Resources:

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

22ITC12

FORMAL LANGUAGES AND AUTOMATA THEORY

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

Pre-requisites: Discrete Mathematics, Data Structures, Design and analysis of algorithms

Course Objectives:
This course aims to:

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

Course Outcomes:
Upon 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. Demonstrate context-free grammar, check the ambiguity of grammar and Test for Closure Properties and Decision Properties of CFL's.
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 Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	1	-	-	-	-	1	-	-	2	-	2
CO 2	2	1	1	-	1	-	-	-	-	-	-	-	1	-	2
CO 3	2	1	1	-	1	-	-	-	-	-	-	-	1	-	2
CO 4	2	1	1	-	1	-	-	-	-	-	-	-	1	-	2
CO 5	2	1	1	-	1	-	-	-	-	1	-	-	1	-	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, Pumping Lemma for CFL's, Applications of Pumping Lemma for CFL's, Closure Properties of CFL's, Decision Properties of CFL's.

UNIT-IV

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.

Context-sensitive Languages: Context-sensitive grammars (CSG), linear bounded automata and equivalence with CSG.

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.

Un decidability: Codes for Turing Machines, The Diagonalization Language, The Universal Language, Un decidability of the Universal Language, Un decidable problems about Turing Machines: Rice's Theorem and Properties of RE languages, Post's Correspondence Problem: Definition of PCP, The Modified PCP, Other Un decidable 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

22ITE05

SERVICE ORIENTED ARCHITECTURE
(Professional Elective 2)

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. Gain Knowledge of service-oriented architecture and evolution off web services.
2. Learn Web Service architecture and its characteristics.
3. Learn various web services like SOAP, UDDI, WSDL.
4. Learn security considerations of webservices.

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	PO 12	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.
2. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

Suggested Reading:

1. Java Web Service Architecture, James McGovern, Sameer Tyagi etal., Elsevier
2. Building Web Services with Java, 2 Edition, S. Graham and others, Pearson Edn.
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.

22ITE06

SOFTWARE PROJECT MANAGEMENT

(Professional Elective 2)

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 Software Project Planning and Evaluation techniques.
2. Learn about the activity planning and risk management principles.
3. Manage software projects and control software deliverables.
4. Develop skills to manage the various phases involved in project management and people management.
5. Deliver successful software projects that support organization's strategic goals.

Course Outcomes:

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

1. Understand fundamental concepts of project planning, monitoring and control.
2. Estimate cost and effort needed to implement software projects effectively
3. Create a critical path and a precedence network for a project, categorize and prioritize actions for risk elimination .
4. Monitor the progress of projects, visualize and assess the state of a project.
5. Identify some of the factors that influence people's behaviour in a project environment, to reduce unnecessary stress and threats to health and safety.

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

UNIT-I

Project Evaluation and Project Planning: Importance of Software Project Management, Activities covered by software project management – Some ways of categorizing software projects– Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation techniques– Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT-II

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

UNIT-III

Activity Planning and Risk Management: Objectives of Activity planning – Project schedules – Projects and activities – Sequencing and scheduling activities – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – identifying the critical path, **Risk Management**-Risk identification Risk Assessment – Risk Planning –Risk Management – Applying the PERT technique – Gantt Charts, Monte Carlo simulation Resource Allocation – Creating critical Paths – Cost schedules.

UNIT-IV

Project Monitoring and control: Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control , Software Project Management Tools: CASE Tools-MS-Project ,**Managing contracts** – Types of contract, Stages in contract Placement, Contract Management.

UNIT-V

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

Text Book:

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management", 6th Edition, Tata McGraw Hill, New Delhi, 2017.
2. Elaine Marmel , "Microsoft office Project 2003 Bible", Wiley publishing Inc.

Suggested Reading:

1. Walker Royce, "Software Project Management" Addison-Wesley, 2019.
2. Robert K. Wysocki , "Effective Software Project Managementll", Wiley Publication, 2011.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.

Web Resources

1. https://www.udemy.com/course/software-project-management-the-complete-course
2. https://www.coursera.org/specializations/product-management

22ADE34

INFORMATION RETRIEVAL SYSTEMS

(Professional Elective 2)

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 and querying in information retrieval systems
2. Learn the different models for information retrieval
3. Expose the students to text classification and clustering
4. Learn about web searching

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

1. Understand the algorithms and techniques for information retrieval systems
2. Analyze different types of indexing, compression, scoring techniques and query processing
3. Quantitatively evaluate information retrieval systems using metrics
4. Classify and cluster documents for efficient retrieval
5. Demonstrate comprehension of web search principles and matrix decompositions for information retrieval.

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

UNIT - I

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.

Boolean Retrieval: An example information, Building an inverted index, processing Boolean queries, the extended Boolean model versus ranked retrieval.

The term vocabulary and postings lists: Document delineation and character sequence decoding, determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings, and Phrase queries.

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, spelling correction.

UNIT - II

Index construction: Hardware basics, blocked sort-based indexing, Single-pass in memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes.

Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction.

Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, the vector space model for scoring, and Variant tf-id functions

UNIT - III

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance.
Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.
Probabilistic information retrieval: Basic probability theory, The Probability Ranking Principle, The Binary Independence Model.
Language models for information retrieval: Language models, The query likelihood

UNIT - IV

Text classification and Naive Bayes: The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, and Feature selection.
Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k- nearest neighbor, Linear versus nonlinear classifiers.
Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, k-means.
Hierarchical clustering: Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

UNIT - V

Matrix decompositions and Latent semantic indexing: Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.
Web search basics: Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling.
Web crawling and Indexes: Overview, Crawling, Distributing indexes, Connectivity servers. Link analysis: The Web as a graph, Page Rank, Hubs and Authorities

Text Books:

1. Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze, An Introduction to Information Retrieval, Cambridge University Press, Cambridge, England,2008
2. David A. Grossman, OphirFrieder, Information Retrieval–Algorithms and Heuristics, Springer, 2nd Edition (Distributed by Universities Press),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.

22CIE55

CYBER SECURITY

(Professional Elective 2)

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

Pre-Requisites:

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

Course objectives:

This course aims to:

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

Course outcomes:

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

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

CO-PO Articulation Matrix

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

UNIT – I

Cyber security: Definition, Principles. **Cyber security challenges**: old techniques and broader results, the shift in the threat landscape. **Cybercrime:** Definition and Origins of the word. **Cyber offenses:** Categories of Cybercrime. **Tools and Methods Used in Cybercrime**: Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDos Attacks, SQL Injection, Buffer Overflow. **Understanding the Cyber security Kill Chain:** External reconnaissance,
Access, and privilege escalation. **Authentication, Authorization, and Accountability (AAA):** Access control, Identity management, user authentication, and technical aspects of accountability.

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

Text books:

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

Suggested Reading:

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

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

22CIE15

EXTENDED REALITY

(Professional Elective 2)

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

Pre-Requisites

Basic knowledge on computer hardware and software components.

Course objectives:

This course aims to:

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

Course outcomes:

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

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

CO-PO Articulation Matrix

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

UNIT – I

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

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UNIT – II

Designing Immersive Experience - Introduction, designing for sensory immersion, Designing for emotional immersion, Designing for narrative immersion, Best practices for user interface and experience design. **Evolution of VR Hardware -** Introduction to virtual reality hardware, The rise of consumer virtual reality, Virtual reality hardware design challenges, The future of virtual reality hardware, Role of haptic feedback on virtual reality hardware, Types of haptic feedback, Benefits and limitations of haptic technology, Case studies

UNIT – III

AI in AR/VR/XR: -Introduction, AI and its usage in VR/AR, Graphic rendering, Natural language processing, User interaction, Predictive analytics. **Business Landscape of AR/VR/XR-** Introduction, Funding and investment, Funding and its challenges for VR/XR industry, Monetization strategies, User adoption and marketing, Technology challenges, Case studies.

UNIT – IV

Applications of AR/VR/XR in Healthcare: -Introduction, Diagnosis and treatment, Rehabilitation and physical therapy Medical education and training, Use of immersive technology in patient education and engagement, Case studies, Design principles, Medical realities. **Applications of AR/VR/XR in Education:** Introduction, Immersive learning environment, Simulations and training, Personalized learning, Collaborative learning, Case studies.

UNIT – V

Ethics in Immersive Technologies: Introduction to ethics in immersive technologies, Safety and physical health Psychological and emotional impact, Case studies. **3D Modeling and User Interface Design:** Introduction to 3D modelling, Modelling technique, Artistic and technical balance, Real-time 3D and game engines, User interface design principles, User interface design software and workflow, Implementing UIs in 3D environment, **Case Study:** Building VR Applications with Unity.

Text book:

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

Suggested Reading:

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

Web Resources:

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

22CSC23

CASE Tools LAB

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

Prerequisites: Object Oriented Programming, Software Engineering.

Course Objectives:
This course aims to:

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

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

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

CO-PO Articulation Matrix

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

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

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

Text Books:

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

22ITC09

ENTERPRISE APPLICATION DEVELOPMENT LAB

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

Course Objectives

This course aims to:

1. 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 Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	3	1	2	2	0	2	2	0	1	0	2	3	0	3
CO 2	2	3	3	3	3	2	2	2	0	1	0	2	3	0	3
CO 3	2	3	3	3	3	2	2	2	0	1	0	2	3	0	3
CO 4	2	3	3	3	3	2	2	2	0	1	0	2	3	0	3
CO 5	2	3	2	3	3	0	2	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/

22ITC11

COMPUTER NETWORKS LAB

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

Course Objectives:

This course aims to:

1. Know about the fundamentals of peer to peer networks.
2. Familiarize with the installation and configuration of Physical systems and network connections.
3. Learn the implementation methodologies of Wire shark software packages.
4. Explore the concepts of simulations.
5. Acquire knowledge on Socket Programming and SMTP Protocol.

Course Outcomes:

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

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

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	-	-	-	-	-		-	-	-	0	2	-	-
CO 2	3	2	1	1	-	-	-	-	-	-	-	0	3	-	1
CO 3	3	2	1	1	1	-	1	-	1	-	-	2	3	3	1
CO 4	2	2	1	1	1	-	1	-	-	-	-	2	3	3	3
CO 5	2	2	1	3	1	3	1	2	-	-	-	2	3	3	2

LIST OF EXPERIMENTS

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

Text Books:

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

Suggested Reading:

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

Web Resources:

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

22CAC18

MACHINE LEARNING LAB

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

Course Objectives:

This course aims to:

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms.
3. 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/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	-	3	2	1	-	-	3	2	2	3	2	2	2
CO 2	3	3	-	3	2	2	-	-	3	2	2	3	2	3	2
CO 3	3	2	-	2	3	2	-	-	3	2	2	3	3	2	3
CO 4	3	2	-	3	3	3	-	2	3	3	3	3	3	3	3
CO 5	3	2	-	3	3	3	-	2	3	3	3	3	2	2	2

LIST OF EXPERIMENTS

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import scikit learn keras and tensor flows 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 Book:

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

Web Resources:

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

22ITC16

COMPETITIVE CODING

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

Prerequisites:
Problem Solving and Programming, Problem Solving and Programming Lab, Data Structures, Data Structures Lab, Design and Analysis of Algorithms, Design and Analysis of Algorithms Lab

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++ / Python / 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 Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	0	1	0	0	0	0	0	0	1	2	3	3
CO 2	2	3	2	0	1	0	0	0	0	0	0	1	2	3	3
CO 3	2	3	2	0	1	0	0	0	0	0	0	1	2	3	3
CO 4	2	3	2	0	0	0	0	0	0	0	0	1	2	3	3
CO 5	2	3	2	0	1	0	0	0	0	0	0	1	2	3	3

Week 1-2: Introduction to Competitive Coding
1. **Session 1 :**
   - Overview of Competitive Coding
   - Setting up the development environment (IDEs, online judges)
   - Introduction to basic data structures (arrays, linked lists, functions, recursion)
2. **Session 2 :**
   - Basic programming constructs in competitive coding
   - Time complexity and Big O notation

Week 3-4: Algorithms and Problem Solving
3. **Session 3 :**
   - Introduction to sorting algorithms (bubble, insertion, selection)
   - Practice problems on sortings
   - Searching algorithms (linear search, binary search)
   - Practice problems on searchings
4. **Session 4 :**
   - Bit manipulations
   - Practice problems on Bit manipulations

Week 5-6: Data Structures

5. **Session 5 :**
    - Stacks and Queues
    - Practice problems on stack and queue implementations
6. **Session 6 :**
    - Introduction to trees and graphs
    - Basic graph traversal algorithms (DFS, BFS)

Week 7-8: Backtracking

7. **Session 7 :**
    - Introduction to backtracking
    - Basic backtracking algorithms
    - Practice problems on backtracking
8. **Session 10:**
    - Advanced backtracking techniques
    - Practice problems on advanced backtracking

Week 9-10: Dynamic Programming

9. **Session 9 :**
    - Introduction to dynamic programming
    - Top-down and bottom-up approaches
    - Fibonacci series as a DP problem
10. **Session 10 :**
    - Practice problems on dynamic programming

Week 11-12: Advanced Algorithms

11. **Session 11 :**
    - Greedy algorithms
    - Practice problems on greedy algorithms
12. **Session 12:**
    - Divide and conquer algorithms
    - Practice problems on divide and conquer

Week 13-14: Advanced Data Structures

13. **Session 13 :**
    - Heaps and priority queues
    - Practice problems on heaps
14. **Session 14 :**
    - Hashing and advanced topics in trees and graphs
    - Practice problems on hashing

Practice Platforms:

Regularly practice problems on online coding platforms like Codeforces, HackerRank, CodeChef, and LeetCode.

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

Websites:

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

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

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CO-PO Articulation Matrix

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

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

DEPARTMENT OF INFORMATION TECHNOLOGY
(R22 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	22ADC12	Big Data Analytics	3	-	-	3	40	60	3
2	22ITC13	Embedded Systems and Internet of Things	3	-	-	3	40	60	3
3	22CAC04	Deep Learning	3	-	-	3	40	60	3
4	22CSC24	Compiler Design	3	-	-	3	40	60	3
5	22EEM01	Universal Human Values II: Understanding Harmony	-	1	-	-	50	-	1
6	22CAC15	Artificial Intelligence	3	-	-	3	40	60	3
7		Professional Elective - 3	3	-	-	3	40	60	3
PRACTICALS									
8	22ADC13	Big Data Analytics Lab	-	-	2	3	50	50	1
9	22ITC14	Embedded Systems and IoT Lab	-	-	2	3	50	50	1
10	22CAC05	Deep Learning Lab	-	-	2	3	50	50	1
11	22ITC15	Mini Project -II	-	-	2	3	50	-	1
12	22EGC03	Employability Skills	-	-	2	3	50	50	1
13	22ITU02	Up-Skill Certification Course-II	-				25	-	0.5
Total			**18**	**1**	**10**	**-**	**565**	**560**	**24.5**

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

Professional Elective -3	
22ITE07	Cloud Computing
22ITE09	Advanced Computer Networks
22CIE07	Ethical Hacking
22ITE10	Scalable Web Application Development
22CAE19	Natural Language Processing

With effect from the AY: 2024-25

22ADC12

BIG DATA ANALYTICS

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

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

1. Understand the processing of large datasets in Hadoop framework and Apply MapReduce architecture to solve real world problems.
2. Develop scripts using Pig over large datasets and query using Hive.
3. Understand the Implementation of Spark and the Scala programming.
4. Expertise in using Resilient Distributed Datasets (RDD) for creating applications in Spark and query using Spark SQL.
5. Gain familiarity with streaming technologies and its application in real-time data processing.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	3	3	3	1	0	0	0	0	2	0	3	3	3	3
CO 2	2	3	2	3	1	3	0	0	0	2	0	3	3	3	3
CO 3	2	3	2	3	3	3	3	3	0	2	3	3	3	3	3
CO 4	2	3	2	3	3	3	3	3	0	2	3	3	3	3	3
CO 5	2	3	2	3	3	3	3	3	0	2	3	3	3	3	3

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

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

UNIT-III

Parallel programming with Spark: Overview of Spark, Fundamentals of Scala and functional programming, Spark concepts - Resilient Distributed Datasets (RDD), creating RDDs, Basic Transformations, Basic Actions, Word Count example; Spark operations, Job execution, Spark Applications – Cluster computing with working sets.

Spark SQL: What is SQL, Big Data and SQL – Spark SQL, Creating DataFrames, Dataframes Operations, How to Run Spark SQL Queries, Tables, Views, Databases, Select Statements.

UNIT-IV

Machine Learning with Spark: Designing a Machine Learning System, Obtaining, Processing and Preparing Data with Spark, Building a Recommendation Engine with Spark, Building a Classification Model with Spark, Building a Regression Model with Spark and Building a Clustering Model with Spark.

Spark GraphX & Graph Analytics: *GraphX* – Introduction, Graphs in Machine Learning Landscape, Graph-structured data, PageRank, *Graph Analytics* – Property Graphs, Graph Operators, Distributed Graphs, GraphX – Unified Analytics; *Case Study*: Flight Data Analysis using Spark GraphX

UNIT-V

Streaming: Introduction to Stream Processing, Batch processing vs. stream processing, Spark structured streaming API, use case using Spark streaming

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

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

Text Books:

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

Suggested Reading:

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

Web Resources:

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

22ITC13

EMBEDDED SYSTEMS AND INTERNET OF THINGS

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 basic concepts of embedded system and 8051 Microcontroller fundamentals.
2. Provide an overview of Programming with 8051and Basics of Internet of Things
3. Know various IoT enabling technologies and the design methodology for IoT.
4. Develop skills to use Raspberry Pi device and its interfaces.
5. Impart IoT concepts and significance.

Course Outcomes:

Upon completion of 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 IoT Application Domain.
5. Get acquainted with M2M and IoT and Industrial IoT with real time Scenarios.

CO-PO Articulation Matrix

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

UNIT- I

Embedded Computing: Introduction, Embedded System Design Process, Challenges and Characteristics of Embedded Systems, Applications of Embedded Systems: **The 8051 Architecture** Introduction, 8051 Micro controller Hardware.

UNIT-II

Data Transfer and Logical Instructions, Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions. Applications of 8051: Keyboards, Display devices and ADC & DAC.

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, Sensors and Actuators. **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.

UNIT-V

IoT and M2M – Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization. **Industrial IoT:** Introduction to Industrial IoT, IIoT Architecture, IIoT Communication Protocols**,** Industry 4.0 Globalization and Emerging Issues, 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,2014.
4. 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.

Web Resources:

1 http://ee.sharif.edu/~sakhtar3/books/The%208051%20Microcontroller%20Ayala/The%208051%20Microcontroller%20Architecture,%20Programming%20and%20Applications%201991.pdf
2 https://nptel.ac.in/noc/individual_course.php?id=noc17-cs05.
3 https://onlinecourses.nptel.ac.in/noc20_cs69/preview

22CAC04

DEEP LEARNING

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

Pre-requisites: Artificial Intelligence, Machine Learning

Course Objectives:
This course aims to:

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

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

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

CO-PO Articulation Matrix

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

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

UNIT-II
Back propagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam.

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

UNIT-III

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

Pre-trained models: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet.
Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks.

UNIT-IV

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

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

UNIT-V

Transformers: ViT and BERT models.
Generative Adversarial Networks (GANs): Introduction, Discriminator, Generator, Activation, Common Activation functions for GANs**.**
Recent Trends: Zero-shot, One-shot, Few-shot Learning; Self-supervised Learning.

Text Books:

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

Suggested Reading:

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

Web 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/

22CSC24

COMPILER DESIGN

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

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

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

Course Outcomes:
Upon completion of this course, students will be able to:
1 Identify the concepts related to translator, tokens, bootstrapping porting and phases of the compiler.
2 Use grammar specifications and implement lexical analyzer by the help of compiler tools.
3 Explore the techniques of Top down, Bottom up Parsers and apply parsing methods for various grammars.
4 Implement syntax directed translation schemes and relate Symbol table organization.
5 Analyze the concepts involved in Intermediate, code generation and Code Optimization Process and understand error recovery strategies and advance topics in compilers.

CO-PO Articulation Matrix

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

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: Top-Down Parsing: Recursive Descent parsing, Predictive parsing, LL (1) Grammars.
Bottom-Up Parsing: Shift Reduce parsing, Operator precedence parsing (Concepts only).
LR parsing: Constructing SLR parsing tables, Constructing Canonical LR parsing tables and Constructing LALR parsing tables. Parser generator (YACC, BISON).

UNIT - III
Syntax directed translation: Syntax directed definitions, Bottom- up evaluation of S-attributed definitions, L-attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.
Type Checking: Type systems, Specification of a simple type checker, overview of Symbol Table.
Runtime Time Environments: Storage Organizations Stack Heap organizations.

UNIT - IV

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

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

UNIT - V

Code generation: Issues in the design of a code generator. The target machine, Basic Blocks and Flow Graphs, a simple code generator, Peephole optimization.

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

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

Text Books:

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

Suggested Reading:

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

Web 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/.

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

22CAC15

ARTIFICIAL INTELLIGENCE

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

Pre-requisites: Data structures, Discrete Mathematics.

Course Objectives:
The course aims to:
1. Become familiar with basic principles of AI and its fundamentals.
2. Discuss the knowledge and application of intelligent systems and their practical applications.
3. Analyze the various knowledge representation schemes, reasoning and learning techniques of AI.

Course Outcomes:
Upon completion of the course, students will be able to:
1. Define the role of agents and interaction with the environment to establish goals.
2. Identify and formulate search strategies to solve problems by applying suitable search strategy.
3. Understand probabilistic reasoning and Markov decision process to solve real world problems.
4. Design applications using Reinforcement Learning.
5. Apply AI concepts to solve the real-world problems.

CO-PO Articulation Matrix

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

UNIT - I
Introduction: The Foundation of AI, The History of AI, The State of art .
Intelligent agents: Agent and Environments, Good Behavior, Nature of Environments, Structure of Agents

UNIT - II
Search Algorithms: State space representation, Search graph and Search tree. Random search, Search with closed and open list, Depth first and Breadth first search. Heuristic search, Best first search. A* algorithm, problem reduction, constraint satisfaction, Game Search, minmax algorithm, alpha beta pruning, constraint satisfaction problems.

UNIT - III
Knowledge & Reasoning: Knowledge-Based Logic Agents, Logic, First-Order Logic, Syntax-Semantics in FOL, Simple usage, Inference Procedure, Inference in FOL, Reduction, Inference Rules, Forward Chaining, Backward Chaining, Resolution.

UNIT - IV
Probabilistic Reasoning: Representing knowledge in an Uncertain Domain, The semantics of Bayesian networks, efficient representation of conditional distribution, Inference in Bayesian Networks, Inference in Temporal Models, Hidden Markov models.
Markov Decision Process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT - V

Reinforcement Learning: Introduction**,** Passive reinforcement learning, Active Reinforcement Learning, Generalization in reinforcement learning, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

Text Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Ed., Prentice Hall, 2010.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, 3rd Edition, 2018.

Suggested Reading:

1. Trivedi M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi, 2018.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.

Web Resources:

1. https://nptel.ac.in/courses/106105077
2. https://nptel.ac.in/courses/106106126
3. https://aima.cs.berkeley.edu

22ITE07

CLOUD COMPUTING

(Professional Elective -3)

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

Prerequisite: Knowledge on Databases and computing mechanisms.

Course Objectives:

This course aims to:

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

Course Outcomes:

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

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

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 2	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 3	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 4	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 5	3	3	3	2	1	1	1	1	2	3	1	3	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 Cyber security Access-Oriented Mechanisms:** Cloud-Based Security Groups, Hardened Virtual Server Image, Identity and Access Management (IAM) System, **Cloud Security and Cyber security 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 Book:

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.

22ITE09

ADVANCED COMPUTER NETWORKS

(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. Get familiar with key concepts of wireless networks, standards, technologies and their basic operations
2. Learn how to design and analyze various medium access methods.
3. Learn how to evaluate MAC and network protocols using network simulation software tools.
4. Familiar with the wireless/mobile market and the future needs and challenges.
5. Demonstrate the advanced technologies such as 802.11i

Course Outcomes:

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

1. Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
2. Design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
3. Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
4. Design wireless networks exploring trade-offs between wireline and wireless links.
5. To Analyze the concepts of 802.11i.

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

UNIT-I

Introduction: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modeling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc.

Wireless Local Area Networks:

IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues

UNIT-II

Wireless Cellular Networks:

1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.5G and 6G Technologies.

UNIT-III

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview

Wireless Sensor Networks: Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

UNIT-IV

Wireless PANs: Bluetooth AND Zigbee, Introduction to Wireless Sensors.

Security: Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.

UNIT-V

Advanced Concepts

IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks

Text Books:

1. Jochen Schiller, "Mobile Communications", Second edition Addison-Wesley, 2008
2. Stallings W., Wireless Communications and Networks, Pearson Education 2005

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. Ivan Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.
4. Michale R. Miller "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World" 1st Edition, 2015
5. Peng K Toh "The New Age of Consumer Wearables: Smart Cameras, Smart Glasses, Smart Gaming, Smart Clothing, Smart Watches" . Kindle Edition e-book

Web Resources:

1. IEEE Network | IEEE Communications Society (comsoc.org)
2. IEEE Xplore: IEEE/ACM Transactions on Networking
3. Computer Networks | IEEE Journals & Magazine | IEEE Xplore
4. IEEE Wireless Communications | IEEE Communications Society (comsoc.org)
5. IEEE WIRELESS COMMUNICATIONS Home (acm.org)
6. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200

22CIE07

ETHICAL HACKING
(Professional Elective –3)

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

Pre-Requisites
Basic understanding of computer networks and operating systems, familiarity with programming languages like Python or C/C++, and knowledge of cyber security fundamentals.

Course Objectives:
This course aims to:
1. Understand the principles and methodologies of ethical hacking.
2. Learn various techniques for reconnaissance, scanning, and enumeration.
3. Develop skills to identify and exploit web and wireless security vulnerabilities.
4. Gain proficiency in vulnerability assessment and penetration testing.
5. Acquire knowledge of various Exploitation and Post exploitation Methods and Tools

Course Outcomes:
On successful completion of this course, students will be able to:
1. Understand the ethical and legal implications of hacking activities.
2. Demonstrate proficiency in conducting reconnaissance and scanning.
3. Identify and exploit vulnerabilities in web and wireless systems.
4. Perform penetration tests to assess the security posture of an organization.
5. Explore various Exploitation and Post exploitation Methods, Protocols, Tools, and Techniques.

CO-PO Articulation Matrix

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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, Foot printing, Passive and Active Foot printing, Foot printing Methods and Tools- Search Engines, Website and E-mail Foot printing, DNS Foot printing, Network Foot printing.

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.

Reference Books

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 Reference

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 completing 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 Articulation Matrix

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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

22CAE19

NATURAL LANGUAGE PROCESSING
(Professional Elective –3)

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

CO-PO Articulation Matrix

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

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

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

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

UNIT-IV

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

Transformers for NLP: Attention , Transformers and BERT.

UNIT-V

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

Text Books / Suggested Reading:

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

Web Resources:

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

With effect from the AY: 2024-25

22ADC13

BIG DATA ANALYTICS LAB

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

Course Objectives:

The course aims is:

1. To provide the knowledge to set up a Hadoop Cluster and implement applications using MapReduce.
2. To introduce Pig, PigLatin and HiveQL to process big data.
3. To get familiarized with the latest big data frameworks and writing applications using Spark and Scala.
4. To learn querying large datasets with Spark SQL.
5. To build end-to-end stream processing pipelines using Kafka and related technologies.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand Hadoop working environment and develop applications using MapReduce framework.
2. Develop scripts using Pig to solve real world problems and query the datasets using Hive.
3. Develop applications in Spark environment using RDDs.
4. Develop queries real-time data using Spark SQL.
5. Apply practical skills in integrating Kafka with Spark Streaming and implementing real-time analytics use cases such as Fraud Detection, Clickstream Analysis, and Real-time Monitoring.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	3	3	3	3	2	2	1	0	2	0	3	3	3	3
CO 2	2	3	2	3	1	3	0	0	0	2	0	3	3	3	3
CO 3	2	3	2	3	3	3	3	3	0	2	3	3	3	3	3
CO 4	2	3	2	3	3	3	3	3	3	2	3	3	3	3	3
CO 5	2	3	2	3	3	3	3	3	3	2	3	3	3	3	3

List of Experiments:

1. Demonstrate the following using HDFS
   i. Basic HDFS commands
   ii. Working with Hadoop file system: Reading, Writing and Copying
2. Develop the following applications using MapReduce
   i. Word count application using Map Reduce on single node cluster
   ii. Analysis of Weather Dataset on Multi node Cluster using Hadoop
   iii. Real world case studies on Map Reduce applications
3. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
4. Working with Hive on the following
   i. HiveQL
   ii. Writing User Defined Functions in Hive
5. Implement the following on Spark
   i. Processing large datasets on Spark framework
   ii. Word count application
6. Implement structured streaming using spark with retail store dataset
7. Implement streaming using Kafka

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2015.
2. Bill Chambers, Matei Zaharia, “Spark: The Definitive Guide”, 4th Edition, O'Reilly Media Inc, 2018
3. Tanmay Deshpande, “Hadoop Real-World Solutions Cookbook”, 2nd Edition, Packt Publishing, 2016.
4. Anand Rajaraman and Jeffrey David Ullman, ―Mining of Massive Datasets, Cambridge University Press, 2012.
5. Neha Narkhede, Gwen Shapira, Todd Palino, "Kafka: The Definitive Guide", 2nd Edition, O'Reilly Media, 2017
6. Viktor Gamov, "Kafka Streams in Action", 1st Edition, Manning Publications, 2018.

Suggested Readings:

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Media Inc, October 2012.
2. VigneshPrajapati, "Big data Analytics with R and Hadoop", Packt Publishing, November 2013.

Web Resources:

1. https://parthgoelblog.wordpress.com/tag/hadoop-installation
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

22ITC14

EMBEDDED SYSTEMS AND IoT LAB

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

Course Objectives:

This course aims to:

1. To 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 IoT environment.
5. To Understand IoT Applications in real time scenario.

Course Outcomes:

Upon completion 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 of different Case studies.

CO-PO Articulation Matrix

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

List of Experiments:

1. Interface Input-Output and other units such as: Relays, LEDs, Switches, Buzzer.
2. Interface Stepper motor, DC motor and 7-segment Display using 8051 Micro controller.
3. Study and Configure Raspberry Pi.Write Program using Raspberry Pi to Interface
    a) LEDs, Switch and Buzzer and Relays.
4. Interface different Sensors using Raspberry Pi
    a) Temperature & Humidity b) PIR c) GAS d) LDR d) Rain e) Soil moisture.
5. Uploading and reading the Cloud data using Thing speak platform.
6. Mini Project Implementation on :
    a) Home Automation (e.g., Smart Lighting),
    b) Smart City Applications (e.g., Smart Parking , Traffic Lighting)
    c) Smart Environment (e.g., Pollution Monitoring, Weather Monitoring)
    d) Smart 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", 2nd 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.

22CAC05

DEEP LEARNING LAB

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

Course Objectives:
The course aim is:

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

1. Evaluate the performance various optimization techniques used in deep learning.
2. Analyze various Auto encoders 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/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	3	1	1	1	1	1	1	2	2	1	1
CO 2	3	3	2	2	3	1	1	1	1	1	1	2	2	2	1
CO 3	3	3	3	3	3	1	1	1	1	1	1	2	3	2	1
CO 4	3	3	3	3	3	1	1	1	2	2	2	3	2	2	1
CO 5	3	3	3	3	3	1	1	1	2	2	2	3	3	2	1

List of Experiments:

1. Understanding of Deep learning Packages Basics: Tensorflow, Keras, Theano and PyTorch.
2. Implementation of Classification with Multilayer Perceptron using Scikit-learn with MNIST Dataset.
3. Compare the Performance of various Optimization techniques of Momentum Based GD, Stochastic GD, Adam.
4. Compare the Performance of the Classification model using various Regularization Techniques.
5. Train a Deep learning model to classify a given image using pre trained model of AlexNet VGGNet and compare their performance.
6. Implementation of De noising auto encoders.
7. Implementation of RNN for text generation.
8. Implementation of Encoder Decoder Models.
9. Understand the Fine tuning of BERT Models.
10. Implementation of GANs for generating synthetic datasets.

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.

Web 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:
On 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 Articulation Matrix

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

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

Prerequisite: Basic Knowledge of Soft skills in the professional setting.

Course Objectives:
This course aims to:

1. Learn the art of communication; participate in group discussions and case studies with confidence and to make effective presentations.
2. With- resume packaging, preparing them to face interviews.
3. Build an impressive personality through effective time management, leadership qualities, self-confidence and assertiveness.
4. Understand professional etiquette and to make them learn academic ethics and value system.
5. To be competent in verbal aptitude.

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

1. Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress.
4. Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
5. Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.

CO-PO Articulation Matrix

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

UNIT – I
Verbal Aptitude: Error Detection, Articles, Prepositions, Tenses, Concord and Transformation of Sentences- Jumbled Words/Sentences - Vocabulary, Synonyms, Antonyms, One Word Substitutes, Idioms and Phrases, Word/Sentence/Text Completion- Reading Comprehension.

UNIT – II
Group Discussion & Presentation Skills: Dynamics of Group Discussion-Case Studies- Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Accuracy, Coherence. Elements of Effective Presentation – Structure of a Presentation – Presentation tools – Body language - Preparing an Effective PPT.

UNIT – III
Behavioural Skills: Personal strength analysis-Effective Time Management- Goal Setting- Stress management- **Corporate Culture** – Grooming and etiquette-Statement of Purpose (SOP).

UNIT – IV

Mini Project: Research-Hypothesis-Developing a Questionnaire-Data Collection-Analysis-General and Technical Report - Writing an Abstract –Technical Report Writing-Plagiarism-Project Seminar.

UNIT – V

Interview Skills: Cover Letter and Résumé writing – Structure and Presentation, Planning, Defining the Career Objective, Projecting ones Strengths and Skill-sets – Interviews: Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Mock Interviews.

Text Books:

1. Leena Sen, "Communication Skills", Prentice-Hall of India, 2005.
2. Gulati and Sarvesh, "Corporate Soft Skills", New Delhi: Rupa and Co., 2006.
3. Edgar Thorpe and Showick Thorpe, "Objective English", 2nd edition, Pearson Education, 2007.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.

Suggested Reading:

1. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
2. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", 2018.
3. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.
4. Shalini Verma, "Body Language - Your Success Mantra", S Chand, 2006.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Inline with AICTE Model Curriculum with effect from AY 2025-26

DEPARTMENT OF INFORMATION TECHNOLOGY
(R22 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		Professional Elective - 4	3	-	-	3	40	60	3
2		Professional Elective - 5	3	-	-	3	40	60	3
3		Professional Elective - 6	3	-	-	3	40	60	3
4		Open Elective – 1	3	-	-	3	40	60	3
PRACTICAL									
5		Professional Elective – 4 Lab	-	-	2	3	50	50	1
6	22ITC26	Project Part -I	-	-	4	-	50	-	2
TOTAL			**12**	**-**	**6**	**-**	**260**	**290**	**15**

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

Professional Elective -4			
22ADE29	Computer Vision	22ADE30	Computer Vision Lab
22ITE11	Devops Tools	22ITE12	Devops Tools Lab
22ADE23	Applied Predictive Analytics	22ADE37	Applied Predictive Analytics Lab
22CIE53	BlockChain Technology	22CIE54	BlockChain Technology Lab
22ITE13	Unmanned Aerial Vehicles	22ITE14	Unmanned Aerial Vehicles Lab

Professional Elective – 5		**Professional Elective - 6**	
22ITE15	Mobile Computing	22CIE03	Digital Forensics
22ADE32	Social Network Analytics	22ITE17	Serverless Computing
22CIE14	Robotic Process Automation	22ADE14	Generative AI
22ITE16	Fundamentals of Business Intelligence	22CAE08	Reinforcement Learning
22ADE33	Explainable Artificial Intelligence	22CAE21	Ethical Intelligence

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

22ADE29

COMPUTER VISION
(Professional Elective -4)

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

Prerequisite: Knowledge on Matrices, Linear Algebra and Calculus

Course Objectives:
This course aims to:
1. Introduce the fundamentals of image formation
2. Provide understanding of segmentation and Augmentation techniques in Computer Vision
3. Identify and interpret appropriate sources of information relating to computer vision.
4. Analyse, evaluate and examine existing practical computer vision
5. Design and develop practical and innovative image processing and computer vision applications.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the fundamental concepts in computer vision.
2. Apply segmentation and augmentation techniques and descriptors.
3. Identify and interpret appropriate sources of information relating to computer vision.
4. Analyse, evaluate and examine existing practical computer vision
5. Design and develop practical and innovative image processing and computer vision 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	3	2	2	1	1	1	1	1	1	1	1	1	3	2	1
CO 2	3	3	2	2	1	1	1	1	2	2	1	1	2	3	1
CO 3	3	3	1	2	3	2	1	1	1	1	1	1	2	3	1
CO 4	3	2	1	2	3	1	1	2	2	1	1	2	3	3	2
CO 5	3	2	3	2	2	2	1	3	3	2	2	2	3	3	2

UNIT – I
Introduction to Computer Vision and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts, **Fundamental Concepts of Image Formation**: Radiometry, Geometric Transformations, Geometric Camera Models.
UNIT – II
Fundamental Concepts of Image Formation: Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections. **Image Processing Concepts**: Image Transforms, Image Transforms, Image Enhancement, Image Filtering, Color Image Processing, Image Segmentation.
UNIT - III
Image Descriptors and Features: Texture Descriptors, Colour Features, Edges/Boundaries, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency.

UNIT - IV
Fundamentals of Machine Learning: Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis.

UNIT – V

Applications of Computer Vision: Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Autoencoders, Gesture Recognition, Motion Estimation and Object Tracking, Programming Assignments.

Text Book:

1. Manas Kamal Bhuyan, "COMPUTER VISION AND IMAGE PROCESSING FUNDAMENTALS AND APPLICATIONS", Taylor & Francis, 2020

Suggested Reading:

1. David A. Forsyth , "COMPUTER VISION A MODERN APPROACH, Pearson, 2012
2. Richard Szeliski, "Computer Vision Algorithms and Applications", Second edition, Springer, 2022.

22ITE11

DEVOPS TOOLS
(Professional Elective -4)

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. Study the fundamentals of DevOps.
2. Describe version control tools in DevOps
3. Study the integration process in DevOps.
4. Understand the containerization in DevOps.
5. Describe the deployment process in DevOps.

Course Outcomes:

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

1. Identify the components of DevOps.
2. Interpret the Git for source code management.
3. Investigate the integration process in DevOps
4. Express proficiency in containerization using Docker.
5. Articulate the deployment process in DevOps.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	1	2	1	-	1	2	1	2	1	1	2	2
CO 2	1	2	1	1	2	1	-	1	2	1	2	1	1	2	2
CO 3	1	1	1	1	2	1	-	1	2	1	3	1	1	2	2
CO 4	1	2	1	1	2	1	-	1	2	1	3	1	1	2	2
CO 5	1	2	1	2	3	1	-	1	2	1	3	1	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. Ryan Russell and Jason Southgate, "Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet", Packt Publishing ,2018.
2. Joakim Verona, "Practical DevOps", 2nd edition ,Packt Publishing , 2018.

22ADE23

APPLIED PREDICTIVE ANALYTICS
(Professional Elective -4)

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

Prerequisite: Knowledge on Data Mining and Statistics.

Course Objectives:
This course aims to:

1. Understand predictive analytics and its challenges.
2. Learn the descriptive modeling algorithms used for predictive software.
3. Identify relationships that associate inputs to one or more target variables in supervised learning models.
4. Gain knowledge on predictive modeling approaches to textual data.
5. Familiarize with various deployment models.

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

1. Analyze key characteristics of data for modeling.
2. Apply clustering techniques and interpret the meaning of the resulting clusters.
3. Assess model accuracy to select and deploy the best model.
4. Extract features from textual data and build predictive models for textual data.
5. Understand various deployment models.

CO-PO Articulation Matrix

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

UNIT - I

Overview of Predictive Analytics: What Is Predictive Analytics?, Business Intelligence, Predictive Analytics vs. Business Intelligence, Predictive Analytics vs. Statistics, Predictive Analytics vs. Data Mining, Challenges in Using Predictive Analytics.

UNIT - II

Descriptive Modeling: Data Preparation Issues with Descriptive Modeling, Principal Component Analysis, Clustering Algorithms, the K-Means Algorithm, the Kohonen SOM Algorithm.

Interpreting Descriptive Models: Standard Cluster Model Interpretation, Problems with Interpretation Methods, and Identifying Key Variables in Forming Cluster Models, Cluster Prototypes, and Cluster Outliers.

UNIT - III

Predictive Modeling: Decision Trees, Logistic Regression, Neural Networks, K-Nearest Neighbor, Naïve Bayes, Regression Models, Linear Regression, Other Regression Algorithms.

Assessing Predictive Models: Batch Approach to Model Assessment, Percent Correct Classification, Rank-Ordered Approach to Model Assessment, Assessing Regression Models.

UNIT - IV

Text Mining: A Predictive Modeling Approach to Text Mining, Structured vs. Unstructured Data, Why Text Mining Is Hard, Data Preparation Steps, Text Mining Features, Modeling with Text Mining Features, Regular Expressions.

UNIT - V

Model Deployment: General Deployment Considerations, Sampling Considerations for Rebuilding Models, Champion-Challenger sampling.

Case Studies: Survey Analysis Case Study: Overview, Deployment: "What-If" Analysis, Help Desk Case Study, Revisit Business Understanding.

Text Books:

1. Abbott, Dean. Applied predictive analytics: Principles and techniques for the professional data analyst. John Wiley & Sons, 2014.
2. McCarthy, Richard V., et al. applying predictive analytics. Springer International Publishing, 2022.

Suggested Reading:

1. Larose, Daniel T. Data mining and predictive analytics. John Wiley & Sons, 2015.
2. Gupta, Deepti. Applied analytics through case studies using Sas and R: implementing predictive models and machine learning techniques. Apress, 2018.

22CIE53

BLOCKCHAIN TECHNOLOGY
(Professional Elective -4)

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. Get acquainted with the foundations of Block-chain.
2. Provide the significance of the bitcoin ecosystem.
3. Explore the consensus mechanisms and technologies that support ethereum.
4. Introduce Hyperledger Fabric and its architecture.
5. Familiarize Blockchain use cases in various domains.

Course Outcomes

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

1. Define distributed systems and blockchain
2. Explain the concepts of bitcoin and consensus mechanisms in bitcoin mining.
3. Explore the consensus mechanisms and technologies that support Ethereum.
4. Describe Hyperledger Fabric architecture and Hyperledger Projects.
5. Analyse block-chain use cases in various domains.

CO-PO Articulation Matrix

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

UNIT –I

Blockchain Foundations: Overview of distributed systems, Introduction to Blockchain, Generic elements of a blockchain,Features of Blockchain, Applications of Blockchain, Hash Functions and Merkle Trees, Components of Blockchain Ecosystem, Cryptography and Consensus Algorithms; Types of Blockchain, Blockchain Platforms.

UNIT –II

Bitcoin Platform: Bitcoin definition, Keys and addresses , Public keys and Private keys in bitcoin, Thetransaction life cycle, The transaction structure, Bitcoin payments, Consensus mechanism in bitcoin, Wallet types, Non-deterministic wallets, Deterministic wallets, Alternative Coins- Namecoin, Litecoin,Zcash.

UNIT –III

Permission less Block-chain Ethereum: Introducing Smart Contracts, Ethereum blockchain , The Ethereum stack,Ethereum virtual machine (EVM), Consensus mechanism in Ethereum, The Ethereum network, EthereumDevelopment, Setting up a development environment, Development tools and clients, Applications developed on Ethereum.

UNIT –IV

Permissioned Blockchain Hyperledger Fabric: Introduction to Hyperledger Fabric, Hyperledger Fabric architecture, Membership services, Hyperledger Projects- Fabric, Sawtooth lake, Iroha , Components of the Fabric,Peers or nodes, Applications on Blockchain, Alternate Blockchains- Ripple, Corda

UNIT –V

Case studies using Blockchain: Cross border payments, Know Your Customer (KYC), Food supplychain, Mortgage over Blockchain, Identity on Blockchain, Blockchain in Insurance Industry, Education, Healthcare,realestate management and Metavers.

Text Books:

1. Imran Bashir, “Mastering Blockchain”, Second Edition, Packt Publishing, 2018
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", First Edition, O'Reilly, 2018

Suggested Reading:

1. Andreas M. Antonopoulos, “Mastering Bitcoin Unlocking Digital Cryptocurrencies”, First Edition Apress,2017
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to BuildSmart Contracts for Ethereum and BlockChain”, Packt Publishing, 2019.
3. Ramchandra Sharad Mangrulkar, Pallavi Vijay Chavan, “BlockchainEssentials - 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:
   a. Blockchain and its Applications,
   b. Blockchain Architecture Design and Use Cases

22ITE13

UNMANNED AERIAL VEHICLES

(Professional Elective -4)

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. 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	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	1	1	2	2	1	0	1	1	1	1	1	3	2
CO2	2	2	1	2	0	2	1	0	0	1	1	1	1	3	2
CO3	2	2	1	1	0	2	1	0	1	1	1	1	1	3	2
CO4	2	2	1	1	1	2	2	0	1	1	1	1	1	3	2
CO5	2	2	1	1	1	2	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 Hours
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 Tunneling.
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	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	1	1	1	-	-	-	-	-	-	1	3	3	-
CO2	2	2	1	1	1	-	-	-	-	-	-	1	3	3	1
CO3	2	2	1	1	1	-	-	-	-	-	-	1	3	3	3
CO4	2	2	1	2	1	-	-	-	-	-	-	1	3	3	3
CO5	2	2	1	2	1	-	-	1	-	-	-	1	3	3	3

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, Tunneling 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.

22ADE32

SOCIAL NETWORK ANALYTICS
(Professional Elective – 5)

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

Prerequisite:

1. A course on "Web Technologies";
2. A course on "Computer Networks";
3. 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. Design the social networks.
2. Gain skills in tracking the social networks and its tools.
3. Implement social network Graphs and Community Mining Algorithms.
4. Visualize social networks and analyze it.
5. Predict human behavior in social network and related communities

CO-PO Articulation Matrix

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

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

Text Books:

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

Suggested Reading:

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

22CIE14

ROBOTIC PROCESS AUTOMATION

(Professional Elective – 5)

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 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 the course, student 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	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	2	2	-	-	-	-	-	-	-	1	2	2	1
CO2	3	2	1	1	1	-	-	-	-	-	-	-	2	2	1
CO3	3	2	1	2	1	-	-	-	-	-	-	-	2	1	2
CO4	3	2	1	1	-	-	-	-	-	-	-	-	2	2	2
CO5	2	2	1	2	1	-	-	-	-	-	-	-	2	2	3

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-APls- 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 useData table usage with examples Clipboard Management-File operation with step-by-step example-CSV/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

Web Reference

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

22ITE16

FUNDAMENTALS OF BUSINESS INTELLIGENCE
(Professional Elective – 5)

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 basic rudiments of business intelligence system.
2 Understand the architectural aspects of Decision system and Data warehousing.
3 Prepare the student to explore the OLAP operations.
4 Learn the ETL tool and concepts used in it.
5 Familiarize with different Business Intelligence Reporting tools.

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

1. Understand the concepts and components of Business Intelligence (BI) and Decision support systems.
2. Analyze how Data Warehouse will help an organization.
3. Identify the technological architecture that makes up OLAP System.
4. Apply the ETL tool for Business Intelligent System.
5. Design the different use cases of a BI system

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
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 Evolution, BI Characteristics, Benefits of BI, BI Platform Components, BI Platform Location, BI Concepts, BI Approaches, BI Capabilities.

UNIT-II

Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system.

Understanding Data Ware housing : Definition of data warehouse- Data marts, Data quality, Data warehouse architecture- ETL tools, Metadata, Cubes and multidimensional analysis-Fact Tables, Dimensional Tables, Hierarchies of concepts and OLAP operations, Materialization of cubes of data.

UNIT-III

OLAP: Introduction to OLAP, Looking at Different OLAP Styles and Architecture- MOLAP: Multidimensional OLAP, ROLAP: relational OLAP, HOLAP (Hybrid OLAP), OLAP versus OLTP,

Multidimensional Databases: Dimensions or Axes for Analysis, Dimension Members, Sharing Properties across Cubes, **MDX Language:** Introduction about MDX Language and some examples,

MOLAP Data Interfaces: Data Import, Source Data Preparation, Data Export.

UNIT-IV

Extract Transform and Load (ETL): ETL Introduction, Why Do We Need an ETL Process?- Details of the Solution, Open Source ETL Suites, Downloading and Installing Pentaho Data Integration(PDI).
Understanding ETL Concepts- Repositories and Connections, Transformations, the Core of Kettle, Jobs or How to Organize a Set of Transformations in a Workflow, Create and Share a Connection, The Global Picture, Discussion of Tables for example, The Fact Table: How to Create the Transformation for the Sales, Creating the Time Dimension, Connecting All of It Up, Designing the Job, Open Source Alternatives to PDI.

UNIT-V

The BI Reporting Interface: How to Choose the BI Tool, Best Practices in Dashboarding, BI Tools- Microsoft Power BI, Tableau, One Case Study using any tool.

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. Swain Scheps (2013). “Business Intelligence for Dummies”. Wiley

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

22ADE33

EXPLAINABLE ARTIFICIAL INTELLIGENCE (XAI)
(Professional Elective – 5)

Instruction	3 L 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 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:
Upon completion of the course, student 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. Evaluate model fairness through the implementation of Counterfactual Explanations (CFEs) using tools like WIT and Alibi to enhance transparency in AI models.

CO-PO Articulation Matrix

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

UNIT – I

Introduction to Explainable Artificial Intelligence Artificial Intelligence, Need for XAI, Explainability vs. Interpretability. **Explainability Types:** Intrinsic explanation, Post-hoc explanation, Model specific, Model agnostic, Local interpretation, Global interpretation, Sublocal interpretation, Textual explanations, Visual explanations. **Tools for Model Explainability:** SHAP, LIME, Skater, Skope_rules. 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, NonLinear Model Explanation – LIME, Non-Linear Explanation – Skope-Rules

UNIT – IV

Explainability for Ensemble Models 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,Apress
2. Hands-On Explainable AI (XAI) with Python: Interpret, visualize, explain, and integrate reliable AI for fair, secure, and trustworthy AI apps by Denis Rothman

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

22CIE03

DIGITAL FORENSICS
(Professional Elective – 6)

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

Pre-Requisites

A foundational grasp of computer hardware, software, networking, basic programming (Python, C++, Java), cryptography, and virtual machines.

Course Objectives:

This course aims to:

1. Gain a thorough understanding of digital forensics principles, and various types of digital evidence, and understand the history, principles, and challenges of digital forensics.
2. Study the cybercrime laws in the United States and Europe.
3. Master techniques for conducting digital investigations.
4. Analyze the use of digital evidence in criminal investigations.
5. Develop skills in network forensics and evidence recovery.

Course Outcomes:

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

1. Explore the core principles of digital forensics, the various types of digital evidence, and their role in cybercrime investigations.
2. Apply a systematic approach to conducting digital investigations, utilizing appropriate forensic tools and techniques for evidence collection and analysis.
3. Analyze network traffic and identify potential security breaches using network forensics tools and best practices.
4. Evaluate the legal implications surrounding digital evidence, including admissibility and privacy concerns.
5. Demonstrate digital evidence findings professionally and ethically, effectively communicating technical details to a non-technical audience.

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	2	1	-	-	-	-	-	-	-	2	1	2	1	1
CO2	3	2	2	1	2	-	-	-	-	-	2	2	1	2	2
CO3	3	3	3	2	3	-	-	-	-	-	3	3	2	2	1
CO4	2	3	2	2	1	-	-	-	-	-	3	2	1	3	2
CO5	3	2	3	3	2	-	-	-	-	-	3	2	2	1	3

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, Digital Forensics research, language of Computer Crime Investigation, Digital Evidence in the Courtroom- Duty of Experts, Admissibility, levels of Certainty in Digital Forensics, Direct versus Circumstantial Evidence, Scientific Evidence, Presenting Digital Evidence.

UNIT – II

Cybercrime law: A United States perspective, Federal Cybercrime law, State Cybercrime law, Constitutional law, Fourth Amendment, Fifth Amendment, and Encryption, Cybercrime law: A European perspective, The European and national legal Frameworks, Progression of Cybercrime legislation in Europe. Specific Cybercrime offenses, Computer-integrity Crimes, Computer-Assisted Crimes, Content-related Cybercrimes, Jurisdiction

UNIT – III

Digital Investigations: Conducting Digital investigations, Digital investigation process models, Scaffolding for Digital investigations, Applying the Scientific Method in Digital investigations, 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, Cyberstalking, How Cyberstalkers operate, Investigating Cyberstalking, Cyberstalking Case Example

UNIT – V

Network Forensics: network Basics for Digital investigators, technical overview of networks, Network technologies, 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.

Text books:

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. "Computer Forensics and Cyber Crime: An Introduction", MarjieT.Britz, 3rd Edition, Prentice Hall, 2013.

Web Reference

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

22ITE17

SERVERLESS COMPUTING
(Professional Elective – 6)

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 the concepts of FaaS, and Comparison with PaaS.
3. Know the Concepts of event driven applications and Automation with Serverless.
4. Familiarize how AWS Lambda work, Execution environment and security.
5. Explore AWS lamda ,its programming models and gateways ,APIs,to build serverless applications.

Course Outcomes:

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

1. Understand the evolution of computing and architectures.
2. Summarize the requirements of serverless computing and comparisons with various containers.
3. Develop event driven applications and implement automation.
4. Use AWS Lambda concepts, configurations to implement serverless applications.
5. Develop Functions and use gateways, APIs to deploy serverless 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
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	3	3	3	-	-	-	-	-	3	-	-	2	-
CO4	-	-	-	-	3	-	-	-	-	-	3	3	-	2	-
CO5	-	-	3	3	1	-	-	-	-	-	3	3	-	2	-

UNIT-I

The Evolution of Compute, Understanding enterprise data centers, Exploring the units of compute, Understanding software architectures, Predicting what comes next

UNIT -II

Introduction: Serverless computing, 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, What is 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, Technical requirements, 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 By Scott Patterson · 2019 , Packt Publishers.
2. Hands-On Serverless Computing b Kuldeep Chowhan, 2018 Packt Publishing

Suggested Readings:

1. Maddie Stigler, Beginning Serverless Computing, Apress, 2018
2. Kuldeep Chowhan ,Hands-On Serverless Computing: Build, run and orchestrate serverless applications using AWS Lambda, Microsoft Azure Functions, and Google Cloud Functions, Packt Publishers, 2018.

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.

22ADE14

GENERATIVE AI
(Professional Elective – 6)

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

Course Objectives:

This course aims to:

1. Learn the fundamental concepts of Generative AI
2. Acquire the knowledge of encoders, decoders and autoregressive models
3. Acquire the knowledge of various generative models for image generation, style transfer and text generation
4. Learn to apply transforms, prompt engineering and APIs for real world problems
5. Learn to implement develop application using chat GPTs and open API

Course Outcomes:

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

1. Understand the fundamental concepts of generative AI (Understand)
2. Understand the of encoders, decoders and autoregressive models (Understand)
3. Apply various generative models for image generation, style transfer and text generation (Apply)
4. Apply transforms, prompt engineering and APIs for real world problems (Apply)
5. Develop application using chat GPTs and open API (Apply)

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	2	2	2	2	-	-	-	-	-	-	-	-	2	2	1
CO2	2	2	2	2	3	-	-	-	-	-	-	-	3	2	1
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	1
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	1

UNIT-I

Introduction: An Introduction to Generative AI – Applications of AI – The rules of Probability – Why use generative models – Unique challenges of generative models.

UNIT-II

Auto Encoders and Autoregressive Models: Auto encoders – Regularized autoencoders – Stochastic Encoders and Decoders – Autoregressive Models – Fully Visible sigmoid Belief Network (FVSBN) – Neural Autoregressive Density Estimation (NADE) – Masked Autoencoder for Distribution Estimation (MADE)

UNIT III

Generative Adversarial Network: Generative Adversarial Networks – Vanilla GAN – Progressive GAN – Style transfer and Image transformation – Image Generation with GANs – Style Transfer with GANs

UNIT-IV

Transformers and Prompt Engineering: Transformers – Large Language Models – MLM/NSP Generative Pretrained Transformers (GPT) – Task – Specific GPT Fine Tuning – Prompt Engineering – Hugging face pretrained Transformers – Hugging face APIs

UNIT-V

Chat GPTs and OpenAI

GPT 3, 3.5, 4 – OpenAI APIS – Working with the OpenAI Playground – Application and Use Cases: Content Filtering – Generating and Transforming Text – Classifying and Categorizing Text – Building a GPT-3-Powered Question - Answering APP

Text Books:

1. Steve Tingiris Exploring GPT-3, Packt Publishing Ltd. Uk, 2021
2. Joseph Babcock Raghav Bali, Generative AI with Python and Tensor flow 2, Packt Publishing Ltd. UK, 2021

Suggested Reading:

1. Sabit Ekin, Prompt Engineerign for Chat GPT: Aquick Guide To Techniques, Tips, and Best Practices, DOI: 10.36227/techrxiv.22683919.v2, 2023

Web Resources:

1. https://huggingface.co/

22CAE08

REINFORCEMENT LEARNING
(Professional Elective – 6)

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

Prerequisites: Probability and Statistics, Machine Learning, Data Structures

Course Objectives:
This course aims to:
1. Understand the fundamental principles of Reinforcement Learning.
2. Apply the concepts of Finite Markov Decision Processes and Value Functions.
3. Analyze Monte Carlo Methods and Temporal-Difference learning techniques.
4. Evaluate the use of Eligibility Traces in reinforcement learning through case studies
5. Create and build solutions to solve complex problems

Course Outcomes:
Upon completion of the course, students will be able to
1. Acquire the key concepts and terminology in Reinforcement Learning, such as Markov Decision Processes and Action-Value Methods.
2. Apply the reinforcement learning to solve real world problems, including optimizing n-armed bandit problems and job-shop scheduling.
3. Analyze and evaluate the effectiveness of Monte Carlo methods, Temporal-Difference learning, and Eligibility Traces in various real-world applications.
4. Evaluate the performance of different reinforcement learning approaches and assess their suitability for specific tasks and domains.
5. Design and implement novel reinforcement learning solutions to address real-world challenges and improve decision-making processes.

CO-PO Articulation Matrix

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

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

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

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

UNIT - IV

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

UNIT - V

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

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

Text Books:

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

Reference Books:

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.

Web Resources:

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

22CAE21

ETHICAL INTELLIGENCE
(Professional Elective – 6)

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

Pre-requisites: Not required

Course Objectives:
This course aims to:
1. Learn conceptual framework for analyzing ethical issues that AI systems pose to our society.
2. Provide a good understanding of the foundations of modern and ancient approaches to ethics and their differences.
3. Apply knowledge and understanding of AI in information transmission and processing.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Enhance their understanding of ethics broadly and apply it effectively.
2. Identify and analyze various ethical dilemmas and challenges.
3. Generate feasible solutions, particularly in the context of algorithms and artificial Intelligence (AI).
4. Utilize ethical frameworks to evaluate and address ethical issues arising from AI applications.
5. Apply ethical principles to diverse domains such as social media, data management and beyond.

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	2	1	1	1	2	2	2	2	-	2	-	3	1	3	2
CO2	1	2	-	-	-	1	-	-	2	2	2	2	1	3	2
CO3	1	2	2	2	-	-	1	2	-	2	-	1	1	3	2
CO4	2	2	-	2	1	2	1	1	1	2	2	2	1	3	2
CO5	1	1	2	2	1	2	1	2	2	2	1	2	1	3	2

UNIT- I
Introduction: Definition of morality and ethics in AI, Impact on society, Impact on human psychology, Impact on the legal system, Impact on the environment and the planet, Impact on trust.
Software Qualities and Normative Ethics: Interpretability, transparency, and normative ethics, Interpretability, transparency, and policy making, Extensibility, usability, and communicability.

UNIT-II
AI and Ethics- Challenges and Opportunities: Challenges, Opportunities- AI Technologies, ethical issues in artificial intelligence, Societal Issues Concerning the Application of Artificial Intelligence in Medicine, Decision-making role in industries, National and International Strategies on AI.

UNIT- III
AI Standards and Regulation: Model Process for Addressing Ethical Concerns during System Design, Transparency of Autonomous Systems.
Data Privacy Process: Algorithmic Bias Considerations, Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT- IV
Ethics of information and Ethics of AI: Ethical issues for different strengths/grades of AI and AI algorithms, Ethics of AI on the Web and in Web based applications, AI technology and social hierarchy.

Normative ethics proposals: Advantages and disadvantages, Care ethics, Virtue Ethics, Problems with implementation, Problems with uptake and enforcement.

UNIT- V

AI, Information transmission, Information processing, and Privacy.
Big data and privacy: Big data and human identity, Gender and cultural bias.
Black boxes: Big data, Recurrent Neural Nets, Black boxes, and social construction

Text Books:

1. John C. Havens "Heartificial Intelligence: Embracing Our Humanity to Maximize Machines Paperback "– Illustrated, 2 February 2016 .
2. Patrick Lin, Keith Abney, George A Bekey, "Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.
3. Ethics, Moral Philosophy, and AI Bauer, W. A. (2020). "Virtuous vs. utilitarian artificial moral agents. AI and Society". Bryson, J. J. (2018).

Suggested Reading:

1. Michael J. Quinn "Ethics for the Information Age" Pearson Publisher,8th edition, Jan 2022.
2. Mark coeckelbergh " AI Ethics", The MIT Press, sep 2020.

Web Resources:

1 Ethical Intelligence: Change the Way You Live Your Life | Udemy

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:
1. Define research problem
2. Review and assess the quality of literature from various sources.
3. Understand and develop various research designs.
4. Collect and analyze the data using statistical techniques.
5. Apply creative thinking and innovative skills.

CO-PO Articulation Matrix

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	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 hypothesistesting research studies, Basic Principles of Experimental Design, Steps in Sample design

UNIT – IV
Data Collection and Analysis: Collection of primary dataObservation, 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

Prerequisite: 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. Differentiate Biological system, intelligent systems and the concepts of crisp and fuzzy set theory
2. Analyze the learning strategies of Artificial Neural networks and learning rules
3. Understand training algorithms and are able to provide adequate knowledge about feed forward and feedback neural networks.
4. Design training algorithms for associative memory network for pattern recognition problems
5. 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	2	1	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-
CO3	3	3	3	3	2	-	-	-	-	-	-	1
CO4	3	3	3	2	3	-	2	-	-	-	-	2
CO5	3	3	3	3	2	-		-	-	-	-	2

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 Readings:

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

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

1 - Slightly; 2 - Moderately; 3 - Substantially

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

Prerequisites: 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	0	0	0	0	2	2	0	0	0	0	2
CO2	1	0	0	0	2	0	1	0	0	0	0	0
CO3	1	0	1	0	2	0	1	1	0	0	0	0
CO4	2	1	1	0	2	0	2	0	0	1	0	0
CO5	1	1	1	0	1	0	1	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 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

Prerequisite: No specific prerequisite is required.

Course Objectives

This course aims to:

1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Course Outcomes

Upon completion of 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 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	-	-	1	-	-	2	2	1	1	-	-	1	2	1	2
CO2	-	-	1	-	-	2	2	1	1	-	-	1	2	1	2
CO3	-	-	1	-	-	2	2	2	2	1	1	1	2	1	2
CO4	-	-	1	-	-	3	2	2	2	1	1	1	2	1	2
CO5	-	-	1	-	-	2	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 ofViolence.

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 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.

22ADE30

COMPUTER VISION LAB
(Professional Elective -4)

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

Prerequisite: Python Programming

Course Objectives:
This course aims to:
1. Preprocess Image data
2. Find Objects from Images and videos
3. Get knowledge about Segmentation and generation of new images
4. Apply Deep Learning Networks for Image Classification
5. Reuse Pre trained models using Transfer Learning

Course Outcomes:
Upon completion of this course, students will be able to:
1 Preprocess Image data
2 Find Objects from Images and videos
3 Get knowledge about Segmentation and generation of new images
4 Apply Deep Learning Networks for Image Classification
5 Reuse Pre trained models using Transfer Learning

CO-PO Articulation Matrix

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

List of Experiments:
1. Demonstrate Loading, Exploring, and Showing an Image, Manipulate Image Pixels and Transforming Image
2. Implement AlexNet from Scratch
3. Implement R-CNN and Faster R-CNN for Object Detection
4. Use YOLO series Networks for multi Object detection
5. Use Data Augmentation to Improve Network Accuracy
6. Use Pertained GoogLeNet for Image Classification
7. Implement VGG16 from Scratch for image classification
8. Implement GAN series to generate Images
9. Implement encoder and decoder technique for semantic Segmentation
10. Demonstrate how to use Transfer Learning for Image Classification

Text Book:
1. Krishnendu Kar , “Mastering Computer Vision with TensorFlow 2.x “ PACKT Publications

Suggested Reading:
1 Shamshad Ansari “Building Computer Vision Applications Using Artificial Neural Networks”, Second Edition. APpress

22ITE12

DEVOPS TOOLS LAB
(Professional Elective -4)

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

Course Objectives:

This course is aims to:

1. Study the DevOps fundamentals for software development.
2. Know the Version Control using GIT to handle the coding.
3. Build, test and deploy applications using Jenkins and Maven.
4. Use the docker for containerization.
5. Build the deployment process of software.

Course Outcomes:

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

1. Apply the DevOps basics for product development.
2. Demonstrate the version control tools.
3. Examine the Jenkin and Maven tools.
4. Demonstrate the Docker for containerization.
5. Describe the deployment process using puppet.

CO-PO Articulation Matrix

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

List of Experiments:

1. To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities.
2. Explore the Version Control System tools for Source Code Management.,
3. Install git and create a GitHub account and to execute various GIT operations.
4. Installing and configuring Jenkins to set up a build job will help you comprehend continuous integration.
5. To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
6. To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
7. To learn Docker file instructions, build an image for a sample web application using Docker file.
8. Deploy a containerized application on Kubernetes cluster.
9. To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
10. To learn Software Configuration Management and provisioning using Puppet Blocks(Manifest, Modules, Classes, Function)

Text Books:

1. Len Bass, Ingo Weber and Liming Zhu, DevOps: A Software Architect's Perspective, Addison-Wesley, Pearson Publication, 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 Readings:

1. Ryan Russell and Jason Southgate, "Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet", Packt Publishing ,2018.
2. Joakim Verona, "Practical DevOps", 2nd edition ,Packt Publishing , 2018.

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22ADE37

APPLIED PREDICTIVE ANALYTICS LAB

(Professional Elective -4)

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. Introduce R libraries for handling raw and derived, observed, experimental datasets.
2. Learn Predictive Modelling Techniques**.**
3. Familiarize Regression and Classification Techniques with case studies.
4. Impart knowledge on the concepts of Neural Networks and various model Evaluation Techniques.
5. Explore time series models, Topic Modelling and Recommender Systems.

Course Outcomes:

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

1. Demonstrate the basic functions and implement R packages and commands
2. Apply regression analysis methods and draw inferences.
3. Develop applications of neural networks and evaluate the techniques
4. Design models using ensemble methods and evaluate performance.
5. Build a system to perform topic modelling on real time datasets

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	1	2	2	-	-	-	-	-	-	-	-	1	3	3	2
CO2	2	3	1	3	2	-	-	-	-	1	-	1	3	3	2
CO3	2	3	1	3	2	-	-	-	-	2	-	1	3	3	3
CO4	2	3	2	3	1	-	-	-	-	2	-	1	3	3	2
CO5	2	3	2	3	2	-	-	-	-	1	-	1	3	3	2

List of Experiments:

1. Implementation of basic statistical functions of R programming
2. Demonstrate the file operations read and write, importing and exporting datasets
3. Demonstrate the regularization with the lasso in R
4. Implement the pocket perceptron algorithm for classification with neural networks
5. Solve a real-world regression problem by evaluating a neural network model to predict the energy efficiency of the buildings
6. Build a neural network model that predicts a numerical digit (0-9) from MNIST database of handwritten digits
7. Explore the field of Banking and Finance and build a classification model which predicts credit scores using Naïve Bayes.
8. Design and evaluate a decision tree classifier which predicts whether a particular banknote is genuine or whether it has been forged
9. Build a model to predict heart disease based on their profile and a series of medical tests with bagging and Decision trees.
10. Implement Topic Modelling on online news stories

Text Books:

1 Rui Miguel Forte, "Mastering Predictive Analytics with R", Packt Publishing Ltd, 2015.
2 Roger D. Peng, "R Programming for Data Science", Lean Publishing, 2015.

Suggested Reading:

1 Lantz Brett, "Machine Learning with R", 2nd Edition, Packt Publishing Limited.

2 Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Tom Fawcett, O′Reilly, 1st edition, 2013.
3 Abbott, Dean. Applied predictive analytics: Principles and techniques for the professional data analyst. John Wiley & Sons, 2014.
4 McCarthy, Richard V., et al. applying predictive analytics. Springer International Publishing, 2022.

Web Resources:

1 https://data-flair.training/blogs/r-predictive-and-descriptive-analytics
2 https://www.littlemissdata.com/blog/predictive-analytics-tutorial-part-1
3 http://uc-r.github.io/mars
4 https://www.coursera.org/learn/design-thinking-predictive-analytics-data-products
5 https://www.coursera.org/learn/meaningful-predictive-modeling

22CIE54

BLOCKCHAIN TECHNOLOGY LAB
(Professional Elective -4)

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

Course Objectives:

This course is aims to:

1. Familiarize the basic concepts of blockchain.
2. Provide the significance of the Ethereum blockchain.
3. Introduce solidity programming for developing blockchain applications
4. Explore Remix Tool for developing smart contracts.
5. Explore the features of Hyper ledger Fabric .

Course Outcomes:

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

1. Explore the working of blockchain fundamentals such as cryptography and distributed computing.
2. Implement smart contract on the Ethereum blockchain.
3. Build smart contracts using Solidity programming language
4. Write smart contracts using the Remix tool.
5. Acquire thorough knowledge of Hyperledger fabric.

CO-PO Articulation Matrix

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

List of Experiments:

1. Explore Blockchain Foundations: Elements of Distributed Computing, Elements of Cryptography, Digital Signature.
2. Familiarize with the working of Remix Ethereum tool, Truffle and Ganache.
3. Setup a Simple Ethereum wallet and use it to send and receive Ethers.
4. Introduction to solidity program structure, compilation and deployment environment.
5. Write a Solidity program for incrementing/decrementing a counter variable in a smart contract.
6. Write a Solidity program to send ether from a Meta-mask account to another Meta-mask account through a smart contract.
7. Write a Solidity program to simulate a lottery game.
8. Write a Solidity program to track provenance and movement of goods through the supply chain, ensuring transparency and authenticity (Supply-Chain).
9. Write a Solidity program that automatically pays out claims based on predefined conditions eliminating the need for intermediate (Insurance).
10. Hyperledger Fabric Demo.

Text Books:

1. Imran Bashir “Mastering Blockchain”, Second Edition, Packt Publishers, 2018.
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", First Edition O'Reilly, 2018.
3. Mackay Hazel, “Python Programming Handbook for Blockchain Technology Development : A Complete Beginners Guide to Learning Essential Skills to Build Secure Smart Contracts and

Decentralized Applications with web3.py", Independently Published, 2024

Suggested Reading:

1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", st Edition, Apress, 2017.
2. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to BuildSmart Contracts for Ethereum and BlockChain", Packt Publishing, 2019.

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
5. https://github.com/HyperledgerHandsOn/trade-finance-logistics

22ITE14

UNMANNED AERIAL VEHICLES LAB
(Professional Elective -4)

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

Course Objectives:

This course is 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 completion of 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	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	1	1	0	0	0	0	1	0	0	1	1	1	1	3	2
CO2	1	2	0	0	1	0	0	0	0	0	2	1	0	3	2
CO3	1	1	1	1	1	0	0	0	0	1	1	0	1	3	2
CO4	1	1	0	0	1	0	0	0	0	0	2	0	0	3	2
CO5	1	1	1	1	1	2	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)
   a) Sonar b) LiDAR c) Camera
9 Write a Program to communicate UAV/UGV using BLE/WiFi/UHF/Cellular devices
10 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:

8. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence
9. John J. Craig, Introduction to Robotics: Mechanics and Control, Addison Wesley publication, 3rd Edition.
10. Reg Austin"Unmanned Aircraft Systems: UAVS Design, Development and Deployment" John Wiley & Sons, Ltd.2011.
11. Fahlstrom P, Gleason T (2012) "Introduction to UAV systems", 4th edn. Wiley, UK
12. 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	4 P Hours per Week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	2

Prerequisite:
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 (A)

Inline with AICTE Model Curriculum with effect from AY 2025-26

DEPARTMENT OF INFORMATION TECHNOLOGY
(R22 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
	22MAO01	Fundamentals Of Quantum Computing							
	22MEO04	Introduction to Operations Research							
	22EEO02	Energy Conservation							
	22BTO04	Bioinformatics							
	22EGO01	Technical Writing Skills							
2		**Open Elective – 3**	3	-	-	3	40	60	3
	22MEO06	Principles of Entrepreneurship and Startups							
	22ECO02	Remote Sensing and GIS							
	22CEO02	Disaster Risk Reduction and Management							
	22BTO05	Cognitive Neuroscience							
	22EGO03	Indian Traditional Knowledge							
	PRACTICAL								
3	22ITC27	Technical Seminar	-		2	-	50	-	1
4	22ITC28	Project Part-2	-		8	-	100	100	4
		TOTAL	**6**		**10**	**-**	**230**	**220**	**11**

D: Drawing **CIE: Continuous Internal Evaluation**

P: Practical/Project Seminar/Dissertation **SEE: Semester End Examination**

22MAO01

FUNDAMENTALS OF QUANTUM COMPUTING
(Open Elective – 2)

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. Learn basic mathematical Concept for Quantum Computing.
2. Understand the evaluation of the quantum bits. & building blocks.
3. Know the basics of Quantum logic gates and circuits.
4. Learn Quantum Algorithms by various Techniques.
5. Introduce fundamental of Quantum cryptography

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

1. Compute basic mathematical operations on Quantum bits.
2. Solve Quantum operations.
3. Apply quantum Logical gates and circuits.
4. Implement quantum algorithm.
5. Implement Cryptography in Quantum.

CO-PO Articulation Matrix

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

UNIT-I
Math Foundation for Quantum Computing:
Introduction to Vector Space, Subspaces, Linear Independent and dependent Vectors, Basis and Finite Dimensions. Orthogonality of Vectors, Inner product and Outer product of Hilbert Spaces. Unitary operators and projections, Eigenvalues and Eigenvectors. Introduction to GCD and Congruence.

UNIT-II
Introduction to Quantum Computing:
Quantum Mechanics (Huygens wave theory, Photo electric effect De-Broglie hypothesis and Heisenberg's uncertainty Principle), Origin of Quantum Computing, Qubits and multi-qubits states, Bra-ket notation, Quantum Superposition Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave). Block sphere representations, Multi-qubits, Inner and outer product of Multiple of qubits, Tensor product.

UNIT-III
Quantum Logical gates and Circuits:
Single Qubit gates: Pauli, Hadamard, Phase shift, Controlled gates: C-NOT, CCNOT. Quantum Entanglement, Quantum Teleportation (EPR Model) and Bell State, Introduction to Discrete Fourier transform.

UNIT-IV
Quantum Algorithms:
Quantum Fourier Transform, Quantum Phase estimation, Major Algorithms: Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm.

UNIT-V
Quantum Cryptography:
Public and private key Cryptography, Quantum key distribution, Quantum Cryptography, Experimental implementation of quantum cryptography protocols.

Text Books:

1 Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2 David McMahon, "Quantum Computing Explained", Wiley .

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

Prerequisite: 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	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

Prerequisites: None

Course Objectives:

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 completion of this course, students 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	PO 12
CO 1	3	2	-	2	-	2	-	-	-	-	-	-
CO 2	3	2		3	-	1	-	-	-	-	-	-
CO 3	3	3	2	3	2	2	-	-	-	-	-	-
CO 4	3	2	2	2	2	1	-	-	-	-	-	-
CO 5	2	2	1	2	2	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

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

Course Objectives:
This course aims to:

1. Provide elementary knowledge in biology and bioinformatics and biological information available to a biologist on the web and learn how to use these resources on their own.
2. Learn the fundamentals of biological databases, Sequence analysis, data mining, sequence alignment and phylogenetics
3. Learn methods for determining the predicting gene and protein

Course Outcomes:
Upon 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	PO 12
CO 1	1	0	0	0	0	0	0	0	0	1	0	1
CO 2	1	1	0	1	1	0	0	0	0	1	0	1
CO 3	2	0	0	1	1	0	0	0	0	1	0	1
CO 4	2	0	0	1	1	0	0	0	0	1	0	1
CO 5	2	1	0	1	1	0	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 databases

UNIT-III
Sequence Analysis and Data Mining: Scoring matrices, Amino acid substitution matrices- PAM and BLOSUM; Gap, Gap penalty; Database similarity searching - BLAST, FASTA algorithms to analyze sequence data, FASTA and BLAST algorithms comparison; Data Mining- Selection and Sampling, Pre-processing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Text Mining Tools

UNIT-IV

Sequence Alignment And Phylogentics: Sequence Alignment – Local and Global alignment; Pairwise sequence alignment – Dynamic Programming method for sequence alignment - Needleman and Wunsch algorithm and Smith Waterman algorithm. Multiple sequence alignment - Methods of multiple sequence alignment, evaluating multiple alignments, applications of multiple sequence alignment. Concept of tree, terminology, Methods of phylogenetic analysis, tree evaluation – bootstrapping, jack knifing

UNIT-V.

Macromolecular Structure Prediction:

Gene prediction, - neural networks method, pattern discrimination methods, conserved domain analysis; Protein structure basics, protein structure visualization, Secondary Structure predictions; prediction algorithms; Chou-Fasman and GOR method, Neural Network models, nearest neighbor methods, Hidden-Markov model, Tertiary Structure predictions; prediction algorithms; homology modeling, threading and fold recognition, ab initio prediction.

Text Books:

1 David Mount, "Bioinformatics Sequence and Genome Analysis", 2nd edition, CBS Publishers and Distributors Pvt. Ltd., 2005

2 Rastogi SC, Mendiratta N and Rastogi P, "Bioinformatics: Methods and Applications Genomics, Proteomics and Drug discovery", 3rdedition, PHI Learning Private Limited, New Delhi, 2010

Suggested Reading:

1 Baxebanis AD and Francis Ouellette BF, "Bioinformatics a practical guide the analysis of genes and proteins", 2nd edition, John Wiley and Sons, Inc., Publication, 2001

2 Vittal R Srinivas, "Bioinformatics: A modern approach. PHI Learning Private Limited", New Delhi, 2009

3 JiXiong, "Essential Bioinformatics", Cambridge University Press, 2006

22EGO01

TECHNICAL WRITING SKILLS
(Open Elective-2)

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

Prerequisite: Language proficiency and the ability to simplify complex technical concepts for a diverse audience.

Course Objectives:
The course will introduce the students to:
1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes:
Upon completion of 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	2	1	1	-	1	1	2	3	3	2	3
CO 2	-	1	-	1	-	-	-	1	2	2	1	2
CO 3	-	2	-	2	-	1	1	1	2	3	2	2
CO 4	2	2	1	3	-	2	2	1	3	3	2	2
CO 5	1	1	1	1	-	1	1	1	3	3	2	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.

Textbooks:

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

UNIT - I

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

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

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

UNIT - V

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

Text Books:

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

Suggested Reading:

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

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

Prerequisite: Basic knowledge of Geography is required

Course Objectives:
This course 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.

CO-PO Articulation Matrix

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

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:

This course aims to:

1. Learn about the types, causes, impacts and management concept of disaster.
2. Learn about the disaster management cycle and early warning systems
3. Make the students become aware of stress and trauma management during a disastér.
4. Identify the role of technology and institutional framework behind disaster management in India.
5. Identify the structural and non-structural measures of disaster mitigation and learn about the provisions of Disaster management Act.

Course Outcomes:

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

UNIT- I

Fundamental concepts in disaster management: Hazard and disaster-concepts, vulnerability and risk, 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

Prerequisites: 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 / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	0	2	0	0	0	2	0	3
CO 2	1	1	1	1	0	2	0	0	0	2	0	3
CO 3	1	1	1	1	0	2	0	0	0	2	0	3
CO 4	1	2	2	3	3	3	0	3	1	3	0	3
CO 5	1	1	2	3	3	3	0	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	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Indian Culture.

Course Objectives:
This course aims to:
1. Get a knowledge in Indian Culture.
2. Know Indian Languages and Literature and the fine arts in India
3. 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 Articulation Matrix:

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

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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

Prerequisite: 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	8 P Hours per Week
Duration of SEE	-
SEE	100 Marks
CIE	100 Marks
Credits	4

Prerequisite: 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:
On 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.

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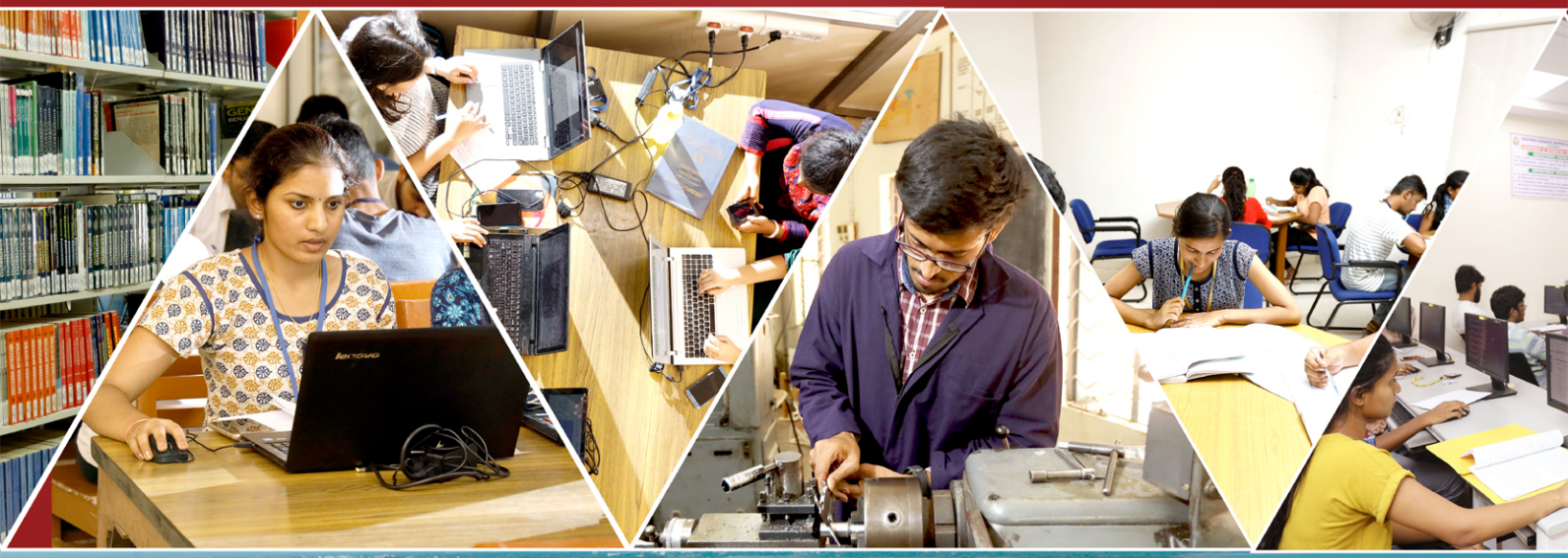

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