UG-R22 Curriculum
With effective from 2022-23

Computer Science and Engineering

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

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

Professor and Head Department
Department of Computer Science & Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075.(T.S.)

SCHEME OF INSTRUCTION AND SYLLABI

OF
B.E. / B.TECH. I TO IV SEMESTERS

FOR

COMPUTER SCIENCE & ENGINEERING

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

(R–22 Regulation)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

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

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

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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 in the frontiers of Computer Science and Engineering with academic excellence and Research

MISSION

1. Educate students with the best practices of Computer Science by integrating the latest research into the curriculum
2. Develop professionals with sound knowledge in theory and practice of Computer Science and Engineering
3. Facilitate the development of academia-industry collaboration and societal outreach programs
4. Prepare students for full and ethical participation in a diverse society and encourage lifelong learning

PROGRAM EDUCATION OBJECTIVES (PEOs)

After the completion of the program, our:

1. Graduates will apply their knowledge and skills to succeed in their careers and/or obtain advanced degrees, provide solutions as entrepreneurs.
2. Graduates will creatively solve problems, communicate effectively, and successfully function in multi-disciplinary teams with superior work ethics and values.
3. Graduates will apply principles and practices of Computer Science, mathematics and Science to successfully complete hardware and/or software-related engineering projects to meet customer business objectives and/or productively engage in research.

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

1. Able to acquire knowledge and practical competency for providing solutions to the problems related to Computer Science and Engineering.
2. Able to design and develop innovative solutions for complex problems by applying the concepts of emerging domains including AI, ML, IoT, Data Science, security and cloud .
3. Able to gain knowledge and skills to develop, deploy and maintain software using modern Software Engineering principles and practices.

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

B.E. - COMPUTER SCIENCE & ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC01	Linear Algebra & Calculus	3	1	0	3	40	60	4
2	22PYC01	Optics and Semiconductor Physics	3	0	0	3	40	60	3
3	22CSC01	Problem Solving And Programming	2	1	0	3	40	60	3
4	22EGC01	English	2	0	0	2	40	60	2
PRACTICAL									
5	22PYC03	Optics and Semiconductor Physics Lab	0	0	3	1.5	50	50	1.5
6	22EGC02	English lab	0	0	2	1	50	50	1
7	22CSC02	Problem Solving and Programming Lab	0	0	3	1.5	50	50	1.5
8	22MEC01	CAD AND DRAFTING	0	1	3	2.5	50	50	2.5
9	22MEC38	Digital Fabrication Lab	0	0	3	1.5	50	50	1.5
TOTAL			**10**	**3**	**14**	**19**	**410**	**490**	**20**

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

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

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22MTC01

LINEAR ALGEBRA & CALCULUS

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO ARTICULATION MATRIX

PO/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.

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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.

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22PYC01

OPTICS AND SEMICONDUCTOR PHYSICS
(CSE, IT, CSE (AI&ML), CSE (IoT), AI&ML, AI&DS)

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

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

COURSE OUTCOMES: After completion of this course, students will be able to
1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

CO-PO ARTICULATION MATRIX

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

UNIT-I

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

UNIT-II

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

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

UNIT-III

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

UNIT-IV

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

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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.

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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/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

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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

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22EGC01

ENGLISH
(COMMON TO ALL BRANCHES)

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO-PSO ARTICULATION MATRIX

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

UNIT I

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

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

UNIT II

Developing Writing Skills I: Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.

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

UNIT III

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

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

UNIT IV

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

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

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UNIT V

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

TEXT BOOKS:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP.1995.

SUGGESTED READINGS:

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

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22PYC03

OPTICS AND SEMICONDUCTOR PHYSICS LAB

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

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO ARTICULATION MATRIX

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

LIST OF EXPERIMENTS:

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

NOTE: A minimum of TWELVE experiments should be done.

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22EGC02

ENGLISH LAB

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

PREREQUISITE: Basic Knowledge of English Communication.

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

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

CO-PO-PSO ARTICULATION MATRIX

PO/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.

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22CSC02

PROBLEM SOLVING AND PROGRAMMING LAB

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

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

COURSE OUTCOMES: After completion of this course, students will be able to
1. Understand various Python program development Environments.
2. Demonstrate the concepts of Python.
3. Implement algorithms/flowcharts using Python to solve real-world problems.
4. Build and manage dictionaries to manage data.
5. Write Python functions to facilitate code reuse.
6. Use Python to handle files and memory.

CO-PO ARTICULATION MATRIX

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

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

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

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

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22MEC01

CAD AND DRAFTING

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

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

COURSE OUTCOMES: After completion of this course, students will be able to
1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

CO-PO ARTICULATION MATRIX

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

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

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

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

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22MEC38

DIGITAL FABRICATION LAB

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO ARTICULATION MATRIX

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

LIST OF EXERCISES:

GROUP-1

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dove tail-joint on the given wooden piece according to the given dimensions.
3.

a. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch

b. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket

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

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

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

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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

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

B.E COMPUTER SCIENCE AND ENGINEERING

SEMESTER –II

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

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2MTC04

DIFFERENTIAL EQUATIONS & NUMERICAL METHODS

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: 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/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.

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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.

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22CYC01

CHEMISTRY

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO ARTICULATION MATRIX

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

UNIT I

Atomic and molecular structure and Chemical Kinetics:

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

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

UNIT II

Use of free energy in chemical equilibria:

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, Numerical.

Battery technology: Rechargeable batteries & Fuel cells:

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

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

UNIT III

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

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

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds) Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides), Cyclization (Diels - Alder reaction)

UNIT IV

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

UNIT V

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

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

TEXT BOOKS:

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

SUGGESTED READINGS:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company 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).

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22EEC01

BASIC ELECTRICAL ENGINEERING

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO ARTICULATION MATRIX

PO/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

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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

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22CSC03

OBJECT ORIENTED PROGRAMMING

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO ARTICULATION MATRIX

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

UNIT I:

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

UNIT II:

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

UNIT III:

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

UNIT IV:

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

UNIT V:

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

TEXT BOOKS AND REFERENCES:

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

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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.

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22CYC02

CHEMISTRY LAB

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: At the end of the course, student will be able to

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

CO-PO ARTICULATION MATRIX

PO/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.

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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 the completion of this Course, Student will be able to

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

MODULE I: APPRECIATION OF RURAL SOCIETY

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

MODULE II: UNDERSTANDING RURAL ECONOMY AND LIVELIHOOD

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

MODULE III: RURAL INSTITUTIONS

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

MODULE IV: RURAL DEVELOPMENT PROGRAMMES

History of Rural Development in India, Current National Programmes: SarvaShikshaAbhiyan, BetiBhachao, BetiPadhao, Ayushman, Bharat, Swachh Bharat, PM AwasYojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

TEXT BOOKS:

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

JOURNALS:

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

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

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.

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

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22MEC37

ROBOTICS AND DRONES LAB

(Common to All Branches)

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

COURSE OBJECTIVES: This course aims to

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

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

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/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12
CO1	3	2	1	1	1	2	1	1	1	2	2	2
CO2	2	3	1	2	3	1	1	1	1	2	2	1
CO3	2	2	2	2	2	1	1	1	1	2	2	2
CO4	2	2	1	2	2	2	1	1	1	2	2	2
CO5	1	1	1	1	1	3	3	3	1	3	3	3

LAB EXPERIMENTS:

1. Assembling of robot mechanical components, mounting of motors, sensors, electronic circuits to the chassis.
2. Connecting to electronic circuitry: motor drivers, incremental encoders proximity sensors, micro controller,
3. Different types of batteries, selection of suitable battery for application, safety precaution.
4. Introduction to Linux Command Line Interface: basic file and directory management and other 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/

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SCHEME OF INSTRUCTION AND SYLLABI

of

III and IV SEMESTERS

of

FOUR YEAR DEGREE COURSE

in

B.E. - COMPUTER SCIENCE AND ENGINEERING

(AICTE Model Curriculum with effect from AY 2021-22)

R-20 Regulation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)
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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

SCHEME OF INSTRUCTION AND EXAMINATION
Model Curriculum (R-20) with effect from AY 2021-22

B.E. (Computer Science and Engineering)

SEMESTER -III

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20EEC01	Basic Electrical Engineering	3	-	-	3	40	60	3
2	20ECC35	Basic Electronics	3	-	-	3	40	60	3
3	20CSC08	Data Structures	3	-	-	3	40	60	3
4	20CSC09	Discrete Mathematics	3	1	-	3	40	60	4
5	20CSC10	Digital Logic Design	3	-	-	3	40	60	3
6	20EGM02	Indian Traditional Knowledge	2	-	-	2	-	50	No Credit
PRACTICAL									
7	20EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
8	20ECC36	Basic Electronics Lab	-	-	2	3	50	50	1
9	20CSC11	Data Structures Lab	-	-	4	3	50	50	2
10	20CSI01	MOOCs / Training / Internship	-	-	4	-	-	-	2
11	20ACT	Activity Points	-	-	-	-	-	-	-
		TOTAL	**17**	**1**	**12**	**-**	**350**	**500**	**22**

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

20EEC01

BASIC ELECTRICAL ENGINEERING

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

Course Objectives: The objectives of this course are

1. To understand the behavior of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To understand the basic principle of operation of AC and DC machines
3. To know about different types of electrical wires and cables, domestic and industrial wiring. safety rules and methods of earthing

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

1. Understand the concepts of Kirchhoff's laws and to apply them in superposition, Thevenin's and Norton's theorems to get the solution of simple dc circuits
2. Obtain the steady state response of RLC circuits with AC input and to acquire the basics, relationship between voltage and current in three phase circuits.
3. Understand the principle of operation, the emf and torque equations and classification of AC and DC machines
4. Explain various tests and speed control methods to determine the characteristic of DC and AC machines.
5. Acquire the knowledge of electrical wiring, types of wires, cables used and Electrical safety precautions to be followed in electrical installations.
6. Recognize importance of earthing, methods of earthing and various low-tension switchgear used in electrical installations

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO 1	3	3	2	3	3	-	3	-	1	2	2	3	-	1	1	1
CO 2	3	3	2	3	2	-	3	-	1	2	2	3	-	1	1	1
CO 3	3	3	2	1	3	-	2	-	1	2	2	3	-	1	1	1
CO 4	2	3	-	1	3	-	2	-	1	2	1	3	-	1	1	1
CO 5	2	-	-	1	1	2	2	1	1	1	2	3	-	1	1	1
CO 6	2	-	-	1	3	1	2	1	1	1	2	3	-	1	1	1

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 and Norton Theorems, Time-domain analysis of first-order RL and RC circuits.

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, RL, RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Transformers: 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

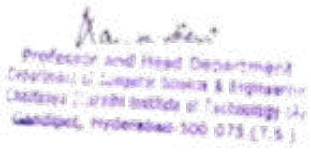
DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators.

DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. **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, 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 Mc Graw Hill, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
3. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGrawHill,2009
4. P.V. Prasad, S. sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.

20ECC35

BASICS ELECTRONICS

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

Prerequisite: Concepts of Semiconductor Physics and Applied Physics.

Course Objectives: The objectives of this course are
1. Describe semiconductor devices principle and to understand the characteristics of Junction Diode.
2. Understand the concept of amplification and able to examine the BJT in more detail.
3. Understand the concept of digital electronics.
4. Understand working principle of incoherent light sources (LEDs), junction devices, operation of CRO
5. Understand the working principle of the transducers and aware the students about the advances in Instrumentation.

Course Outcomes: After the completion of this course, the student will be able to
1. Interpret the usage of semiconductor devices in making circuits like rectifiers, filters, regulators etc
2. Design and Analyse the characteristics of electronic circuits and systems
3. Make use of various types of small and large signal amplifiers for electronic control systems.
4. Model a prototype module using the operational amplifier for real time applications.
5. Evaluate the performance of various semiconductor devices.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

UNIT-I

Semiconductor Theory: Energy levels, Intrinsic and Extrinsic Semiconductor, Mobility, Diffusion and Drift current, Hall effect, Law of mass action, Characteristics of P-N Junction diode, current equation, Parameters and Applications.

Rectifiers: Half wave and Full wave Rectifiers Bridge and center tapped with and without filters, Ripple factor, regulation and efficiency.

UNIT-II

Transistors: Bipolar and field effect transistors with their h-parameter equivalent circuits, Basic Amplifiers classification and their circuits (Qualitative treatment only).

Regulators and Inverters: Zener Diode**,** Breakdown mechanisms, Characteristics, Effect of Temperature, Application as voltage regulator.

UNIT-III

Feedback Amplifiers: Properties of Negative Feedback Amplifier, Types of Negative Feedback, Effect of negative feedback on Input impedance and Output impedance, Applications (Qualitative treatment only).

Oscillators: principle of oscillations, LC Type-Hartley, Colpitts and RC Type- Phase shift, Wien Bridge and Crystal Oscillator (Qualitative treatment only).

UNIT-IV

Operational Amplifiers: Basic Principle, Ideal and practical Characteristics and Applications-Summer, Integrator, Differentiator, Instrumentation Amplifier.

Amplifiers: Operation of Class A, Class B, Class AB and Class C power amplifiers

UNIT-V

Data Acquisition systems: Study of transducers-LVDT, Strain gauge. Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics and their applications only.

Display Systems: Constructional details of C.R.O and Applications.

Text Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson Education, 9th edition, LPE, Reprinted, 2006.
2. Morris Mano, "Digital Design", Pearson Education, Asia 2002.

Suggested Readings:

1. Jacob Millman and C., Halkias, "Electronic Devices", McGraw Hill, Eight Edition, Reprinted, 1985.
2. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall of India, 3rd edition, 1985.
3. W. D. Cooper, A. Helfric, "Electronic Instrumentation and Measurement Techniques", PHI, 4th edition.

20CSC08

DATA STRUCTURES

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

Pre-requisites: Basic knowledge of programming language such as C, C++, Java, Python is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: The objectives of this course are
1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different balanced binary trees, which provides efficient implementation for data structures.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basic concepts of data structures and sorting techniques.
2. Analyze the performance of algorithms.
3. Distinguish between linear and non-linear data structures.
4. Apply linear and non-linear data structures.
5. Identify the significance of balanced search trees, graphs and hashing.
6. Establish a suitable data structure for real world applications.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

UNIT - I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time-space trade off, Asymptotic Notations. **Recursion**: Introduction, format of recursive functions, recursion Vs. Iteration, examples. **Sorting:** Quick sort, Merge Sort, Selection Sort, Radix sort, Comparison of Sorting Algorithms.

UNIT - II

Linked Lists: Introduction, Linked lists, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays, Types of Linked Lists and operations-Circular Single Linked List, Double Linked List, Circular Double Linked List, Skip List-Definition and uses

UNIT- III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation of stack. Introduction to queues, applications of queues and implementations, Double Ended Queues, Priority Queues and applications

UNIT - IV

Trees: Definitions and Concepts, properties of Binary Trees, types of binary trees, Representation of binary tree, Tree Traversal. **Binary Search Trees:** Representation and operations. Tries- Definition and uses
Heap Tree: Definition, Representation, Heap Sort. **Balanced Search Trees:** AVL Trees

UNIT - V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals,
Hashing: Introduction, Hashing Functions-Modulo, Middle of Square, Folding, Collision Techniques-Linear Probing, Quadratic Probing, Double Hashing, Separate Chaining.

String Algorithms: Introduction, String Matching Algorithm, Brute Force Method, Rabin-Karp String Matching Algorithm

Text Books:

1. Narasimha karumanchi, “Data Structures and Algorithms Made Easy”, Career Monk Publications, 2020
2. S. Sahni and Susan Anderson-Freed, “Fundamentals of Data structures in C”, E. Horowitz, Universities Press, 2nd Edition.
3. Reema Thareja, “Data Structures using C”, Oxford University Press.
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structure and Algorithms in Python”, Wiley, 2013.

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

Online Resources:

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

20CSC09

DISCRETE MATHEMATICS

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Objectives: The objectives of this course are
1. To introduce Propositional and Predicate Logic.
2. To introduce various proof techniques for validation of arguments.
3. To develop an understanding of counting, functions and relations.
4. Familiarize with fundamental notions and applicability of graph theory and algebraic systems

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

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO 1	3	2	-	-	-	-	-	-	-	-	-	-	2	1	1	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	2	1	1	-
CO 4	3	2	-	-	-	-	-	-	-	-	-	-	2	1	1	-
CO 5	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1	-
CO 6	3	2	-	-	-	-	-	-	-	-	-	1	2	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 and Functions:** Cartesian Products and Relations. Partial ordering relations, POSET, Hasse diagrams, Lattices as Partially Ordered Sets, Equivalence relations. Pigeon hole principle.

Functions: Types of Functions, Composition of functions and Inverse of functions.

UNIT-III

Fundamental Principles of counting: The Rules of Sum and Product, permutations, Combinations, Binomial Theorem.

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

UNIT-IV

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

Trees: Definitions, Properties, Rooted Trees, Spanning Trees, Minimum Spanning trees: The Algorithms of Kruskal and Prims.

UNIT–V

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

Text Books:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", An Applied Introduction, 4th edition, Pearson Education, 2003.
2. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TATA Mc Graw-Hill Edition, 1995.
3. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 8th Edition, Tata Mc Graw-Hill, 2005

Suggested Reading:

1. R. K. Bisht, H. S. Dhami, "Discrete Mathematics", Oxford University Press, Published in 2015.
2. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", 8th Edition, PHI, 1986.
3. David D. Railey, Kenny A. Hunt, "Computational Thinking for the Modern Problem Solving", CRC Press, 2014.

Online Resources:

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

20CSC10

DIGITAL LOGIC DESIGN

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

Course Objectives: The objectives of this course are
1. To understand the basic building blocks of digital hardware and various minimization techniques.
2. To analyse and design the Combinational and Sequential circuits.
3. To design the circuits using verilog HDL.

Course Outcomes: On Successful completion of this course, student will be able to
1. Demonstrate the number system conversions and simplify Boolean functions.
2. Recall basic theorems and properties of Boolean algebra to represent logical functions in canonical and standard forms.
3. Analyze and simplify Boolean expressions using karnaugh-maps and tabulation method.
4. Analyze and Design various combinational circuits and Sequential circuits used in Computer Hardware.
5. Understand the designs of Combinational and Sequential circuits using Verilog HDL.
6. Develop different applications by configuring registers, counters and memories.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/ 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	PSO 4
CO 1	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO 2	2	1	-	-	-	-	-	-	-	-	-	1	1	2	-	-
CO 3	2	2	-	1	1	-	-	-	-	1	-	1	1	1	-	-
CO 4	3	3	3	2	2	-	1	1	1	1	1	2	2	2	2	2
CO 5	2	2	2	2	2	2	1	1	1	1	1	2	2	2	2	3
CO 6	2	2	2	2	2	2	2	2	2	2	2	2	1	2	3	2

UNIT - I

Digital Systems and Binary Numbers: Digital systems, Binary numbers, Number base conversions, Octal and Hexadecimal numbers, Complements of Numbers, Binary codes. **Boolean Algebra and logic Gates:** Binary logic, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.

UNIT - II

Minimization of Switching Functions: Introduction, the map method, minimal functions and their properties, the tabulation procedure, the prime implicant chart. **NAND and NOR Gates**: NAND Circuits, Two-level Implementation, Multilevel NAND Circuits, NOR Circuits. **Exclusive OR Gates**: Odd Function, Parity Generation and Checking.

UNIT - III

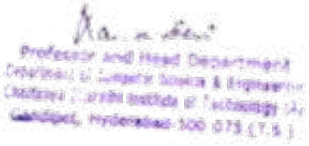
Combinational Logic Design: Combinational Circuits. **Analysis Procedure:** Derivation of Boolean Functions, Derivation of the Truth Table, Logic Simulation. **Design Procedure:** Decoders, Encoders, Multiplexers - Designing Combinational Circuits using Multiplexers, Binary Adders, Adder-Subtractor, Binary Multiplier, HDL Representations – Verilog.

UNIT - IV

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

UNIT - V

Registers: Registers, Shift registers. **Counters**: Ripple Counters, Synchronous Binary counters, Other Counters. **Memory and Programmable Logic**: Introduction, Random-Access Memory, Memory Decoding, Error



Detection and Correction, Read-Only Memory, Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Text Books:

1. Morris Mano M. and Michael D. Ciletti, "Digital Design, With an Introduction to Verilog HDL", Pearson 5th edition, 2013.
2. ZVI Kohavi, "Switching and Finite Automata Theory", Tata McGraw Hill 2nd Edition, 1995.

Suggested Reading:

1. Ronald J Tocci, Neal Widmer, Greg Moss, "Digital Systems: Principles and Applications", Pearson 11th Edition, 2011.
2. Stephen Brown, ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL design, McGraw Hill 2nd Edition, 2009.

20EGM02

INDIAN TRADITIONAL KNOWELDGE

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

Prerequisite: Knowledge on Indian Culture

Course Objectives: The objectives of this course are
1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: On Successful completion of this course, student 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.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

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

UNIT-III

Linguistic Wealth: Indian Languages and Literature: the role of Sanskrit, Paleography, Significance of scriptures to current society, Indian semantics and lexicography, Bhakti literature, Darsanas

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: Helio-centic system, Sulbasutras, Katapayadi, Hindu calendar, 6 pramanas in Indian logic, Scientific method applied to therapeutics, Fallacies, Tarka – Induction &Deduction, Ayurvedic biology, Definition of health

Essential Readings:

1. Kapil Kapoor, Text and Interpretation: The Indian Tradition, ISBN: 81246033375, 2005
2. Samskrita Bharati, Science in Samskrit, ISBN-13: 978-8187276333, 2007
3. Satya Prakash, Founders of sciences in Ancient India, Govindram Hasanand, ISBN-10: 8170770009, 1989
4. Brajendranath Seal, The Positive Sciences of the Ancient Hindus, Motilal Banarasidass, ISBN-10: 8120809254, 1915
5. Kancha Ilaiah, Turning the Pot, Tilling the Land: Dignity of Labour in Our Times

Suggested Readings:

1. Swami Vivekananda, Caste, Culture and Socialism, Advaita Ashrama, Kolkata ISBN-9788175050280
2. Swami Lokeswarananda, Religion and Culture, Advaita Ashrama, Kolkata ISBN-9788185843384
3. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
4. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn,ISBN: 978-0143426158, 2016
5. Swami Vivekananda, The East and the West, Advaita Ashrama, Kolkata 9788185301860
6. Srivastava R.N., Studies in Languages and Linguistics, Kalinga Publications ISBN-13: 978-8185163475
7. Subhash Kak and T.R.N. Rao, Computation in Ancient India, Mount Meru Publishing ISBN-1988207126
8. R.N Misra, Outlines of Indian Arts Architecture, Painting, Sculpture, Dance and Drama, IIAS, Shimla & Aryan Books International, ISBN 8173055149
9. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
10. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014
11. Ravi Prakash Arya, Engineering and Technology in Ancient India, Indian Foundation for Vedic Science, ISBN-10: 1947593072020
12. Shashi Tharoor, The Hindu Way
13. Amartya Sen, Argumentative Indian

SWAYAM/NPTEL:

1. History of Indian Science and Technology - https://onlinecourses.swayam2.ac.in/arp20_ap35/preview
2. Introduction to Ancient Indian Technology – https://onlinecourses.nptel.ac.in/noc19_ae07/preview
3. Indian Culture & Heritage - https://onlinecourses.swayam2.ac.in/nos21_sc11/preview
4. Language and Society - https://nptel.ac.in/courses/109/106/109106091/
5. Science, Technology & Society - https://nptel.ac.in/courses/109/103/109103024/
6. Introduction to Indian Philosophy - https://nptel.ac.in/courses/109/106/109106059/
7. Introduction to Indian Art - An appreciation - https://onlinecourses.nptel.ac.in/noc20_hs09/preview

20EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Course Objectives: The objectives of this course are

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

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

1. Get an exposure to common electrical components, their ratings and basic electrical measuring equipment.
2. Make electrical connections by wires of appropriate ratings and able to measure electric power and energy.
3. Comprehend the circuit analysis techniques using various circuital laws and theorems.
4. Determine the parameters of the given coil and calculate the time response of RL & RC series circuits.
5. Recognize the basic characteristics of transformer and components of switchgear.
6. Understand the basic characteristics of dc and ac machine by conducting different types of tests on them.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO 1	2	2	1	1	-	-	1	1	2	1	-	1	-	1	1	1
CO 2	2	1	1	1	-	-	1	1	2	1	-	1	-	1	1	1
CO 3	3	3	2	1	-	-	1	-	2	1	-	1	-	1	1	1
CO 4	3	1	2	1	-	-	1	-	2	1	-	1	-	1	1	1
CO 5	3	3	2	3	-	-	1	-	2	1	-	1	-	1	1	1
CO 6	3	3	2	2	-	-	1	-	2	1	-	1	-	1	1	1

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components.
2. Verification of KCL and KVL.
3. Time response of RL and RC series circuits.
4. Determination of parameters of a choke or coil by Wattmeter Method
5. Verification of Thevenin's and Norton's theorems
6. Turns ratio /voltage ratio verification of single phase Transformers
7. Open Circuit and Short Circuit tests on a given single phase Transformer
8. Observation of Excitation Phenomenon in Transformer
9. Measurement of three phase power in a balanced system using two Wattmeter method.
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle)
11. Load test on DC Shunt motor
12. Speed control of DC Shunt motor
13. Demonstration of Low Tension Switchgear Equipment/Components
14. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted from the above list.

20ECC36

BASICS ELECTRONICS LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

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

Course Objectives: The objectives of this course are
1. Learn about various electronic components, devices and systems.
2. Study the operation of CRO.
3. Study the transistor characteristics in different modes.
4. Analyze application of diodes and transistors.
5. Learn about analog circuits and digital circuits operation.

Course Outcomes: On Successful completion of this course, student will be able to
1. Demonstrate the concepts of basic electronic components, devices, and systems.
2. Analyze the measurements of time period, amplitude and phase of different waveforms.
3. Design and analyze the behavior of the diode and transistor circuits
4. Develop various types of feedback and power amplifiers
5. Examine the functionality of various analog and digital circuits

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

List of Experiments:
1. Study of Electronic components.
2. Characteristics of Semiconductor diodes (Ge, Si and Zener).
3. CRO and its Applications.
4. Half, Full wave rectifiers with and without filters.
5. Voltage Regulator using Zener diode.
6. Characteristics of BJT in CE Configuration.
7. Characteristics of FET in CS Configuration.
8. Amplifier with and without feedback.
9. RC Phase shift oscillator
10. Operational Amplifier and its applications.
11. Power Amplifier Characteristics.
12. Realization of Half and Full adder
13. Structured Enquiry: Design a switching circuit using BJT and analyse its operation.
14. Open ended Enquiry: Design a suitable 10watt audio amplifier.

Text Books:
1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, *Basic Electronics*, A Text - Lab Manual, 7th Edition, TMH, 1994
2. Paul B. Zbar, Industrial Electronics, A Text - Lab Manual, 3rd Edition.

20CSC11

DATA STRUCTURES LAB

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Pre-requisites: Any Programming Language

Course Objectives: The objectives of this course are
1. Understand basic concepts data structures and abstract data types.
2. Differentiate between linear and non-linear data structures.
3. Analyze various searching, sorting and hashing techniques.

Course Outcomes: On Successful completion of the 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. Analyze various sorting techniques.
5. Analyze various algorithms of linear and nonlinear data structures.
6. Design and develop real world problem using suitable data structures.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

List of Experiments
1. Implementation of Quick Sort, Merge Sort, Selection Sort, Radix Sort.
2. Implementation of Insert, Delete and Search operations on Single Linked List.
3. Implementation of Insert, Delete and Search operations on doubly Linked List.
4. Implementation of skip list.
5. Implementation of Stack using array and linked list.
6. Converting of Infix Expression to Postfix.
7. Implement the algorithm for Evaluation of Postfix.
8. Implementation of Queue using array and linked list.
9. Implement application of queue.
10. Implementation of Binary Tree Traversals.
11. Implementation of Binary Search Tree.
12. Implementation of Heap Sort.
13. Implementation of Graph Traversal Techniques.
14. Implementation of Hashing.
15. Implementation of string matching algorithm.
16. **Case study-** Given a page of text from a textbook, break each sentences into words, remove whitespaces, punctuations, special symbols from it. Convert all words into unique case (i.e. either lower or upper case). Perform the following task on those words- find the frequency of each word, find the top k words which are frequent and construct word cloud on those top k words. (Similar type of case studies can be given by the faculty)

Text Books:

1. Brian WKernighan, Dennis Ritchie, "C Programming Language", PH PTR, 2nd Edition.
2. Richard M Reese, "Understanding and Using C Pointers", O`Reily, 2013.
3. Narasimha karumanchi, "Data Structures and Algorithms Thinking with Python ", Career Monk Publications, 2020

Online Resources:

1. https://nptel.ac.in/courses/106102064/
2. https://www.udemy.com/algorithms-and-data-structures-in-python/

20CAC02

FUNDAMENTALS OF DATA SCIENCE LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-Requisites: Probability and Statistics

Course Objectives: The objectives of this course are
1. Understand the significance of data science tools.
2. Apply statistical methods to implement various functionalities.
3. Apply exploratory data analytical techniques to deal with single and multiple variables.

Course Outcomes: On successful completion of this course, Student will be able to:
1. Understand the significance of data science tools.
2. Apply statistical methods to implement functionalities in Numpy, Scipy, Pandas packages.
3. Analyze the significance of Inferential Statistics.
4. Apply Exploratory Data Analytical Techniques to visualize Single variable.
5. Apply Exploratory Data Analytical Techniques to visualize Multiple variables.
6. Analyze the significance of Time Series Forecasting.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

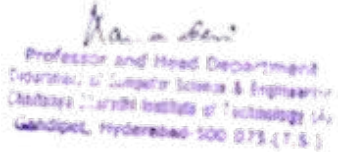
PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	1	1	1	1	-	-	-	-	-	1	-	1	1	-	1
CO 2	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1
CO 3	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1
CO 4	3	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO 5	3	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO 6	3	2	-	2	-	-	-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

List of Experiments
1. Identification and Installation of required softwares/Technologies (python/modules).
2. Implementation of statistical methods in Numpy.
3. Implementation of statistical methods in Scipy.
4. Implementation of statistical methods in Pandas.
5. Demonstration of Inferential Statistics-sampling.
6. Demonstration of Hypothesis testing-variants of t-test.
7. Demonstration of statistical methods Anova.
8. Time Series Forecasting with ARIMA model.

Text Books:
1. EMC Education Services "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2012.
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
3. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd ed.

Suggested Readings:
1. JojoMoolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, 2016.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013.
3. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.
4. Hastie, Trevor, et al., "The elements of statistical learning: Data Mining, Inference, and Prediction", Vol. 2. No. 1. New York: Springer, 2009.

Online Resources:
1. https://www.topcoder.com/role-of-statistics-in-data-science/
2. https://www.logianalytics.com/predictive-analytics/what-is-predictive-analytics/.
3. https://data-flair.training/blogs/



4. https://www.analyticsvidhya.com/blog/2016/02/time-series-forecasting-codes-python/
5. https://conjointly.com/kb/descriptive-statistics/

Professor and Head Department
Department of Computer Science & Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075 (T.S.)

20CAC01

FUNDAMENTALS OF DATA SCIENCE

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	2

Pre-requisites: Probability and Statistics

Course Objectives: The objectives of this course are
1. Understand the significance of data science concepts and tools in the modern world.
2. Apply various data science techniques relating to pre-processing, exploring and visualizing data.
3. Apply statistical and predictive analytical methods to deal with the real time data.

Course Outcomes: On successful completion of this course, Student will be able to:
1. Understand the significance of data science tools and techniques.
2. Apply data cleaning, transformation and discretization techniques.
3. Analyze various inferential statistics and time-series methods.
4. Understand and apply data visualization techniques.
5. Understand predictive analytics and its applications.
6. Apply data science techniques to deal with the real-world problems.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO 1	2	1	1	1	1	-	-	-	-	-	1	-	1	1	-	1
CO 2	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1
CO 3	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1
CO 4	3	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO 5	3	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO 6	3	2	1	2	2	-	-	-	-	1	-	-	1	1	1	1

UNIT – I: Introduction

Introduction to Data Science: Evolution of Data Science, Data Science Roles, Life Cycle of Data Science Project, Applications of Data Science, Data Security Issues.

Data collection and types :primary, secondary, structured data, unstructured data.

UNIT – II: Data Pre-Processing

Data Pre-Processing Overview, **Data Cleaning:** Missing values, dealing with noisy data, Spread, outliers **Data Transformation & Discretization:** Transformation strategies overview, transformation by normalization, discretization by binning, Dimensionality Reduction.

UNIT – III: Exploratory Data Analytics

Organizing Data : Variables and data, organizing Qualitative data, organizing Quantitative data**Introduction to Frequency Tables and Graphs:** Line Graphs, Bar Graphs, Frequency Polygons, Relative Frequency Graphs, Pie Charts, Grouped Data and Histograms, Stem and leaf Plots, sets of paired data.

.

UNIT – IV: Statistical Analysis

Statistical Methods for Evaluation: Random Variables, Expected Values, Variance of Random Variables, Distribution of Sampling Statistics, population mean, Testing Statistical Hypothesis: Hypothesis testsand significance levels, t-test, Wilcoxon Rank-Sum Test, ANOVA.

UNIT – V: Real-time Applications of Data Science

Introduction to predictive analytics, applications of predictive analytics, Data science for recommendation systems, data science for healthcare, data science for educational systems.

Text Books:

1. EMC Education Services “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley Publishers, 2012.

2. Neil A.Weiss, "Introductory Statistics", 10th Edition, Pearson Education Limited, 2017.
3. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd ed.

Suggested Reading:

1. JojoMoolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013.
3. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.
4. Hastie, Trevor, et al., “The elements of statistical learning: Data Mining, Inference, and Prediction”, Vol. 2. No. 1. New York: Springer, 2009.
5. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.

Online Resources:

1. https://www.topcoder.com/role-of-statistics-in-data-science/
2. https://www.logianalytics.com/predictive-analytics/what-is-predictive-analytics/.
3. https://data-flair.training/blogs/
4. https://www.analyticsvidhya.com/blog/2016/02/time-series-forecasting-codes-python/
5. https://conjointly.com/kb/descriptive-statistics/
6. https://www.udemy.com/course/datascience-statistics/
7. https://www.google.co.in/books/edition/Introductory_Statistics/c838DAAAQBAJ?hl=en&gbpv=1&pg=PA2&printsec=frontcover

20CSI01

MOOCS / TRAINING / INTERNSHIP

Instruction	4 Hours per week
Duration of End Examination	-
Semester End Examination	-
Continuous Internal Evaluation	-
Credits	2

Course Objectives: The objectives of this course are

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

SCHEME OF INSTRUCTION AND EXAMINATION

Model Curriculum (R-20) with effect from AY 2021-22

B.E. (Computer Science and Engineering)

SEMESTER –IV

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MTC13	Mathematical Foundation for Data Science & Security	3	-	-	3	40	60	3
2	20CSC12	Design and Analysis of Algorithms	3	-	-	3	40	60	3
3	20CSC13	Computer Architecture and Microprocessor	3	-	-	3	40	60	3
4	20CSC14	Data Base Management Systems	3	-	-	3	40	60	3
5	20CSC15	Internet & Web Technologies	2	-	-	3	40	60	2
6	20MBC01	Engineering Economics & Accountancy	3	-	-	3	40	60	3
PRACTICAL									
7	20MTC14	Mathematical Foundation for Data Science & Security Lab	-	-	2	3	50	50	1
8	20CSC16	Design and Analysis of Algorithms Lab	-	-	2	3	50	50	1
9	20CSC17	Data Base Management Systems Lab	-	-	2	3	50	50	1
10	20CSC18	Internet & Web Technologies Lab	-	-	4	3	50	50	2
11	20ACT	Activity Points	-	-	-	-	-	-	-
		TOTAL	**17**	**-**	**10**	**-**	**440**	**560**	**22**

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

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

20MTC13

MATHEMATICAL FOUNDATION FOR DATA SCIENCE & SECURITY

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

Course Objectives: The objectives of this course are

1. Able to learn and Analyzing data in Linear and Non-Linear form.
2. Able to fit the hypothetical data using probability distribution.
3. To know the characteristic of various continuous probability distributions
4. To know the impact of number theory before computer age.
5. To know the security issues of Cryptography

Course outcomes: On Successful completion of the course, students will be able to

1. Analyze the coefficient of skewness and fitting of the data by various methods
2. Apply properties of Mathematical Expectations and analyse the various distributions.
3. Evaluate areas of curves by using various distributions.
4. Apply various technics of Number Theory for solving problems
5. Apply RSA –PKC for solving security issues.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

UNIT-I: Curve Fitting

Measures of Central Tendency, Measures of Dispersion, Moments (Moments about the mean and moments about a point). Skewness, Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness for frequency distribution, Kurtosis. Correlation, coefficient of correlation, limits of correlation coefficient. Linear Regression, Regression coefficients, Properties of Regression Coefficients. Curve fitting by the Method of Least Squares, Fitting of Straight lines, Second degree parabola and Growth curve ($y = ae^{bx},\ y = ax^b and y = ab^x$).

UNIT-II: Mathematical Expectation and Discrete Probability Distribution

Basic Probability, 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. Poisson distribution, MGF and Cumulates of the Poisson distribution, Recurrence formula for the probabilities of Poisson distribution (Fitting of Poisson distribution)

UNIT-III: Continuous Probability Distributions

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

UNIT-IV: Number Theory

Division Algorithm, Greatest Common Divisor, Euclidean Algorithm, Diophantine Equation ax+by=c, Fundamental Theorem of Arithmetic, Little Fermat's Theorem, Wilson's Theorem, Euler's Phi-Function, Euler's Theorem, Some Properties of the Phi-Function.

UNIT-V: Cryptography (RSA – PKC)

The RSA public key cryptosystem, Implementation and security issues, Pollard's p−1 factorization algorithm, Quadratic Residues and quadratic reciprocity

Text Books:

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

Suggested Reading:

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3^{rd} Ed., Wiley, 1968.
2. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.
3. Koshy, T. Elementary Number Theory with Applications, Elsevier Publications, New Delhi, 2002.

G. A. Jones & J. M. Jones "Elementary Number Theory", Springer UTM, 2007.

20CSC12

DESIGN AND ANALYSIS OF ALGORITHMS

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

Pre-requisites: Basics of Data structures and algorithms.

Course Objectives: The objectives of this course are

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

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

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

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	1	1	1	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-	1	1	1	-
CO5	2	2	1	-	-	-	-	-	-	-	-	-	1	1	1	-
CO6	2	3	1	-	-	-	-	-	-	-	-	-	1	1	1	-

UNIT - I

Introduction: Characteristics of algorithm. **Analysis of algorithm:** Asymptotic analysis of complexity bounds – best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs. **Divide and Conquer:** The general method. **Analysis of recursive algorithms through recurrence relations:** Substitution method, Recursion tree method and Masters' theorem.

UNIT - II

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

UNIT - III

Backtracking: The general Method, 8-Queens Problem, Graph Coloring, 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, sartaj sahni and sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press, 2008.

Suggested Reading:

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

Online Resources:

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

20CSC13

COMPUTER ARCHITECTURE AND MICROPROCESSOR

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

Pre-requisites: Digital Logic Design.

Course Objectives: The objectives of this course are

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

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

1. Understand the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2. Design assembly language program for specified computing 16 bit multiplication, division and I/O device interface.
3. Derive flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4. Design a memory module and analyze its operation by interfacing with the CPU.
5. Apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.
6. Develop testing and experimental procedures on Microprocessor and analyze their operation under different cases.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO1	2	1	-	1	-	-	-	-	-	2	1	-	1	-	-	-
CO2	2	1	1	2	3	-	-	-	3	1	2	-	2	2	1	1
CO3	1	2	-	1	-	-	-	-	-	2	-	1	-		2	1
CO4	-	2	2	1	-	-	-	-	3	1	-	1	-	2	2	1
CO5	-	3	2	1	1	-	-	-	-	1	-	1	-	2	-	-
CO6	-	1	1	1	1	2	2	-	3	1	-	-	2	3	2	2

UNIT - I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers. **Arithmetic:** Addition and Subtraction of Signed numbers, Design of fast adders, Multiplication of positive numbers, Signed-Operand Multiplication, Integer Division.

UNIT - II

Basic Processing Unit: Fundamental concepts, Execution of a complete instruction, Multiple-Bus organization, Hardwired control, Micro programmed control. **8086 Architecture:** CPU Architecture, Internal operation, Machine language instructions, Addressing modes, Instruction formats, Instruction execution timing.

UNIT- III

Assembly Language Programming: Instruction format, Data transfer instructions, Arithmetic instructions. **Assembly Language Programming:** Branch instructions, Loop instructions, NOP and HLT, Flag manipulation instructions, Logical instructions, Shift and Rotate instructions, Directives and Operators.
Modular Programming: Linking and Relocation, Stacks, Procedures, Interrupts and Interrupt routines, Macros and String instructions, REP prefix.

UNIT - IV

Peripheral devices and their characteristics: Input-output subsystems, I/O deviceinterface,I/Otransfers– ProgramControlled,InterruptDrivenandDMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces– SCSI,USB.

Pipelining: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Superscalar operation, Performance considerations.

UNIT – V

The Memory System: Memory hierarchy ,Semiconductor RAM Memories, Cache Memories, Performance considerations, Virtual Memories, Memory Management requirements, Secondary Storage. **Large Computer Systems:** Forms of Parallel Processing, Array Processors, Structure of general purpose multiprocessors, Program parallelism and shared variables.

Text Books:

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

Suggested Reading:

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

20CSC14

DATA BASE MANAGEMENT SYSTEMS

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

Pre-requisites: Discrete mathematics of computer science, Programming and data structures.

Course Objectives: The objectives of this course are

1. To become familiar with fundamental concepts of database management. These concepts include aspects of database design, database languages and database-system implementation.
2. To understand about data storage techniques and indexing.
3. To impart knowledge in transaction management, concurrency control techniques and recovery procedures.

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

1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS .Design the database logically using ER modeling.
2. Outline the schema of the relational database and key constraints. Develop queries using fundamental, extended operators of relational algebra and DDL, DML and DCL of SQL .
3. Explore the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Summarize the concepts of dense ,sparse ,ISAM and B+ tree indexing and get familiar with static and extendable techniques of hashing .
5. Explain the states and properties of transaction. Interpret the locking, time stamp, graph and validation based protocols for concurrency control.
6. Relate log based, ARIES recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transaction .

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO 1	3	1	-	-	-	1	-	-	-	-	-	2	1	-	2	-
CO 2	3	2	1	-	-	1	-	-	-	-	-	3	1	3	2	-
CO 3	3	2	2	2	-	2	-	-	2	-	-	-	2	2	2	3
CO 4	3	2	2	2	2	2	-	-	2	-	-	-	2	3	2	3
CO 5	3	2	3	2	2	2	3	-	2	-	3	3	2	3	3	3
CO 6	3	3	3	2	2	2	3	-	2	-	3	3	2	3	3	3

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Users and Administrators, Database System Architecture, Application Architectures. **Database Design and E-R Model:** Overview of the Design Process, Data Models, The E-R Model, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Reduction to Relation Schemas.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations. **Structured Query Language:** Overviews, 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.

UNIT- III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization–1NF,2NFand 3NF,Dependency Preservation, BCNF, Comparison of BCNF and 3NF.Indexing: Basic Concepts, Primary Index, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+Tree Index Files.

UNIT - IV

Hash based Indexing: Static Hashing, Extendible Hashing. **Transaction Management and Concurrency Control:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity.

UNIT - V

Deadlocks: Deadlock Prevention, Deadlock Detection and Recovery**. Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Non-volatile Storage, ARIES Recovery Method, Remote Backup Systems.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", Eight Editions, Pearson Education, 2006.
3. Raghu Ramakrishnan, Johnnes Gehrke, "Database Management Systems", Third Edition, McGraw-Hill, 2003.
4. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2006.

Suggested Reading:

1. J. D. Ullman, "Principles of Database Systems", Galgotia.

Online Resources:

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

20CSC15

INTERNET AND WEB TECHNOLOGIES

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	2

Pre-requisites: Programming and Problem Solving, Object Oriented Programming concepts.

Course Objectives: The objectives of this course are
1. Acquire knowledge on XHTML, Java Script and XML to develop client side web applications.
2. Acquire knowledge on web frameworks to develop server side web applications
3. Develop dynamic web content using Django.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the technologies required for developing web application.
2. Identify and choose XHTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
3. Design and Develop interactive and innovative web pages using various platforms/technologies like XHTML, CSS, XML, JAVASCRIPT.
4. Create and deploy web applications in web server by using server-side programming concepts like Python.
5. Build a data driven web site using different frameworks and Databases.
6. Evaluate different web applications to implement optimal solutions for real time problems.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

UNIT – I

Web Basics and Overview: Introduction to Internet, World Wide Web, URL, MIME,HTTP Transactions, Enterprise Application Architecture styles, containers, Client-Side Scripting, Server-Side Scripting, Accessing Web Servers, Apache and MySQL, IDE's.

UNIT – II

XHTML: Introduction to basics of XHTML, Cascading Style Sheets.

XML: Introduction to XML, XML document structure, DTD, Namespaces and XML Schemas.

UNIT - III

The Basics of Java script: Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements.

Dynamic Documents with Java Script: Positioning Elements, Moving Elements, Changing Colors and Fonts, Dynamic Content.

UNIT – IV

Django: Introduction, Models, Templates, supported data bases, URL configuration. Templates, Modifying and Improving the Templates , Creating a Form, Connecting Django with databases, enable Django sessions.

UNIT – V

Applications: Introduction to Ajax, Node.js and JSON.

Bootstrap: Introduction to Bootstrap, bootstrap grid, bootstrap components.

Web Application Frameworks: AngularJS, JQuery, Flask, Web2py, FuelPhP.

Professor and Head Department

Text Books:

1. Nigel George, "Build a Website with Django3", GNW Independent Publishing, Hamilton NSW, Australia, 2019
2. HTML5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery), Dreamtech, 2017.
3. Robert W Sebesta, "Programming the World Wide Web", Pearson Education, 8th Edition-2013
4. Adrian Holovaty and Jacob Kaplan-Moss" The Definitive Guide to Django Web Development Done Right", après-2009
5. P. J. Deitel - Deitel, H. M. Deitel - Deitel, "Internet & World Wide Web How To Program", 5th Edition, Prentice Hall, 2007.
6. Miguel Grinberg , "Flask Web Development", First edition-2014.

Suggested Reading:

1. Web Technologies, Uttam K Roy, Oxford University Press
2. Chris Bates, "Web Programming, building internet applications", 2nd edition, John Wiley & Sons, 2010.
3. JavaScript for Modern Web Development: Building a Web Application Using HTML, CSS, and JavaScript, by Alok Ranjan, Abhilasha Sinha, Ranjit Battwad, BPB, 2020.

Online Resources:

1. https://www.w3.org/standards/webdesign/
2. https://www.w3schools.com/angular/
3. https://www.w3schools.com/jquery/default.asp
4. https://www.tutorialspoint.com/flask/index.htm
5. https://www.tutorialspoint.com/web2py/index.htm
6. https://www.tutorialspoint.com/fuelphp/index.htm

20MBC01

ENGINEERING ECONOMICS & ACCOUNTANCY

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

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

Course Outcomes: After Completion of the Course, Student will be able to:
1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make 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.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

Unit-I Introduction to Managerial Economics

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

Unit-II Demand and Supply Analysis

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

Unit-III Production and Cost Analysis

Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.

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

Unit-IV Accountancy

Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

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, 11th Edition, 2013.

Suggested Readings:

1. Panday I.M. "Financial Management", 11th edition, VikasPublishing House, 2015.
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, 2013.

20MTC14

MATHEMATICAL FOUNDATION FOR DATA SCIENCE & SECURITY LAB
R- Programming/C/C++

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Course Objectives: The objectives of this course are
1. Able to learn and Analyzing data in Linear and Non-Linear form.
2. Able to fit the hypothetical data using probability distribution.
3. To know the characteristic of various continuous probability distributions
4. To know the impact of number theory before computer age.
5. To know the security issues of Cryptography

Course outcomes: On successful completion of this course the students shall be able to
1. Analyze the coefficient of skewness and fitting of the data by various methods
2. Apply properties of Mathematical Expectations and analyze the various distributions.
3. Evaluate areas of curves by using various distributions.
4. Apply various technics of Number Theory for solving problems
5. Apply RSA –PKC for solving security issues.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

List of Programs
1. Write a Program for Create Graphs and Charts
2. Write a Program for Calculate measures of Central Tendency for the data
3. Write a Program for Standard Deviation for the data
4. Write a Program for Correlation and Covariance using Pearson method
5. Write a Program for simple linear Regression and Logistic regression
6. Write a Program for Compute probabilities using Binomial Distribution
7. Write a Program for Compute Probabilities using Poisson Distribution
8. Write a Program for Compute Probabilities using Normal Distribution

Remark: The programs 1-4 are quite elementary.

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

Online Resources:
1. http://www.cyclismo.org/tutorial/R/

20CSC16

DESIGN AND ANALYSIS OF ALGORITHMS LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Programming and Problem Solving, Basics of Data structures and algorithms lab and Object Oriented Programming.

Course Objectives: The objectives of this course are

1. Design and construct simple programs by using the different design strategies for solving different problems.
2. To enhance programming skills while improving their practical knowledge in implementing the algorithms.
3. To strengthen the practical ability and to apply suitable algorithmic approaches for solving real time problems.

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

1. Implement greedy, dynamic programming, backtracking and branch and bound techniques.
2. Demonstrate various algorithmic design techniques.
3. Analyze the performance of various algorithms.
4. Compare various design strategies.
5. Formulate solutions to solve real world problems use acquired knowledge.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

The following task should be carried out by the students in the laboratory for each experiment:-

1. Setup the environment for the experiment.
2. Select appropriate design technique to implement the problem.
3. Represent the solution using algorithm
4. Analyze the performance of the algorithm (Time and Space complexity)
5. Justify the performance of your solution is better than other strategies.

By performing the above task for each experiment the following COs are achieved,

Course Outcome	-	1	2	3	4	5
Task	1	2	3	4	5	*

*As all the questions are real world applications so CO5 is achieved

List of Experiments:

1. You are given the task of choosing the optimal path to connect 'N' devices. The devices are connected with the minimum required N-1 wires into a tree structure, and each device is connected with the other with a wire of length 'L' ie 'D_1'connected to 'D_2' with a wire of length 'L_1'. This information will be available for all 'N' devices.
    a) Determine the minimum length of the wire which consists of N-1 wires that will connect all devices.
    b) Determine the minimum length of the wire which connects D_i and D_j
    c) Determine the minimum length of the wire which connects D_i to all other devices.
    d) Determine the minimum length of the wire which connects D_i to all other devices where $1 \leq i \leq N$.
2. An X-ray telescope (XRT) is a telescope that is designed to observe remote objects in the X-ray spectrum. In order to get above the Earth's atmosphere, which is opaque to X-rays, X-ray telescopes must be mounted

on high altitude rockets, balloons or artificial satellites. Planets, stars and galaxies and the observations are to be made with telescope. Here the process of rotating equipment into position to observe the objects is called slewing. Slewing is a complicated and time consuming procedure handled by computer driven motors. The problem is to find the tour of the telescope that moves from one object to other by observing each object exactly once with a minimum total slewing time.

3. CSE department of CBIT want to generate a time table for 'N' subjects. The following information is given- subject name, subject code and list of subjects code which clashes with this subject. The problem is to identify the list of subjects which can be scheduled on the same time line such that clashes among them do not exist.
4. A Test has 'N' questions with a heterogeneous distribution of points. The test-taker has a choice as to which questions can be answered. Each question Q_i has points P_i and time T_i to answer the question, where $1 \leq i \leq N$. The students are asked to answer the possible subsets of problems whose total point values add up to a maximum score within the time limit 'T'. Determine which subset of questions gives student the highest possible score.
5. Given N items with their corresponding weights and values, and a package of capacity C, choose either the entire item or fractional part of the item among these N unique items to fill the package such that the package has maximum value.
6. Given a bunch of projects, where every project has a deadline and associated profit if the project is finished before the deadline. It is also given that every project takes one month duration, so the minimum possible deadline for any project is 1 month. In what way the total profits can be maximized if only one project can be scheduled at a time.
7. N-Queen is the problem of placing 'N' chess queens on an N×N chessboard. Design a solution for this problem so that no two queens attack each other.

   Note: A queen can attack when an opponent is on the same row, column or diagonal.
8. Bi-connected graphs are used in the design of power grid networks. Consider the nodes as cities and the edges as electrical connections between them, you would like the network to be robust and a failure at one city should not result in a loss of power in other cities.
9. Consider a source code structure where you are building several libraries DLLs (Dynamic-Link Library) and they have dependencies on each other. For example, to build DLL , you must have built DLLs B, C and D (Maybe you have a reference of B,C and D in the project that builds A).

Text Books

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press/McGraw-Hill, 2009.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", Second Edition, Wiley, 2001.

20CSC17

DATA BASE MANAGEMENT SYSTEMS LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Course Objectives: The objectives of this course are

1. To become familiar with the concepts of structured query language.
2. To understand about programming language / structured query language (PL/SQL).
3. To 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: On Successful completion of the 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.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO 1	3	2	2	2	2	-	-	-	-	-	-	-	1	-	2	-
CO 2	3	2	2	2	2	-	-	-	3	-	2	-	1	3	2	-
CO 3	3	1	2	-	-	-	-	-	2	-	2	-	2	2	2	3
CO 4	3	-	2	-	-	-	-	-	-	-	-	-	2	3	2	3
CO 5	3	2	2	-	-	-	-	-	-	-	-	-	2	3	3	3
CO6	3	2	2	-	-	-	-	-	-	-	-	-	2	2	2	2

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.

PL/SQL:

11. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
12. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/SQL.
13. Write a PL/SQL block using SQL and Control Structures in PL/SQL.
14. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
15. Write a PL/SQL code using Procedures, Functions and Packages.

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

Text Books / Suggested Reading:

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

20CSC18

INTERNET AND WEB TECHNOLOGIES LAB

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Pre-requisites: Programming and Problem Solving, Object Oriented Programming concepts.

Course Objectives: The objectives of this course are

1. To acquire knowledge on XHTML, Java Script, Ajax, Node.js, JSON, Bootstrap and XML to develop web applications.
2. Ability to develop dynamic web content using web frameworks.
3. To understand the design and development process of a complete web application.

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

1. Identify and install web development tools.
2. Develop client side web pages using XHTML, CSS and XML.
3. Create dynamic, interactive web applications using java script.
4. Develop server side web application using Django Frame work.
5. Understanding working of Ajax, Node.js and JSON.
6. Identify and explore different frame works for web applications.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO 1	-	-	-	1	3	-	-	-	1	-	-	2	-	-	-	-
CO 2	1	2	2	2	-	-	-	3	2	1	2	2	-	-	2	2
CO 3	1	2	2	2	3	-	-	3	2	1	2	2	-	-	-	-
CO 4	1	2	2	2	2	-	-	3	2	1	2	2	-	-	2	2
CO 5	1	2	2	2	2	-	-	3	2	1	2	2	-	-	-	-
CO 6	1	2	2	2	2	-	-	3	2	1	2	2	-	-	-	-

LIST OF PROGRAMS

1. Creation of development environment (IDE, Web Server)
2. Design simple web pages using XHTML and CSS.
3. Create well-formed document using DTD and XML schema.
4. Develop an application to validate form fields using java script.
5. Installation of Django and creation of web pages.
6. Create a form validation and session handling in Django.
7. Develop a data driven web application using databases (MySQL/SQLite).
8. Create a responsive web site using bootstrap.
9. Build an application on Ajax, Node.js and JSON.
10. Exploration of web frame works (AngularJS, JQuery, Flask, Web2py, FuelPhP).

Text Books:

1. Nigel George,"Build a Website with Django3", GNW Independent Publishing, Hamilton NSW, Australia,2019
2. HTML5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, JQuery), Dreamtech, 2017.
3. Robert W Sebesta, "Programming the World Wide Web", Pearson Education, 8th Edition-2013
4. Adrian Holovaty and Jacob Kaplan-Moss "The Definitive Guide to Django Web Development Done Right",aprèss- 2009
5. P.J.Deitel – Deitel, H.M.Deitel – Deitel, "Internet & World Wide Web How to Program", 5th Edition, Prentice Hall, 2007.
6. Miguel Grinberg , "Flask Web Development", First edition-2014

Suggested Reading:

1. Web Technologies, Uttam K Roy, Oxford University Press

2. Chris Bates, "Web Programming, building internet applications", 2nd edition, John Wiley & Sons, 2010.
3. JavaScript for Modern Web Development: Building a Web Application Using HTML, CSS, and JavaScript, by Alok Ranjan , Abhilasha Sinha, Ranjit Battwad, BPB,2020.

Online Resources:

1. https://websitesetup.org/bootstrap-tutorial-for-beginners/
2. https://www.guru99.com/node-js-tutorial.html.
3. https://www.w3.org/standards/webdesign/
4. https://www.w3schools.com/angular/
5. https://www.w3schools.com/jquery/default.asp
6. https://www.tutorialspoint.com/flask/index.htm
7. https://www.tutorialspoint.com/web2py/index.htm
8. https://www.tutorialspoint.com/fuelphp/index.htm

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

SCHEME OF INSTRUCTION AND EXAMINATION
Model Curriculum(R-20) with effect from the A.Y. 2021-22

B.E. (Computer Science and Engineering)

SERVICE COURSES

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	
1	20CSC36	Introduction To AI Tools, Techniques And Applications	1	1	-	3	40	60	2
2	20CSC37	Introduction To AI Tools, Techniques And Applications Lab	-	-	2	3	50	50	1
3	20CSC38	Design Thinking And Innovation	-	-	3	3	50	50	1.5
4	20CSC06	Basics of Data Structures	2	-	-	3	40	60	2
5	20CSC07	Basics of Data Structures Lab	-	-	2	3	50	50	1
6	20CSC34	OOPS using Python (for Biotech)	3	-	0	3	40	60	3
7	20CSC35	OOPS using Python Lab (for Biotech)	-	-	2	3	50	50	1

20CSC36

INTRODUCTION TO AI TOOLS, TECHNIQUES AND APPLICATIONS

Instruction	1L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	2

Prerequisite: Basic understanding of computer fundamentals

Course Objectives: The objectives of this course are to:
1. Introduce fundamental concepts of AI
2. Demonstrate the capabilities of AI applications
3. Present various modeling and formulation techniques to solve problems using AI
4. Introduce state-of-art tools and techniques

Course Outcomes: On successful completion of the course, students will be able to
1. Understand fundamental concepts of AI and its importance.
2. Identify various Machine Learning algorithms and their limitations.
3. Develop Chatbots based on requirements.
4. Analyze complex problems involving image processing, Computer Vision and HCI.
5. Understand smart solutions for various domains .

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs			
													1	2	3	4
CO1	2	-	-	-	2	-	-	-	-	-	-	-	2	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO4	-	-	2	3	2	-	-	-	-	-	-	-	3	-	2	1
CO5	2	2	2	-	-	-	1	-	-	-	-	-	3	-	-	1

UNIT - I

Introduction to Artificial Intelligence: Definition, importance of AI, application areas, state-of-the-art in AI, overview of hard AI problems and challenges facing in the field of AI;

Machine Learning: Introduction, machine learning algorithms, machine learning in practice, testing, problems with machine learning, dangers of machine learning and benefits

UNIT - II

Natural Language Processing: Overview of NLP and components, applications, use cases of NLP and challenges; **Computer Vision:** capabilities of computer vision, use of computer vision, computer vision on mobile devices, best practices and use cases, challenges

UNIT - III

Building AI and Machine Learning Projects: Workflow of a ML project, data science project, data collection, data set preparation; **AI Technologies, Tools, Platforms**: TensorFlow, Scikit, PyTorch, Keras, RapidMiner, AWS, Google Cloud AI, Azure, IBM Watson

UNIT - IV

Chatbots: Introduction to chatbots, architecture of a chatbot, process build Chatbots, challenges in building successful Chatbots, best practices, industry case studies. Virtual assistants

UNIT - V

Applications and Impact of AI: Smart applications, Current challenges, trends, opportunities, scalability, adversarial attacks on AI, adverse uses of AI, impact of AI on world's economy and its social implications

Text Books:

1. Tom Markiewicz & Josh Zheng, "Getting Started with Artificial Intelligence – A Practical Guide to Building Enterprise Applications" O'Reilly, 2017
2. Stuart J. Russell and Peter Norvig,Artificial Intelligence A Modern Approach

Suggested Reading:

1. Aurélien Géron,Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017
2. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv_ Computer Vision Projects with Python-Packt Publishing (2016)

Online Resources:

1. https://medium.com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe
2. https://www.coursera.org/learn/uol-machine-learning-for-all
3. https://www.coursera.org/learn/uol-machine-learning-for-all#syllabus
4. http://aws.amazon.com 2.http://code.google.com/appsengine
5. http://scikit-learn.org/stable
6. https://opencv.org/
7. https://github.com/qqwweee/keras-yolo3
8. https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/

20CSC37

INTRODUCTION TO AI TOOLS, TECHNIQUES AND APPLICATIONS LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Course Objectives: The main objectives of this course are to:
1. Expose the students to AI related real world problems
2. Familiarize students with AI tools and techniques
3. Expose students with AI technologies and platforms

Course Outcomes: At the end of the course, students shall be able to
1. Demonstrate the capabilities of AI
2. Build models for various real time problems using AI/ML Tools
3. Develop Chatbots, programs for simple applications
4. Analyze and interpret the experimentation results
5. Develop skills to communicate the experimentation results

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs			
													1	2	3	4
CO1	2	-	-	-	2	-	-	-	-	-	-	-	3	2	-	-
CO2	2	2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	-	2	-	-	-	-	-	-	-	-	-	2	3	2	-
CO4	-	2	2	3	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	2	-	-	-	-	2	-	-	-	-	-	2

Lab Experiments
1. Overview of AI, AI/ML project life cycle
2. Design/construct the workflow of a general AI project using draw.io
3. Train a ML model to recognize a Person or Object including gestures
4. Train a ML model to recognize various sound bytes and speech
5. Develop an app to recognize objects using image classification
6. Develop an Expression Match app using the trained ML model for facial expressions
7. Develop a Voice Authentication app tat uses a trained audio model of the user using audio classification to recognize the user's voice to authentication
8. Develop a conversational chatbot to automatically recognize speech, understand the intent of the user and generate a response accordingly using Amazon Lex
9. Design a program using Wolfram Language to classify Data (Numbers, Images, Colors) using automatic model selection
10. Design a program using the Wolfram Language to demonstrate Vector Encoding based Feature Extraction and Clustering for a dog image dataset

Text Books:
1. Tom Markiewicz & Josh Zheng, "Getting Started with Artificial Intelligence – A Practical Guide to Building Enterprise Applications" O'Reilly, 2017

Online Resources:
1. https://teachablemachine.withgoogle.com/v1/
2. https://appinventor.mit.edu/
3. https://aws.amazon.com/lex/
4. https://www.wolfram.com/
5. https://www.coursera.org/

20CSC38

DESIGN THINKING AND INNOVATION
(Course for all branches)

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

Course Objectives: The main objectives of this course are:
1. To immerse students into the world of innovation as a systematic process of tackling relevant business and/or social problems
2. To provide a social and thinking space for the recognition of innovation challenges and the design of creative solutions
3. To make the students to understand design thinking techniques, idea generation approaches

Course Outcomes: At the end of the course, students shall be able to
1. Recognize the latest and future issues and challenges in innovations
2. Understand creative thinking techniques, corporate needs and commercialization of ideas/products
3. Identify the state-of-the-art perspectives, ideas, concepts and solutions related to the design and execution of innovation driven projects using design thinking principles
4. Develop innovative ideas or alternative models for solving problems
5. Recognize and specify the best problem to solve and restate the problem as a function of its mutually exclusive and collective exhaustive different dimensions

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

UNIT-1
Introduction to Design Thinking: Introduction, history of modern design, early innovations industrialization, new materials, nature of design work, design for survival and survival for designing.

UNIT-2
Design Thinking: Design thinking as a systematic approach to innovation, brain storming, visual thinking, design challenges, product development.

UNIT-3
Idea Generation: Innovation, art of innovation, strategies for creativity, teams for innovation, design alternatives, decision making for new design.

UNIT-4
Design Thinking and Commercialization: Design thinking for strategic innovation, application of design thinking in business strategy, linking design thinking solutions to business challenges, Enterprise creativity, competitive logic of business strategy, design thinking for startups.

UNIT-5
Creative Thinking Techniques: Linear thinking, constraints in design, design thinking to meet corporate needs, designs for future

Text Books:

1. David Raizman “History of Modern Design”, Laurence King Publishing Ltd. Ed2, 2010
2. Tim Brown “Change by Design”, Harper Bollins, 2009
3. Tom Kelley with Jonathan Littman, “Ten Faces of Innovation”, Currency Books, 2006
4. Jimmy Jain, “Design Thinking for Startups”, Notion Press, 2018
5. Tom Kelley & Jonathan Littman, “The Art of Innovation”, Harper Collins Business, 2001
6. Michael Michalco, “Thinker Toys”, Ten Speed Press, 2006
7. Idris Mootee, “Design Thinking for Strategic Innovation” , John Willey & Sons, 2013

20CSC06

BASICS OF DATA STRUCTURES
(Common for all Programmes except CSE & IT)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	20 Marks
Credits	2

Prerequisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: To introduce
1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Course Outcomes: The students will be able to
1. Identify various data structures, searching & sorting techniques and their applications.
2. Describe the linear and non-linear data structures, searching and sorting techniques.
3. Apply suitable data structures to solve problems.
4. Analyze various searching and sorting techniques.
5. Evaluate the linear and non-linear data structures.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/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	PSO 4
CO 1	2	1	-	-	-	–	-	-	-	–	–	-				
CO 2	2	1	-	-	-	–	-	-	-	–	–	-				
CO 3	2	2	1	-	-	–	-	-	-	–	–	-				
CO 4	2	3	1	-	-	–	-	-	-	–	–	-				
CO 5	2	2	-	-	-	–	-	-	-	–	–	-				

UNIT - 1

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms- Complexity- Time and space tradeoff.

Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT - 2

Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT - 3

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications

UNIT - 4

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT - 5

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees

Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort

Text Books:

1. Narasimha Karumanchi "Data Structures and Algorithms Made Easy", Career Monk Publications, 2017
2. E. Horowitz , S. Sahni and Susan Anderson-Freed, "Fundamentals of Data structures in C", Silicon Pr; 2 edition (1 August 2007)
3. ReemaThareja, "Data Structures using C", Oxford, 2014

Suggested Reading:

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-1#DS
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms
5. https://www.coursera.org/specializations/data-structures-algorithms

20CSC07

BASICS OF DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Any Programming Language(C)

Course Objectives:

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes: The students will be able to

1. Implement the abstract data type.
2. Demonstrate the operations on stacks, queues using arrays and linked lists
3. Apply the suitable data structures including stacks, queues to solve problems
4. Analyze various searching and sorting techniques.
5. Choose proper data structures, sorting and searching techniques to solve real world problems

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

List of Experiments

1. Implementation of operations on arrays
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting Techniques
7. Case study like Banking System, Students Marks Management, Canteen Management, Library Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers, O`Reily , 2013.

Online Resources:

1. https://nptel.ac.in/courses/106102064/
2. https://www.udemy.com/algorithms-and-data-structures-in-python/

20CSC34

OOPS USING PYTHON

Instruction	3 Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Sessional	40 Marks
Credits	3

Course Objectives: The objectives of this course are
1. Describe the principles of Object-Oriented Programming.
2. Enable the students to solve problems using OOPs features.
3. Debugging in programs and files.
4. Use of library modules to develop applications.

Course Outcomes: On Successful completion of the course students will be able to:
1. Demonstrate the concepts of Object-Oriented Programming languages to solve problems.
2. Apply the constructs like selection, repetition, functions and packages to modularize the programs.
3. Design and build applications with classes/modules.
4. Find and rectify coding errors in a program to assess and improve performance.
5. Develop packages for solving simple real world problems.
6. Analyze and use appropriate library software to create mathematical software.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

UNIT - I

Introduction to Object Oriented Programming: Introduction to Programming Languages, Features of Object Oriented Programming, Merits and Demerits of OOPs

Basics of Python Programming: Features of Python, Variables, Identifiers, Data types, Input/Output operations, Operators and Expressions, Operations on Strings, Type Conversion.

UNIT - II

Decision Control Statement: Selection/Conditional Branching, Loop Control Structures, Nested Loops.

Functions and Modules: Uses of functions, Function definition, function call, Variable scope and Lifetime, Recursion, Lambda functions, map, reduce and filter built-in functions, Recursive Functions, Modules, Packages.

UNIT - III

Classes and Objects: Introduction, Classes and Objects, init method, Class variables, and Object variables, Public and Private Data members, calling methods from other methods, garbage collection, class methods, static methods.

UNIT - IV

Inheritance: Introduction, Inheriting classes, Polymorphism and method overloading, Composition or Containership, Abstract classes and inheritance.

Operator Overloading: Introduction, Implementation of Operator Overloading, Overriding.

File Handling: File types, opening and closing files, reading and writing files, file positions, Regular Expression.

UNIT - V

Error and Exception Handling: Introduction to errors and exceptions, Handling Exceptions, Plotting Graphs in Python (Use of Matplotlib).

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Text Books:

1. ReemaThareja "Python Programming", Oxford Press, 2017.
2. Mike McGrath "Python in easy steps: Makes Programming Fun", Kindle Edition,2017.

Suggested Reading:

1. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.

Online Resources:

1. https://anandology.com/python-practice-book/ object_oriented_programming.html
2. http://python-textbok.readthedocs.io/en/1.0/ Object_Oriented_Programming.html
3. http://www.tutorialspoint.com/python/python_classes_objects.html
4. https://docs.python.org/3/

20CSC35

OOPS USING PYTHON LAB

Instruction	2 Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Sessional	50 Marks
Credits	1

Course Objectives: The objectives of this course are
1. Identification and installation of required software to work with Python.
2. Program development using OOPs concepts.
3. Handling of errors in program code.
4. Use of library modules to develop applications.

Course Outcomes: On Successful completion of the course, student will be able to
1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to build the solutions.
3. Develop the solutions with modular approach using functions, packages to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of STLs and modules to build applications.
6. Determine the requirements of real world problems and use appropriate modules to develop solutions.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

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

Lab Experiments:
1. Installation of any Object Oriented Programming Language and IDE.
2. Simple scripts to demonstrate the use of basic data types and operators.
3. Simple scripts to demonstrate the use of control structures.
4. Functions and Lambda function and parameter passing.
5. Experimentation with Modules.
6. Implementation of classes with attributes and methods.
7. Demonstration of inheritance.
8. Experiments on Overloading.
9. Experimentation of Files and Regular Expressions.
10. Building code to demonstrate Exceptions and built-in tools.
11. Demonstration of Plotting graphs.

Text Book:
1. Reema Thareja "Python Programming", Oxford Press, 2017.

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

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Scheme of Instruction and Syllabi

of
V - VI SEMESTERS

of
FOUR YEAR DEGREE COURSE

in
BE-COMPUTER SCIENCE AND ENGINEERING

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

R-20 Regulation

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SCHEME OF INSTRUCTIONS AND EXAMINATION

Model Curriculum(R-20)

B.E. (Computer Science and Engineering)

SEMESTER - V

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	20CSC19	Formal Language and Automata Theory	3	1	-	3	40	60	4
2.	20CSC20	Operating Systems	3	-	-	3	40	60	3
3.	20CSC21	Data Communication and Computer Networks	3	-	-	3	40	60	3
4.	20CSC22	Software Engineering	3	-	-	3	40	60	3
5.	20CSEXX	Professional Elective-I	3	-	-	3	40	60	3
6.	20XXXXX	Open Elective-I	3	-	-	3	40	60	3
PRACTICAL									
7.	20CSC23	Operating Systems Lab	-	-	3	3	50	50	1.5
8.	20CSC24	Data Communication and Computer Networks Lab	-	-	3	3	50	50	1.5
9.	20CSC25	Case Studies using UML Lab	-	-	2	3	50	50	1
10.	20CSI02	Internship-II (Industrial / Rural Internship)	3 to 4 weeks / 90 Hours			-	50	-	2
		Total	**18**	**1**	**8**	**-**	**440**	**510**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Professional Elective – I	
20CSE01	Image Processing and Computer Vision
20CSE02	Advanced Databases
20CSE03	System Modelling and Simulation
20CSE04	Free and Open Source Technologies
20CSE05	Optimization Techniques

Open Elective - I	
20ECO10	Fundamentals of Wireless Communication
20EEO05	Waste Management
20MEO09	Organizational Behaviour
20MTO03	Quantum Computing
20BTO04	Bioinformatics

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20CSC19

FORMAL LANGUAGE AND AUTOMATA THEORY

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

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

Course Objectives: The objectives of this course are,

1. To identify the hierarchy of formal languages, grammars, and Design finite automata to accept a set of strings of a language.
2. Should be able to prove that a given language is regular and able to apply the closure properties of languages and design context free grammars, conversions into normal forms.
3. To find equivalence of languages accepted by Push down Automata and distinguishes between computability Vs non-computability and Decidability Vs Undecidability.

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

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

UNIT - I

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular languages and finite automata: Regular expressions and languages, Deterministic Finite Automata (DFA) and equivalence with regular expressions, Nondeterministic Finite Automata (NFA) and equivalence with DFA. Equivalence and Minimization of Automata.

UNIT - II

Regular Expressions and Finite Automata: Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, and Algebraic Laws for Regular Expressions.

Properties of Regular Languages: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties and Decision Properties of Regular Languages.

UNIT - III

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

UNIT - IV

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

Turing Machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs.

UNIT - V

Unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Undecidability: universal Turing machine, reduction between languages and Rice s theorem, PCP and Modified PCP, Various translators.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", Third edition, Pearson Education, 2011.

Suggested Reading:

1. John C Martin. "Introduction to Language and Theory of Computation", 3rd edition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2ndedition, Wiley Publications, 2007.
3. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", 3rd edition, Prentice Hall of India 2008.
4. Shyamalendra Kandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.
5. Kamala Krithivasan, Rama R. "Introduction to Automata Theory, and Computation", Pearson 2009.

Online Resources:

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

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20CSC20

OPERATING SYSTEMS

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

Prerequisites: Computer Architecture and Programming Fundamentals.

Course Objectives: The objectives of this course are,

1. Should be able to describe the operating system service, and the design of an operating system.
2. To understand the structure and organization of the file system, process synchronization, process scheduling, system calls and different approaches to memory management.
3. To understand about the cloud infrastructures and technologies.

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

1. Identify the basics of an operating systems and its major components.
2. Understand the concepts related to process synchronization and deadlocks.
3. Distinguish various memory management techniques.
4. Interpret various threats and defense mechanisms used to protect the system.
5. Evaluate various file allocation methods.
6. Apply security as well as recovery features in the design of algorithms.

UNIT - I

Concepts of Operating Systems: Computer System over view, concept of an operating system, Types of operating systems, general system architecture, system components, operating system services, system calls, system programs, approaches to OS design and implementation: Micro-kernel, Layered, Kernel Approach.

UNIT - II

Processes and Threads: Concept of process, process states, process state transitions, process control block, operations on processes, concurrent processes, mutual exclusion and synchronization, principles of deadlocks, integrated deadlocks strategy, scheduling levels, scheduling criteria, algorithms, Inter Process Synchronization, Inter Process Communication, Linux IPC Mechanisms, RPC, RPC exception handling, Security issues.

UNIT - III

Memory Management and Data Management: Logical and physical address space, storage allocation and management techniques, swapping concept of multi-programming, paging, segmentation, virtual storage management strategies, demand paging, page replacement algorithms, thrashing, File organization, record blocking, access methods, directory structure, protection file system structure, allocation methods, free space management, directory implementation, disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels.

UNIT - IV

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

UNIT - V

Case studies and OS Abstractions: Linux/Unix OS design and architecture, Unix shell, Unix OS services, user perspective, representation of files in Unix, system processes and their structure, I/O system, memory management in Unix. Processes management, file management, IPC and network related system calls,

Text Books:

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

Suggested Reading:

1. Ekta Walia, “Operating System Concepts”, Khanna Book Publishing, 2020.

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2. William Stallings, “Operating Systems Internals and Design Principles”, Pearson Edition, 2012.
3. Charles Crowley, “Operating Systems –A Design Oriented Approach”, McGraw Hill Education, 2017.
4. Andrew S. Tanenbaum, Albert S Woodhull, “Operating systems Design and Implementation”, Pearson Edition, 2009.

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20CSC21

DATA COMMUNICATION AND COMPUTER NETWORKS

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

Pre-requisites: Programming for problem solving and data structures.

Course Objectives: The objectives of this course are,

1. To understand the principles of data communication and organization of computer networks,
2. To analyze various routing protocols and congestion control algorithms.
3. To study the functions of the transport layer and to understand application layer protocols.

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

1. Learn the communication protocol suites like ISO-OSI and TCP/IP.
2. Illustrate and explain Data Communications System and its components.
3. Identify and analyze various congestion control algorithms.
4. Distinguish the internet protocols like IP, ARP, ICMP, IGMP, routing protocols and DHCP.
5. Understand the transport layer protocols like TCP, UDP, RTCP.
6. Identify various application layer protocols like HTTP, WWW, DNS, Email Protocols, FTP and the underlying protocols.

UNIT - I

Introduction: Data communication, network types and models, TCP/IP and OSI Protocol Suite, transmission media (wired and wireless), switching.

UNIT - II

Data Link Layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, HDLC, point to point protocols, multiple access protocols.
LAN: Wired LAN, wireless LAN, connecting devices and Virtual LAN.

UNIT - III

Network Layer: Network layer design issues, routing algorithms, congestion control algorithms, Quality of service, IPV4, IPV6, network layer protocols: ARP, RARP, ICMP, IGMP and DHCP.

UNIT - IV

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission ControlProtocol (TCP), SCTP, congestion control, quality of service.

UNIT - V

Application Layer: DNS, DDNS, SMTP, POP, IMAP, SSH, SFTP,WWW, HTTP, SNMP, Firewalls.

Text Books:

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw Hill, Fifth Edition, 2017.
2. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013.
3. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2007.

Suggested Reading:

1. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012.
2. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105081/
2. https://nptel.ac.in/courses/106/106/106106091/

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20CSC22

SOFTWARE ENGINEERING

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

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

Course Objectives: The objectives of this course are,

1. To understand the Software Engineering Practice and Process Models.
2. To understand Design Engineering and Project Management in Software Development.
3. To gain knowledge in software testing and overall project activities.

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

1. State the software process and explain perspective process model, evolutionary process models.
2. Understand the agile Software process models and demonstrate the skills necessary to specify the requirements of software product so as to prepare SRS document.
3. Recall the modeling 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 apply software testing methods in conventional and O-O approaches and estimates software quality of SW.

UNIT - I

Introduction to Software Engineering: The nature of Software, 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, Concurrent Models, 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 Modeling (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, Components SRS, Structure of a Requirements Document

UNIT - III

Flow-Oriented Modeling, **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.

UNIT - IV

Design Concepts: Coupling, Cohesion, The Open-Closed Principle, Function-Oriented Design - Structure Charts, Structured Design Methodology, An Example, Software Architecture, A Brief Taxonomy of Architectural Styles, C**omponent-Level Design:** Definition, Basic Design Principles, Design Guidelines, Designing Traditional Components, Coding Principles and guidelines, Incremental Development of Code, Code Inspection – Planning, Self-Review, Group Review Meeting.

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. Software Review Techniques - Informal Reviews Formal Technical Reviews, Quality Concepts - What is Quality, Software Quality.

Text Books:

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1. Roger S. Pressman “Software Engineering: A practitioner's approach”, McGraw Hill, 7th Edition, 2010.
2. Pankaj Jalote “A concise Introduction to Software Engineering”, Springer, Kindle Edition, 2008.

Suggested Reading:

1. Sommerville “Software Engineering”, 10th Edition, Pearson, 2016.
2. Rajib Mal “Fundamental of Software Engineering”, 4th Edition, PHI Learning, 2014.

Online Resources:

1. https://nptel.ac.in/courses/106101061/

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20CSE01

IMAGE PROCESSING AND COMPUTER VISION
(Professional Elective – I)

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

Pre-requisites: Linear Algebra and calculus.

Course Objectives: The objectives of this course are,
1. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: On successful completion of the course, students will be able to,
1. Understand basic principles of image processing and its significance in real world.
2. Interpret and evaluate various approaches for image. Transformation, segmentation, and restoration.
3. Determine and compute object, scene recognition and categorization algorithms for real time images.
4. Analyze images and videos for problems such as tracking and structure from motion.
5. Appraise recovery of 3D structure of ill-posed scenes.
6. Apply various techniques to build computer vision applications.

UNIT - I
Image Formation and Description: Fundamental steps of image processing, the image model and Image acquisition, Relationship between pixels. Sampling and Quantization, Elements of Digital Image Processing Systems.
Image Transforms: Digital Image Transforms - Fourier Transform, Extension to 2D.Properites of Fourier transformations.

UNIT - II
Image Enhancements: Histogram Equalization, Image Smoothing, Image Sharpening, Edge Detection.
Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts.
Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation.

UNIT - III
Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, constrained structure and motion
Dense motion estimation: Translational alignment, parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT - VI
Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT - V
3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, volumetric representations, Model-based reconstruction.

Text Books:
1. R. C. Gonzalez, R. E. Woods "Digital Image Processing" Addison Wesley, 2008.
2. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

Suggested Reading:
1. Robert J. Schallkoff "Pattern Recognition: Statistical. Structural and Neural Approaches", John Wiley & Sons, 1992.
2. D. A. Forsyth, J. Ponce. "Computer Vision: A Modern Approach", Pearson Education; 2003.

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3. Richard Hartley, Andrew Zisserman, “Multiple View Geometry in Computer Vision”, Second Edition, Cambridge University Press, 2004.
4. K. Fukunaga, "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_ee40.
2. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline.
3. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/cil/ftp/html/vision.html.

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20CSE02

ADVANCED DATABASES
(Professional Elective – I)

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

Pre-requisites: Programming for problem solving, Database management systems.

Course Objectives: The objectives of this course are,

1. To design high-quality relational databases and database applications.
2. To translate complex conceptual data models into logical and physical database designs.
3. To gain an understanding of Oracle11g and XML.
4. To perceive knowledge about Parallel and Distributed Databases.
5. To get exposed in Performance Tuning.

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

1. Analyze and evaluate modeling and development methods/techniques in Object-based Databases.
2. Understand and analyze query processing and optimization.
3. Understand how distributed and parallel databases are implemented, and how applications can be designed for those databases.
4. Develop applications for mobility and personal databases.
5. Understand and implement cloud-based databases.
6. Gain insight into some advanced topics in database such as Performance Tuning, spatial databases, temporal databases.

UNIT - I

Object Based Databases: Overview, complex Data Types, Structured Types and Inheritance in SL, table Inheritance, Array and Multiset Types in SQL, Object –Identity and Reference Types in SQL, Implementing O-R features, Persistent Programming Languages, Object Relational Mapping, Object Oriented versus Object Relational.

UNIT - II

XML: Motivation, Structure of XML data, XML Document schema, Querying and Transformation, Application Program Interface to XML, Storage of XML data, XML applications.

UNIT - III

Query processing: Overview, Measures of Query Cost, Selection operating, sorting, Join Operation, Other Operations, Evaluation of Expressions.

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expressing Results, Choice of Evaluation plans, Materialized Views.

UNIT - IV

Parallel Databases: Introduction, I/O Parallelism, Inter-query Parallelism, Intra-query Parallelism, Interoperation Parallelism Query Optimization, and Design of Parallel Systems.

Distributed Databases: Homogenous and Heterogeneous Databases, distributed data storage, Distributed Transactions, Commit Protocols, concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, cloud Based Databases, Directory systems.

UNIT - V

Advanced Application development: Performance Tuning, Performance Benchmarks Other Issues in Application Development, Standardization.

Spatial and Temporal Data and Mobility: Motivation, Time in Databases, spatial and Geographical Data, Multimedia Databases, Mobility and Personal databases.

Test Books:

1. Abraham Silbershatz, Henry F Korth, S Sudharshan, “Database System Concepts”, McGraw Hill

International Edition, Sixth Edition, 2010.
2. ElmasriNavathe, Somayajulu, Gupta, "Fundamentals of Database Systems", Pearson Education, Fourth Edition, 2006.

Suggested Reading:

1. CJ Date, A Kannan, S Swamynathan, "An Introduction to database Systems", Pearson Education, Eight Edition, 2006
2. Ramakrishna, Gehrke, "Database Management", International Edition, Third Edition, 2003.

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20CSE03

SYSTEM MODELLING AND SIMULATION
(Professional Elective – I)

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

Course Objectives: The objectives of this course are,

1. Review the cost-effectiveness and the time-effect of modeling with industry-related examples of modeling in science and engineering.
2. Estimate essential inputs of the model and respective outcomes from the simulation.
3. Analyze different models and simulations, describe the iterative development process of a model, and explain how models link the physical and virtual worlds.

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

1. Create a computer simulation based on the physical characteristics of the system.
2. Solve ordinary and partial differential equations with computational methods.
3. Display insight into the uncertainties in a system and how they can be characterized.
4. Manipulate the data structures of numerical computing; matrices, and vectors, and visually represent data sets coming from computer simulations.

UNIT - I

Introduction to Modeling; Modeling Concepts and Definitions; Introduction to MATLAB; MATLAB Scripts; MATLAB Arrays.

UNIT - II

Aspects of discrete event simulation; Random number/variate generation; linear models; graphing data in MATLAB; MATLAB Array Math.

UNIT - III

Graphing in MATLAB; Nonlinear Functions and Modeling; Curve fitting; MATLAB I/O.

UNIT - IV

Stochastic models; Accuracy and precision in modeling; MATLAB conditional statements; MATLAB loops; MATLAB functions.

UNIT - V

Simulation models validation methods; Read/write simulation data from/to external files.

Text Books:

1. Steven I. Gordon, Brian Guilfoos “Introduction to Modeling and Simulation with MATLAB® and Python”. CRC Press, 2017.
2. Law and Kelton “Simulation Modeling and Analysis”, Third Edition, McGraw Hill, Boston, MA, 2000.

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20CSE04

FREE AND OPEN SOURCE TECHNOLOGIES
(Professional Elective – I)

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

Pre-requisites: Programming for problem solving, Object Oriented Programming.

Course Objectives: The objectives of this course are,
1. To familiarize the students with Open Source Technologies.
2. To expose students with OSS Projects, Advantages of Open Source.
3. To make the students understand the principles, methodologies, policies, licensing procedures and ethics of FOSS.

Course Outcomes: On Successful completion of this course, student will be able to,
1. Identify various FOSS tools, platforms, licensing procedures and development models, ethics
2. Describe various FOSS projects, development models and project management
3. Adapt to the usage of FOSS tools and technologies.
4. Distinguish between Proprietary and Open Source tools, development methods
5. Practice Open Source principles, ethics, and models and to evaluate various Open Source projects like Linux, Apache, GIT, etc.

UNIT - I
Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Free Vs. Proprietary Software, Public Domain software, Historyof free software, Proprietary Vs Open Source, uses and advantages of Free and Open Source Software.

UNIT - II
Principles and Open Source Methodology: Open Source Initiatives, Open Standards Principles, Methodologies, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT - III
Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, GIT, GNU CC, LibreOffice.

UNIT - IV
Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, OpenSource Teaching (OST), Open Source Media.
How to create your own Licenses, Important FOSS Licenses (Apache, BSD, GPL and LGPL).

UNIT - V
Open Source Ethics: Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:
1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek, James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

Suggested Reading:
1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.

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5. Clay Shirky, Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

Online Resources:

1. https://fossee.in/
2. https://opensource.com
3. https://www.gnu.org/

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20CSE05

OPTIMIZATION TECHNIQUES
(Professional Elective - I)

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

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

Course Objectives: The objectives of this course are,

1. To identify and develop optimization techniques from the verbal description of real system.
2. To learn different techniques to get optimum solution LPP.
3. To understand the Mathematical representations that are needed to solve optimization problem.
4. To analyze the results of the different real-world problems.
5. To construct network and find critical path using network scheduling technique

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

1. Calculate the optimum values for given objective function by LPP.
2. Solve the solution for maximize the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for assignment and travelling salesman problems and computing the optimal solution for Job sequencing models.
4. Compute the optimum values for given objective function by IPP and optimal strategy for games.
5. Identify critical path using network scheduling.

UNIT - I

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

UNIT - II

Introduction, Mathematical Formulation of transportation Problem, Balanced / Unbalanced, Minimization / Maximization, Determination of the initial basic feasible solution using (i) North-West Corner Rule (ii) Least cost method & (iii) Vogel's approximation method for balanced & unbalanced transportation problems. Optimality Test & obtaining of optimal solution (Considering per unit transportation cost) using MODI method and steppingstone method.

UNIT - III

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

UNIT - IV

Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique Game and strategies: Introduction, Game with maximin-minimax principle (Pure Strategies), Game with Mixed Strategies, Dominance Property, Graphical Method for 2 X n or m x 2 Games, Linear Programming Approach for Game Theory.

UNIT - V

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

Text Books:

1. Kanti Swarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand Publications, 2010.
2. R. Pannerselvam, "Operations Research", PHI, 2nd Edition, 2016.

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Suggested Reading:

1. Deb K. “Optimization for Engineering Design Algorithms and Examples”, PHI, 2000.
2. Arora J. “Introduction to Optimization Design”, Elsevier Academic Press, New Delhi, 2004.
3. Saravanan R. “Manufacturing Optimization through Intelligent Techniques”, Taylor & Francis (CRC Press), 2006.
4. Hardley G. “Linear Programming”, Narosa Book Distributors Private Ltd., 2002.

Online Resources:

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

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20ECO10

FUNDAMENTALS OF WIRELESS COMMUNICATION
(Open Elective – I)

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

Prerequisite: A course on basics of electronics is required.

Course Objectives: The objectives of this course are,

1. To familiarize the concepts related to cellular communication and its capacity.
2. To teach students the fundamentals of propagation models and multipath fading.
3. To describe diversity schemes applied in wireless communication and understand the latest Wireless technologies

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

1. Understand the overview of Wireless Communication.
2. Relate the cellular concepts like frequency reuse, hand off, coverage and capacity.
3. Analyse the mobile radio propagation with large scale and small scale fading.
4. Select the suitable diversity technique to combat the multipath fading effects.
5. Compare the multiple access techniques and apply to wireless standards.

UNIT - I

An overview of wireless communications: Roadmap of cellular communications. First-Generation systems. Second-Generation systems. Third-Generation systems, Fourth-Generation systems and Fifth-Generation Systems.

UNIT - II

The Cellular Concept-System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies. Handoff Strategies. Interference and System Capacity. Power Control for Reducing Interference.

UNIT - III

Mobile Radio Propagation: Large-Scale Path Loss, Introduction to Radio Wave Propagation, Free Space Propagation Model, the Three Basic Propagation Mechanisms, **Small-Scale Fading and Multipath:** Small-Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift, Types of Small-Scale Fading.

UNIT - IV

Diversity Techniques: Practical Space Diversity Considerations- Selection Diversity, Feedback or Scanning, Maximal Ratio Combining Diversity Equal Gain Combining. **Orthogonal frequency division multiplexing:** Introduction, Principle of OFDM. OFDM transceivers Cyclic prefix, Spectrum of OFDM, Fading mitigation in OFDM. Intercarrier interference.

UNIT - V

Multiple access techniques: Duplexing: FDD versus TDD. FDMA. TDMA. CDMA. OFDMA. SDMA
Wireless Standards: Global System for Mobile (GSM). GSM Services and Features, GSM System Architecture, GSM Radio Subsystem. GPRS and EDGE- features.

Text Books:

1. Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, First Edition, 2005.
3. Ke-Lin Du, Concordia University, Montréal,M. N. S. Swamy- Wireless Communication Systems.From RF Subsystems to 4G Enabling Technologies. April 2010.

Suggested Reading:

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1. Sanjay Kumar, “Wireless Communication the Fundamental and Advanced Concepts” River Publishers, Denmark, 2015
2. Andreas F.Molisch - Wireless Communications John Wiley, 2nd Edition, 2006.
3. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.

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20EEO05

WASTE MANAGEMENT
(Open Elective – I)

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

Course Objectives: The objectives of this course are,

1. To imbibe the concept of effective utilization of any scrap.
2. To become familiar with the processes of all disciplines of engineering.
3. To learn the technique of connectivity from waste to utility.

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

1. Categorize the waste based on the physical and chemical properties.
2. Explain the Hazardous Waste Management and Treatment process.
3. Illustrate the Environmental Risk Assessment, methods, mitigation and control.
4. Interpret the Biological Treatment of Solid and Hazardous Waste.
5. Identify the waste disposal options, describe the design and construction, Operation, Monitoring, Closure of Landfills.

UNIT - I

Introduction to waste management and Municipal Solid Waste Management: Classification of waste: Agro based, Forest residue, Industrial waste, e-Waste, Municipal Solid Waste Management: Fundamentals Sources, composition, generation rates, collection of waste, separation, transfer and transport of waste, treatment and disposal options.

UNIT - II

Hazardous Waste Management and Treatment: Hazardous Waste Identification and Classification, Hazardous Waste Management: Generation, Storage and collection, Transfer and transport, Processing, Disposal, Hazardous Waste Treatment: Physical and Chemical treatment, Thermal treatment, Biological treatment, Pollution Prevention and Waste Minimization, Hazardous Wastes Management in India.

UNIT - III

Environmental Risk Assessment: Defining risk and environmental risk, Parameters for toxicity quantification, Types of exposure, Biomagnifications, Effects of exposure to toxic chemicals, risk analysis and risk matrix, methods of risk assessment, mitigation and control of the risk, case studies.

UNIT - IV

Biological Treatment: Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

UNIT - V

Waste Disposal: Key Issues in Waste Disposal, Disposal Options and Selection Criteria: Disposal options, Selection criteria, Sanitary Landfill: Principle, Landfill processes, Landfill Gas Emission: Composition and properties, Hazards, Migration, Control, Leach ate Formation: Composition and properties. Leach ate migration, Control, Treatment, Environmental Effects of Landfill, Landfill Operation Issues, Design and construction, Operation, Monitoring, Closure of Landfills - Landfill Remediation, national and International Waste management programs.

Text Books:

1. John Pichtel "Waste Management Practices", CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous "Waste Management", McGraw Hill International Editions, New York, 1994.
3. Richard J. Watts, Hazardous "Wastes - Sources, Pathways, Receptors", John Wiley and Sons, New York, 1997.

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Suggested Reading:

1. Basics of Solid and Hazardous Waste Mgmt. Tech. by KantiL.Shah 1999, Prentice Hall.
2. Solid and Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist.

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20MEO09

ORGANIZATIONAL BEHAVIOUR
(Open Elective – I)

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

Course Objectives: The objectives of this course are,

1. Define basic organizational behavior principles and analyze how these influence behavior in the work place.
2. Analyze the influence of perceptions and personality on individual human behavior in the work place.
3. Discuss the theories of Motivation and Leadership.
4. Provide knowledge on different organizational structures; and concepts of culture, climate and organizational development and make the students familiarize with individual behavior.
5. Describe the interpersonal and their intrapersonal reactions within the context of the group and also demonstrate effective communication and decision making skills in small group settings.

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

1. Understand Organizational Behavioral principles and practices.
2. Compare various organizational designs and cultures enabling organizational development.
3. Apply motivational theories and leadership styles in resolving employee‘s problems and decision makingprocesses.
4. Understand the group dynamics, communication network, skills needed to resolve organizational conflicts.
5. Analyze the behavior, perception and personality of individuals and groups in organizations in terms of the key factors that influence organizational behavior.

UNIT – I

Introduction: Organizational behaviour, nature and levels of organizational behavior, individuals in organization, individual differences , personality and ability, the big 5 model of personality , organizationally relevant personality traits, the nature of perception , characteristics of the perceiver, target and situation, perceptual problems.

UNIT – II

Organization structure: Organizational designs and structures, traditional and contemporary organizational designs, organizational culture and ethical behavior , factors shaping organizational culture, creating an ethical culture, concepts, organizational climate, organization conflict, and organization development.

UNIT – III

Motivation and leadership: Motivation, early and contemporary theories of motivation, leadership, early and contemporary approaches to leadership.

UNIT – IV

Group dynamics: Groups and group development, turning groups into effective teams, managing change , process, types and challenges, communicating effectively in organizations, communication process, barriers to communication, overcoming barriers to communication, persuasive communication, communication in crisis situations.

UNIT – V

Power, Politics, Conflict and Negotiations: Power, politics, conflict and negotiations, sources of individual, functional and divisional power, organizational politics conflict, causes and consequences, Pondy‘s model of organizational conflict, conflict resolution strategies.

Text Books:

1. Jennifer George and Gareth Jones, “Understanding and Managing Organizational Behavior”, Pearson Education Inc., 2012.
2. Jon L Pierce and Donald G. Gardner, “Management and Organizational behavior”, Cengage Learning

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India (P) Limited, 2001.
3. Richard Pettinger, "Organizational Behaviour", Routledge, 2010.

Suggested Reading:

1. Stephen P. Robbins, Jennifer George and Gareth Jones, "Management and Organizational Behaviour", Pearson Education Inc., 2009.
2. John Schermerhorn, Jr., James G. Hunt and Richard N. Osborn, "Organizational Behaviour", 10th edition, Wiley India Edition, 2009.

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20MTO03

QUANTUM COMPUTING
(Open Elective – I)

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

Course Objectives: The objectives of this course are,

1. To learn Quantum bits and compute mathematical foundation
2. To understand the evaluation of the quantum bits.
3. To learn Quantum operations by building blocks of Quantum programming
4. To know the basics of Quantum logic gates and circuits
5. To learn Quantum Algorithms by various Techniques.

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

1. Compute basic mathematical operations on Quantum bits.
2. Execute Quantum operations of Quantum computing
3. Built quantum programs
4. Develop quantum Logical gates and circuits.
5. Develop the quantum algorithm

UNIT - I

Math Foundation for Quantum Computing: Introduction of Vector Space, Subspaces, Basis and Finite Dimensions. Vectors and orthogonality, inner product and Outer product and Hilbert Spaces. Formation of Matrices by Linear Transformation. Linear Independent and dependent Vectors. Unitary operators and projectors, Eigen values and Eigen Vectors.

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, Overview of major concepts in Quantum Commuting ,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

UNIT – III

Building Blocks for Quantum Program: Block sphere representations, Multi-qubits, Inner and outer product of Multiple of qubits, Tensor product, Quantum Entanglement, Quantum Teleporation (EPR Model) and Bell State.

UNIT – IV

Quantum Logical gates and Circuits: Pauli, Hadamard, Phase shift, controlled gates, AND, OR and NAND gate, C-Not, CCNOT gate Introduction of Fourier Transform and Discrete Fourier transform.

UNIT – V

Quantum Algorithms: Z-Transform. Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Quantum Phase estimation, Quantum walks), Major Algorithms (Shore's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm).

Text Books:

1. David McMahon, "Quantum Computing Explained", Wiley-IEEE Computer Society Pr., 2008.

Suggested Reading:

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press, 2010.

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20BTO04

BIOINFORMATICS
(Open Elective – I)

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

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

Course Objectives: The objectives of this course are,

1. To 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. To learn the fundamentals of biological databases, Sequence analysis, data mining, sequence alignment and phylogenetics.
3. To learn methods for determining the predictinggene and protein.

Course Outcomes: On successful completion of the 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.

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, jackknifing

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

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Distributors Pvt. Ltd., 2005
2. Rastogi SC, Mendiratta N and Rastogi P, "Bioinformatics: Methods and Applications Genomics, Proteomics and Drug discovery", 3rd edition, 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 Bioinfomatics", Cambridge University Press, 2006.

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20CSC23

OPERATING SYSTEMS LAB

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

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

Course Objectives: The objectives of this course are,

1. To explore Unix/Linux operating system.
2. To analyze various system calls available in Linux/Unix.

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

1. Understand Linux/Unix environment.
2. Identify and interpret various system programs.
3. Understand and implement shell programming.
4. Simulate memory management and file allocation techniques.
5. Analyze process and file management system calls by creating and/or modifying concurrent programs.
6. Build network-oriented applications using system calls.

List of Experiments:

1. Shell programming.
2. Implementation of memory management techniques like paging and segmentation.
3. Implementation of Linked, Indexed and Contiguous file allocation methods.
4. Demonstration of Linux/Unix file related system calls: mkdir, link, unlink, mount, unmount, users+, chown, chmod, open, close, read, write, lseek, stat, sync.
5. Demonstration of Linux/Unix process related system calls: fork, wait, exec, exit, getpid, getuid, setuid brk, nice, sleep.
6. Development of applications using Linux/Unix system calls: signal, socket, accept, snd, recv, connect.

Text Books:

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

Suggested Reading:

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

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20CSC24

DATA COMMUNICATION AND COMPUTER NETWORKS LAB

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

Pre-requisites: Operating Systems, Data Communication and Computer Networks.

Course Objectives: The objectives of this course are,

1. To familiarize students with the communication media, devices, and protocols.
2. To expose students to gain practical knowledge of computer networks and its configuration.
3. To create simple network topologies using simulation tools.

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

1. Identify the different types of wiring equipment's used in the networks lab.
2. Understand the various network devices like repeater, hub, switch, and routers.
3. Practice the basic network configuration commands like ifconfig, ping, traceroute, nslookup, dig, arp, netstat, nmap.
4. Design and demonstrate network topologies using GNS3.
5. Examine the packet transfer using tcpdump.
6. Analyze the network performance using Wireshark or any tool.

List of Experiments:

1. Study of Network media, cables, and devices and Cable Construction.
2. Demonstration of basic network commands/utilities (both in Windows and Linux).
3. PC Network Configuration.
4. Building a switch-based network / Configuration of Cisco Switch CBS250-24T-4G 24-Port.
5. Configuration of Cisco Router ISR-4331.
6. Configuration of VLAN in Cisco switch.
7. Develop different local area networks using GNS3. Connect two or more Local area networks. Explore various sub-netting options.
8. Configure Static routing using GNS3 tool.
9. Basic OSPF configuration using GNS3 tool.
10. Basic EIGRP Configuration using GNS3 tool.
11. Analysis of network traces using tcpdump.
12. Analysis of network traces using Whireshark.

Text Books:

1. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013.

Online Resources:

1. https://learningnetwork.cisco.com/s/question/0D53i00000Kt7EkCAJ/tools-for-ccnp-network-simulator-lab-tasks
2. https://www.packettracernetwork.com/
3. https://www.ghacks.net/2019/11/13/gns3-is-an-open-source-graphical-network-simulator-for-windows-linux-and- macos/
4. https://www.imedita.com/blog/top-10-list-of-network-simulation-tools/
5. https://www.gns3.com/

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20CSC25

CASE STUDIES USING UML LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Prerequisites: Object Oriented Programming, Software Engineering.

Course Objectives: The objectives of this course are,

1. To identify Project Scope, Objectives and infrastructure.
2. To understand Software Engineering methodologies for project development
3. To gain knowledge about Computer Aided Software Engineering (CASE) tools.
4. To use effective communication and technical skills for building quality software.

Course Outcomes: On successful completion of the 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 structured approach to develop ER and Data Flow Diagrams.
4. Apply/Use the design notations of OO approach to develop UML diagrams using rational tools.
5. Implement, analyze and prepare the documentation for the proposed system.

Select one large Information System/Approach and device the following using UML tool:

1. Structured Diagrams (Data Flow Diagrams, Entity-Relationship Diagrams etc.)
2. Preparation of Software Requirement Specification Document for a given Case Study.

UML Diagrams

1. Use Case Diagrams
2. Class Diagrams
3. Sequence Diagrams
4. Activity Diagrams
5. State Chart Diagrams
6. Component Diagrams
7. Deployment Diagrams

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.

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20CSI02

INTERNSHIP – II

(Industrial / Rural Internship)

Instruction	3 to 4 weeks / 90 Hours
Duration of End Examination	-
Semester End Examination	-
Continuous Internal Evaluation	50 Marks
Credits	2

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SCHEME OF INSTRUCTIONS AND EXAMINATION

Model Curriculum(R-20)

B.E. (Computer Science and Engineering)

SEMESTER - VI

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	20CSC26	Compiler Design	3	-	-	3	40	60	3
2.	20CSC27	Artificial Intelligence	3	-	-	3	40	60	3
3.	20CSEXX	Professional Elective – II	3	-	-	3	40	60	3
4.	20CSEXX	Professional Elective – III	3	-	-	3	40	60	3
5.	20XXXXX	Open Elective-II	3	-	-	3	40	60	3
6.	20EGM03	Universal Human Values 2.0	3	-	-	3	40	60	3
PRACTICAL									
7.	20CSC28	Compiler Design Lab	-	-	3	3	50	50	1.5
8.	20CSC29	Artificial Intelligence Lab	-	-	3	3	50	50	1.5
9.	20CSEXX	Professional Elective – II Lab	-	-	2	3	50	50	1
10.	20EGC03	Employability Skills	-	-	2	3	50	50	1
		TOTAL	**18**	**-**	**10**	**-**	**440**	**560**	**23**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Professional Elective - II	
20CSE06	Soft Computing
20CSE07	Internet of Things
20CSE08	Enterprise Application Development
20CSE09	Machine Learning
20CSE10	DevOps

Professional Elective - II Lab	
20CSE15	Soft Computing Lab
20CSE16	Internet of Things Lab
20CSE17	Enterprise Application Development Lab
20CSE18	Machine Learning Lab
20CSE19	DevOps Lab

Professional Elective - III	
20CSE11	Natural Language Processing
20CSE12	Embedded Systems
20CAE04	Algorithmic Game Theory
20CSE13	Adhoc Sensor Networks
20CSE14	Software Quality Testing

Open Elective - II	
20ECO01	Remote Sensing and GIS
20MTO01	Financial Mathematics
20EEO02	Energy Management Systems
20EGO01	Technical Writing Skills
20CEO02	Disaster Risk Reduction And Management
20CHO04	Environmental and Sustainable Development

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20CSC26

COMPILER DESIGN

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

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

Course Objectives: The objectives of this course are,

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

Course Outcomes: On successful completion of the 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. Explain the algorithms to generate code for a target machine code and evaluate.
6. Recognize the errors and their recovery strategies and understanding advance topics

UNIT - I

Introduction to compilers – Analysis of the source program, 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, scanner 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

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, a simple code generator. Overview of machine-dependent and independent optimizations .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.

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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.

Online Resources:

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

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20CSC27

ARTIFICIAL INTELLIGENCE

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

Pre-requisites: Data structures, Discrete Mathematics.

Course Objectives: The objectives of this course are,

1. To become familiar with basic principles of AI and its fundamentals.
2. To discuss the knowledge and application of intelligent systems and their practical applications.
3. To analyze the various knowledge representation schemes, reasoning and learning techniques of AI.

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

1. 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.

UNIT - I

Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures.

Intelligent agents: Classification, Working of an agent, single agent and multi agent systems, multi agent application.

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 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: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

Markov Decision Process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT - V

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, 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.

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Online Resources:

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

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20CSE06

SOFT COMPUTING
(Professional Elective – II)

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

Pre-requisites: Linear Algebra & Calculus, Differential Equations and Transform Theory.

Course Objectives: The objectives of this course are,
1. To learn various types of soft computing techniques and their applications.
2. To acquire the knowledge of neural network architectures, learning methods and algorithms.
3. To understand Fuzzy logic, Genetic algorithms and their applications.

Course Outcomes: On Successful completion of this course, student will be able to,
1. Understand various soft computing concepts and techniques.
2. Analyze and design various learning models.
3. Apply the Neural Network Architecture for various Real time applications.
4. Examine and approximate reasoning using fuzzy logic.
5. Design Genetic algorithms in different applications.
6. Develop soft computing techniques to solve different applications.

UNIT - I
Soft computing vs. Hard computing, Various types of soft computing techniques.
Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network, important terminologies of ANNs. McCulloch-Pitts neuron, linear separability, Hebb network.

UNIT - II
Supervised Learning Neural Networks: Perceptron networks, Adaptive linear neuron (Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network.

UNIT - III
Unsupervised Learning Neural Networks: Kohonen Self Organizing networks, Adaptive resonance theory.
Associate Memory Networks: Bidirectional associative memory network, Hopfield networks.

UNIT - IV
Fuzzy Logic: Introduction to classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membershipfunctions, Defuzzification.

UNIT - V
Genetic Algorithms: Introduction, Basic operators and terminology, Traditional algorithm vs. genetic algorithm, Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Genetic programming, Applications of genetic algorithm.

Text Books:
1. S.N. Sivanandam& S.N. Deepa, “Principles of soft computing”, Wiley publications, 2nd Edition, 2011.
2. Soft Computing – Ikvinderpal Singh, Khanna Book Publishing 2015.

Suggested Reading:
1. S. Rajasekaran, G.A. Vijayalakshmipai, “Neural Networks, Fuzzy logic & Genetic Algorithms, Synthesis & Applications”, PHI publication, 2008.
2. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.
3. K.L.Du & M.N.S Swamy, “Neural Networks in a Soft Computing Framework”, Springer International edition, 2008.
4. Simon Haykins, “Neural Networks a Comprehensive Foundation”, PHI, second edition.
5. Goldberg, David E., “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, New Delhi, 2002.
6. Learning and Soft Computing by Kecman, Pearson Education, 2001.

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7. N.P. Padhy and S.P. Simon,"Soft Computing: With Matlab Programming", Oxford University Press, 2015.
8. Neuro fuzzy and soft computing by Jang, Pearson Education, 1996.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs13/preview.
2. https://archive.nptel.ac.in/courses/106/105/106105173/

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20CSE07

INTERNET OF THINGS
(Professional Elective – II)

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

Pre-requisites: Computer architecture and microprocessor, Programming for problem solving.

Course Objectives: The objectives of this course are,

1. To understand the architecture, basics and applications of IoT.
2. To impart practical knowledge on components of IoT.
3. To develop skills required for building real-time IoT based projects.

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

1. Understand IoT, its hardware and software components.
2. Comprehend I/O interface and programming APIs.
3. Analyze the use of communication protocols in IoT.
4. Explore Solution framework for IoT applications.
5. Illustrate unstructured data storage.
6. Develop real time IoT based projects.

UNIT - I

Introduction to IoT: Architectural Overview, Design principles and requirements of IoT, IoT Applications.
Elements of IoT: Basics of networking, sensors, actuators, computing devices, software, data management and processing environment and Security issues.

UNIT - II

IoT Hardware Components: Computing (Arduino, Raspberry Pi), Communication modules, Sensors, Actuators, I/O interfaces, Programming API's.

UNIT - III

IoT Data Protocols: MQTT, CoAP, AMQP, DDS, HTTP, WebSocket
Network Protocols for IoT: 6LowPAN, RPL, IPV6, WiFi, Bluetooth, ZigBee, Z-Wave, LoRaWan, MQTT, XMPP

UNIT - IV

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT - V

IoT Case Studies: IoT case studies based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

Text Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle,"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1st Edition, Academic Press, 2014.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill, 2017.

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4. Cuno Pfister, "Getting Started with the Internet of Things", 0' Reilly Media, 2011.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, "RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks", IETF, Standards Track, Mar. 2012.
3. Z. Shelby, K. Hartke, C. Bormann, "The Constrained Application Protocol (CoAP)", Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, "What's The Difference Between IEEE 802.15.4 And ZigBee Wireless?",Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo *et al*., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.
7. https://onlinecourses.nptel.ac.in/noc19_cs31/
8. https://www.nabto.com/guide-iot-protocols-standards/

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20CSE08

ENTERPRISE APPLICATION DEVELOPMENT
(Professional Elective – II)

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

Pre-requisites: Internet and web technologies, OOPs, Database management systems.

Course Objectives: The objectives of this course are,

1. To provide good understanding of latest web technologies on client side components like ReactJS and Angular2
2. To acquire knowledge on web frameworks, develop server side web applications like Node.js and Express
3. To develop innovative web applications using various technologies.

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

1. Understand the database connectivity and application servers.
2. Explore the type of forms with validations using ReactJS.
3. Utilize Express framework to develop responsive web applications.
4. Demonstrate the architecture and file system of NodeJs.
5. Identify the significance of component intercommunication with Angular2.
6. Adapt MEAN or MERN stack to implement a real-time web application.

UNIT - I

Introduction to Full stack development and NoSQL

MongoDB: Basics, Configuring Server and Client, MongoDB Compass, Creating Database, MongoDB Commands, MongoDB CRUD Operations.

REST: Introduction to REST and API, REST Constraints, Representations, Resource Identifier, REST Actions, Status Codes.

UNIT - II

NodeJs: Introduction, NodeJS Features and Drawbacks, setup Environment for NodeJs, NodeJS Program architecture, NodeJS Web Server, NodeJS Global Objects, NodeJS OS Objects, NodeJS Error Handling, Node JS Event Loop, NodeJS File System, Async and Sync, Connecting with Database, Handling CRUD Operations.

UNIT - III

Building an Express web application: Introduction to Express, Installation of Express, Create first Express application, the application request and response objects, configuring an Express application, rendering views, Authentication, Authorization.

UNIT - IV

Introduction to ReactJS: React Components, React State and Props

Component intercommunication: Component Composition, pass data from parent to child, pass data from child to parent, Fetching data API using axioms, Types of forms, Form Validations, Posting Data, React Router, Building & Deploying React App.

UNIT - V

Introduction to Angular2: Angular2 Architecture (Component-Based Architecture), Consuming API, State Management, Validation, Routing. Passing data from parent to child and Passing data between siblings.

Angular2 Specific: Directives, Modules, Components, Observables, Binding, Pipes, Dependency Injection.

Text Books:

1. Amos Q. Haviv, MEAN Web Development, Second Edition, Packt Publications, November 2016.
2. Vasan Subramanian, "Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node", 2nd Edition, APress.
3. Fernando Doglio, "REST API Development with Node.js", 2nd Edition, APress.

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Suggested Reading:

1. Shelly Powers, "Learning Node: Moving to the Server-Side", 2nd Edition, O'REILLY, 2016.
2. Simon D. Holmes and Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Second Edition, Manning Publications, 2019
3. Brad Dayley, "Node.js, MongoDB and Angular Web Development", 2nd Edition, Addison-Wesley Professional, 2017.

Online Resources:

1. https://www.mongodbtutorial.org/mongodb-crud/
2. https://reactjs.org/tutorial/tutorial.html
3. https://www.javatpoint.com/expressjs-tutorial
4. https://www.javatpoint.com/nodejs-tutorial
5. https://angular-training-guide.rangle.io/

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20CSE09

MACHINE LEARNING
(Professional Elective – II)

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

Pre-requisites: Linear Algebra and Calculus, Artificial Intelligence.

Course Objectives: The objectives of this course are,

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

Course Outcomes: On successful of the course student will be able to,

1. Define the basic concepts related to Machine Learning.
2. Recognize the underlying mathematical relationships across ML algorithms and their paradigms.
3. Determine the various applications of Machine Learning.
4. Model, design and develop solutions to real world problems using Machine Learning Algorithms.
5. Evaluate and interpret the results of the various machine learning tools.

UNIT - I

Introduction to Machine Learning: Introduction, Classic and Adaptive machines, learning Types-Supervised, Unsupervised, deep learning, bio-inspired adaptive systems, Machine Learning, and big data.

Elements of Machine Learning: Data formats, Learnability, Statistical learning concepts, Class balancing, Elements of Information theory.

UNIT - II

Feature Selection and Feature Engineering: Data sets, creating training and test sets, managing categorical data, missing features, data scaling and normalization, whitening, Feature selection and filtering, PCA, Visualization of high-dimensional datasets.

Regression Algorithms: Linear regression, Regression types: Ridge, Lasso, ElasticNet, Robust, Polynomial and Isotonic.

UNIT - III

Classification Algorithms: KNN, Linear classification, logistic regression, grid search, classification metrics, ROC curve.

Naïve Bayes and Discriminant Analysis: Bayes theorem, Naïve Bayes classifiers, Discriminant analysis.

Decision Trees and Ensemble Learning: Binary Decision trees, Introduction, to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier.

UNIT - IV

Support Vector Machines: Linear SVM, Kernel based Classification.

Clustering Fundamentals: Basics, K-means, Evaluation methods, DBSCAN, Spectral Clustering, and Hierarchical Clustering.

UNIT - V

Machine Learning Architectures: Data collection, Normalization and regularization, Dimensionality reduction, Data augmentation, Modeling/Grid Search/Cross-validation, Visualization, GPU support, introduction to distributed architectures, Scikit-learn tools for ML architectures.

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018,
2. Tom Mitchel “Machine Learning”, Tata McGraW Hill, 2017.

Suggested Reading:

1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
2. ReemaThareja “Python Programming”, Oxford Press, 2017

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3. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm

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20CSE10

DEVOPS
(Professional Elective – II)

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

Pre-requisites: Database management systems, Operating systems, OOPs.

Course Objectives: The objectives of this course are,

1. To describe the agile relationship between development and IT operations.
2. To understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. To implement automated system update and DevOps lifecycle.

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

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration, testing and code deployment tools.
4. Investigate different DevOps Software development models.
5. Assess various Devops practices.
6. Collaborate and adopt Devops in real-time projects.

UNIT - I

Introduction: Software development models, Introduction to DevOps, Why DevOps, DevOps process and Continuous Delivery, Delivery pipeline, Release management, Scrum, Kanban DevOps Architecture, DevOps Workflow DevOps Lifecycle for Business Agility, and Continuous Testing.

UNIT - II

Introduction to project management: The need for source code control, the history of source code management, Git - **A version control tool**, Version Control System and Types, CVCS and DVCS.
Git Essentials: Creating repository, Cloning, check-in and committing, Fetch pull and remote, Branching.

UNIT - III

Jenkins - Continuous integration: Introduction to Continuous Integration, Build & Release and relation with DevOps Why continuous integration, Nodes/Salves, Managing plugins, Managing Software Versions.
Build Tools: Overview of Maven, Virtualization, and Virtualization in DevOps Understand Containers Dockers - A containerization technology.

UNIT - IV

Testing Tools and automation: Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium -Introduction, Selenium features, Testing backend integration points, Test-driven development, REPL-driven development.
Deployment Tools: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, SaltStack.

UNIT - V

Code monitoring and Issue Tracking: Code monitoring tools Nagios, Munin, Ganglia, Log handling. Introduction to issue trackers, Need of issue tracker: Workflows and issues.
Trackers tools: Bugzilla, GitLab tracker, and Jira.

Text Books:

1. Joakim Verona, “Practical Devops”, Second Edition. Ingram short title; 2nd edition, 2018.
2. Deepak Gaikwad, Viral Thakkar, “DevOps Tools from Practitioner's Viewpoint”. Wiley publications, 2019.

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Suggested Reading:

1. Len Bass, Ingo Weber, Liming Zhu, “DevOps: A Software Architect's Perspective”. Addison Wesley, 1st Edition, 2015.

Online Resources:

1. https://www.coursera.org/learn/intro-to-devops
2. hhttps://www.tutorialspoint.com/introduction-to-devops/index.asp

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20CSE11

NATURAL LANGUAGE PROCESSING
(Professional Elective – III)

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

Pre-requisites: Artificial Intelligence, Compiler Design.

Course Objectives: The objectives of this course are,
1. To learn the fundamentals of natural language processing.
2. To understand the various text processing techniques in NLP.
3. To understand the role Text Classification Deep Learning for Text Classification techniques of NLP
4. To use Topic Modelling, Case Studies and apply the NLP techniques to IR applications.

Course Outcomes: On successful completion of the course, students will be able to,
1. Understand the basic concepts of Natural language processing pipeline and applications of NLP.
2. Illustrate various text representation techniques in NLP.
3. Analyse text classification techniques and deep learning basics to process natural language text.
4. Explore text summarization methods and example systems.
5. Demonstrate levels of NLP for several case studies.
6. Apply NLP Pipe lines to solve real world applications.

UNIT - I

NLP: A Primer, NLP in the Real World, NLP Tasks, NLP Levels, What Is Language? Building Blocks of Language, Why Is NLP Challenging? Machine Learning and Overview Approaches to NLP, Heuristics-Based, Machine Learning, Deep Learning for NLP.

NLP Pipeline: Data Acquisition, Pre-Processing Preliminaries Frequent Steps, Advanced Processing Feature Engineering Classical NLP/ML Pipeline DL Pipeline Modeling, Evaluation of Models, Post-Modeling Phases.

UNIT - II

Text Representation Vector Space Models Basic Vectorization Approaches, One-Hot Encoding Bag of Words, Bag of N-Grams, TF-IDF, Distributed Representations, Word Embedding, Going Beyond Words, Distributed Representations.

UNIT - III

Text Classification Applications One Pipeline, Many Classifiers, Using Neural Embeddings in Text Classification Deep Learning for Text Classification Interpreting Text Classification Models.

Deep Learning for Text Classification CNNs for Text Classification, LSTMs for Text Classification

UNIT - IV

Topic Modelling Text Summarization, Use Cases Setting Up a Summarizer: An Example Recommender Systems for Textual Data Machine Translation Question-Answering Systems, Social Media, E-Commerce and Retail, Healthcare, Finance, and Law.

UNIT - V

Case Study on NLP Pipeline, Text Classification: Ticketing, Ecommerce, Social media, health care, Recommender systems and other applications of NLP

Text Books:

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana "Practical Natural Language Processing: A Comprehensive Guide to Building Real world NLP Systems", O'Reilly Media, Inc., 1st Edition, 2020.
2. James Allen, "Natural Language Understanding", Bejamin Cummings, 2nd edition, 1995.

Suggested Reading:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

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Online Resources:

1. https://nptel.ac.in/courses/106101007/
2. http://www.cs.colorado.edu/~martin/sp2.html
3. https://web.standford.edu/~jurafsky/sp3/

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20CSE12

EMBEDDED SYSTEMS
(Professional Elective – III)

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

Pre-requisites: Computer architecture and microprocessor, Digital logic design, Programming for problem solving.

Course Objectives: The objectives of this course are,

1. To be aware of general computing system, embedded system and classification of embedded system.
2. To analyze the core concepts of embedded system and its architecture.
3. To analyze the RTOS for embedded systems.
4. To learn embedded system development environment.
5. To learn to use tools in embedded software development process.

Course Outcomes: On successful of the course student will be able to,

1. Understand the basics of embedded systems.
2. Analyze the core concepts of Embedded System and Embedded System Architecture.
3. Design and develop Embedded System hardware and software using Embedded C.
4. Analyze the operating system for embedded systems.
5. Analyze the embedded system development environment and tools used in embedded software development process.

UNIT - I

Introduction to Embedded Systems: Embedded Systems, Processor embedded into a system, Embedded hardware units and devices in a system, Embedded software in a system, Examples of embedded systems, Design process in Embedded system, Formalization of system design, Design process and design examples(smart card, digital camera, mobile phone), Classification of Embedded Systems, Skills required for embedded system designer.

UNIT - II

Inter process communication and synchronization of processes, Threads and Tasks. Multiple processes in an application, Multiple threads in an application, Tasks, Task states, Task and data, Clear cut distinction between functions, ISRs and tasks and their characteristics. Concept of semaphores, Shared data, Inter process communication, Signal function, Semaphore functions, Message queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

UNIT - III

Real time operating systems: OS services, Process management, Timer functions, Event functions, Memory management, Device , File, IO subsystems management, Interrupt routine in RTOS environment and handling of Interrupt source calls, RTOS, RTOS task scheduling models, Interrupt latency, Response of tasks as performance metrics, OS security issues.

UNIT - IV

8051 interfacing with displays (LED, 7 segment display, LCD), Switch, Relay, Buzzer, D/A and A/D converters, Stepper motor.

Networked Embedded systems, Serial communication protocols, I2C bus, CAN bus, RS232, Introduction to advanced architectures: ARM and SHARC.

UNIT - V

Embedded software Development process tools: Introduction to embedded software development process and tools, Host and Target machines, linking and locating software, Getting embedded software into target system, Issues in hardware - software design and Co-design.

Testing, simulation and debugging techniques and tools: Testing on host machine, Simulators, Laboratory tools.

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Text Books:

1. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education India, 2009.

Suggested Reading:

1. David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Elsevier, 2008.

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20CAE04

ALGORITHMIC GAME THEORY
(Professional Elective – III)

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

Pre-requisites: Linear Algebra and Calculus, Design and analysis of algorithms.

Course Objectives: The objectives of this course are,

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

Course Outcomes: On successful of this course student will be able to,

1. Acquire knowledge about the real world problems and formulate mathematical models of these problems.
2. Identifying the algorithmic Models for finding the optimal solutions for real world examples.
3. Analyze the major limitations and capabilities of game theory problems.
4. Design and analyze problems using game theory approaches.
5. Explore the real world scenarios of economic and algorithmic interactions using game theory solutions.

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

Text Books:

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

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5. T. Ferguson, “Game Theory”, Web Notes.
6. Karlin and Peres, “Game Theory”, Alive, AMS.
7. DeVos and Kent, “Game Theory: A Playful Introduction”, AMS

Suggested Reading:

1. Robert Duncan Luce “Games and Decisions: Introduction and Critical Survey” (Dover Books on Mathematics), Howard Raiffa, 1989.
2. William Spaniel “Game Theory 101: The Complete Textbook”, 2011.
3. John von Neumann, Oskar Morgenstern, “Theory of Games and Economic Behavior”, Princeton Univ. Press. 2007.

Online Resources:

1. https://nptel.ac.in/courses/128106007
2. https://nptel.ac.in/courses/110101133
3. https://arxiv.org/list/cs.GT/1703
4. https://dl.acm.org/doi/book/10.1145/3241304#secAuthors

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20CSE13

ADHOC SENSOR NETWORKS
(Professional Elective – III)

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

Pre-requisites: Data Communication and Computer Networks, IoT.

Course Objectives: The objectives of this course are,
1. To understand the design issues in ad hoc and sensor networks.
2. To learn the different types of MAC protocols.
3. To be familiar with different types of adhoc routing protocols.
4. To get exposure to the TCP issues in adhoc networks.
5. To learn the architecture and protocols of wireless sensor networks.

Course Outcomes: On successful of the course student will be able to,
1. Explain the concepts, network architectures and applications of ad hoc and WSN.
2. Identify different issues in wireless adhoc and sensor networks.
3. Analyze the protocol design issues of adhoc and sensor networks
4. Design routing protocols for adhoc and WSN with respect to protocol design issues.
5. Evaluate the QoS related performance measurements of adhoc and sensor networks.

UNIT - I

Introduction: Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

UNIT - II

MAC Protocols for AdHoc Wireless Networks: Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11.

UNIT - III

Routing Protocols and Transport Layer In AdHoc Wireless Networks : Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing on-demand), hybrid routing-Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

UNIT - IV

Wireless Sensor Networks (WSN) and MAC Protocols: Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC-IEEE 802.15.4.

UNIT - V

WSN Routing, Localization & QoS: Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

Text Books:

1. C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols “, Prentice Hall Professional Technical Reference, 2008.

Suggested Reading:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, “Wireless Sensor Networks”, Elsevier Publication, 2002.

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3. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005.
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007.
5. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

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20CSE14

SOFTWARE QUALITY TESTING
(Professional Elective – III)

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

Pre-requisites: Software engineering.

Course Objectives: The objectives of this course are,

1. To understand the basics of testing, test planning &design and test team organization.
2. To study the various types of tests in the life cycle of the software product.
3. To build design concepts for system testing and execution.
4. To learn the software quality assurance, metrics and defect prevention techniques.

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

1. Perform white-box and black-box tests in the life cycle of the software product.
2. Understand system testing and significance of software reliability.
3. Identify defect prevention techniques and SQA metrics.
4. Apply various techniques and standards of SQA.
5. Reduce potential risks to an acceptable level before they occur.

UNIT - I

Software Testing - Concepts, Issues, and Techniques

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group, System Test Team Hierarchy, Team Building**.**

UNIT - II

System Testing

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. Functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models

UNIT - III

System Test Categories

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests. Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote. System test design-Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. System test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.

UNIT - IV

Software Quality

Software quality - Pec ‘s Quality Factors and Criteria – Relationship vare Quality Standard. Maturity models- Test

UNIT - V

Software Quality Assu

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Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.

Text Books:

1. Kshirasagar Nak Priyadarshi Tripathy, "Software Testing and Quality Assurance-Theory and Practice", John Wiley & Sons Inc, 2008.
2. Jeff Tian, "Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement", John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.

Suggested Reading:

1. Daniel Galin "Software Quality Assurance - From Theory to Implementation", Pearson Education Ltd. UK, 2004.
2. Milind Limaye "Software Quality Assurance", TMH, New Delhi, 2011.

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20ECO01

REMOTE SENSING AND GIS
(Open Elective - II)

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

Prerequisite: Basic knowledge of Geography is required

Course Objectives:

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:

1. Demonstrate the understanding of basic concepts of remote sensing and interpret 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.

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, Orbits of Remote sensing satellites, Indian remote sensing satellites.

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.

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20MTO01

FINANCIAL MATHEMATICS
(Open Elective - II)

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

Course Objectives: The objectives of this course are,

1. To explain the terms of financial market and its derivatives including options and futures.
2. To explain the modern portfolio theory.
3. To discuss the pricing theory in discrete time.
4. To explain the stochastic calculus.
5. To discuss the pricing theory in continuous theory.

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

1. Calculate the internal rate of return, annuity and amortization.
2. Apply the portfolio theory.
3. Examine the binomial model of pricing.
4. Analyze the stochastic differential equations.
5. Solve the BSM partial differential equations.

UNIT - I

Introduction to financial markets: Introduction to financial markets, financial instruments, bonds, stocks, futures & forwards, swaps and options. Time value of money, simple and compound interest rate, net present value, annuities, Amortization, Bond yield, internal rate of return and annuities. Markowitz portfolio theory, risk and return, two and multi-asset portfolio theory, minimum variance portfolio, efficient frontier.

UNIT - II

Modern portfolio theory: Capital Asset Pricing Model and portfolio performance analysis. No arbitrage principle, pricing of forwards and futures, properties of options. Derivative pricing by replication in single and multi-period binomial model.

UNIT - III

Risk neutral pricing in discrete time: Discrete probability spaces, filtration, conditional expectation. Discrete time martingales, Markov chain, risk-neutral pricing in binomial model for European and American derivatives.

UNIT - IV

Stochastic Calculus: General probability spaces, conditional expectation, Brownian motion and its properties. Ito integral, Ito formula, Girsanov's theorem, martingale representation theorem, stochastic differential equation.

UNIT - V

Risk neutral pricing in continuous time:-Black Scholes-Merton (BSM) model, pricing of European derivatives in BSM framework. Valuation of European options in BSM model, BSM formula, BSM partial differential equation, hedging, model completeness, and fundamental theorems of asset pricing.

Text Books:

1. Ales Cerny "Mathematical Techniques in Finance: Tools for Incomplete Markets". Princeton University Press, 2009.
2. Luenberger, David G. "Investment Science", Oxford University Press. Delhi, 1998.

Suggested Reading:

1. Hull, J. C., &Basu, S. "Options, Futures and Other Derivatives" 7th Edition Pearson Education. New Delhi, 2010.
2. S. R. Pliska "Introduction to Mathematical Finance: Discrete Time Models". Blackwell Publishers Inc., 2002.
3. Ross, Sheldon M. "An elementary Introduction to Mathematical Finance" 3rd Edition, Cambridge University Press. USA, 2011.

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20EEO02

ENERGY MANAGEMENT SYSTEMS
(Open Elective - II)

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

Prerequisites: Students should have prior knowledge on different energy generation systems, basic idea about audit instruments.

Course Objectives: The objectives of this course are,

1. To know the concept of Energy Management.
2. To understand the formulation of efficiency for various Engineering Systems.
3. To enable the students to develop managerial skills to assess feasibility of alternative approachesand drive strategies regarding Energy Management.

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

1. Know the current Energy Scenario and importance of Energy Conservation.
2. Understand the concepts of Energy Management, Energy Auditing.
3. Interpret the Energy Management methodology, Energy security and Energy Strategy.
4. Identify the importance of Energy Efficiency for Engineers and explore the methods of improving Energy Efficiency in mechanical systems, Electrical Engineering systems.
5. Illustrate the Energy Efficient Technologies in Civil and Chemical engineering systems.

UNIT - I

Various form of Energy and its features: Electricity generation methods using different energy sources such as solar energy, wind energy, Bio-mass energy, and Chemical energy such as fuel cells. Energy Scenario in India, Impact of Energy on economy, development, and environment sectors of national and international perspective.

UNIT - II

Energy Management-I: Defining Energy Management, need for Energy Management, Energy management techniques, importance of Energy Management, managing the Energy consumption, Energy Audit and Types, Energy Audit Instruments.

UNIT - III

Energy Management-II: understanding Energy costs, bench marking, Energy performance, matching energy use to requirement, optimizing the input, fuel & Energy substitution, material and Energy balance diagrams, Energy pricing, Energy and Environment, Energy Security.

UNIT - IV

Energy Efficient Technologies-I: Importance of Energy Efficiency for Engineers, Energy Efficient Technology in Mechanical engineering: Compressed Air System, Heating, ventilation and air- conditioning, Fans and blowers, Pumps and Pumping Systems,

Energy Efficient Technology in Electrical engineering: Automatic Power Factor Controllers, Energy Efficient Motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, space cooling, energy efficiency of lifts and escalator, energy saving potential of each technology.

UNIT - V

Energy Efficient Technologies-II: Energy Efficient Technology in Civil Engineering: Intelligent Buildings, And Various Energy Efficiency Rating Systems for Buildings, Green Buildings Energy Efficiency: management of green buildings, importance of embodied energy in selection of sustainable materials, green building design, waste reduction/recycling, rainwater harvesting, maintenance of the green buildings, green building certification, Renewable energy applications.

Energy Efficient Technology in Chemical Engineering: Green chemistry, Low carbon cements, recycling paper.

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Text Books:

1. Umesh Rathore, 'Energy Management', Kataria publications, 2nd ediiton, 2014.
2. G Hariharaiyer, “Green Building Fundamentals”, Notion press.com.
3. K V Shama, P Venkataseshaiah, "Energy management and conservation", I. K. International Publishing agency pvt. ltd., 2011.

Suggested Reading:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects.
2. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014) An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering, The University of Adelaide and Queensland University of Technology.
3. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org).

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20EGO01

TECHNICAL WRITING SKILLS
(Open Elective - II)

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

Course Objectives: The objectives of this course are,

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

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

UNIT - I

Communication – Nature and process.
Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.
Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT - II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT - III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles: Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

UNIT - IV

Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals: Definition, types, characteristics, structure and significance.

UNIT - V

Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.
Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Books:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communications-Principles and Practice", Oxford University Press, Second Edition, 2012.
2. M Ashraf Rizvi, "Effective Technical Communication", Tata McGraw Hill Education Pvt Ltd, 2012.

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Suggested Reading:

1. Kavita Tyagi, Padma Misra, "Basic Technical Communication", PHI Learning Pvt Ltd, 2012.
2. R.C Sharma, Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill, 2003

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

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20CEO02

DISASTER RISK REDUCTION AND MANAGEMENT
(Open Elective - II)

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

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

1. Identify and understand the concepts of hazards, causes and impacts of disasters.
2. Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management.
3. Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe.
4. Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction.
5. Evaluate DM study including data search, analysis and presentation as a case study.

UNIT - I

- 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.
- GIS and remote sensing.
- 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.
- Early warning systems.

UNIT - II

- Trauma and stress management.
- First aid and emergency procedures.
- Awareness generation strategies for the community on safe practises in disaster (as per regional significance).

UNIT - II

- Components of disaster management –preparedness of rescue and relief, mitigation, rehabilitation &reconstruction.
- Institutional frame work of disaster management in India (NDMA-SDMA, NDRF, Civic volunteers, NIDM).
- Phases of disaster/risk management and post-disaster responses.
- Compensation and insurance.
- Applications of remote sensing and GIS in disaster management.

UNIT - V

- Capacity building for disaster/damage mitigation (structural and non-structural measures).
- 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. “Disaster management Guidelines for Earth quakes, Landslides, Avalanches and Tsunami”. Horizon Press publications, (2017).

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2. Taimpo, “Disaster management and preparedness”. CRC Press Publications, 2016.
3. Nidhi, G.D., “Disaster management preparedness” .CBS Publications Pvt. Ltd, 2014.
4. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S., “Flood Disaster Risk Management-CBS Publications Pvt Ltd., 2013.
5. Singh, R., “Disaster management Guidelines for Natural Disasters” Oxford University Press Pvt. Ltd., 2016.

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20CHO04

ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT
(Open Elective - II)

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

Course Objectives: This course will help the students:

1. To have an increased awareness on issues in areas of sustainability.
2. To understand the role of engineering & technology within sustainable development.
3. To know the methods, tools and incentives for sustainable product service system development.
4. To establish a clear understanding of the role and impact of various aspects of engineering decisions on environmental, societal and economic problems.
5. To communicate results related to their research on sustainable engineering.

Course Outcomes: At the completion of this course students will be able:

1. To relate sustainability concepts and ethical principles towards environment.
2. To understand the different types of environmental pollution problems and their respect sustainable solutions.
3. To become aware of concepts, analytical methods/models, and resources for evaluating and comparing sustainability implications of engineering activities.
4. To critically evaluate existing and new methods.
5. To develop sustainable engineering solutions by applying methods and tools to research a specific system design.
6. To apply concepts of sustainable development to address sustainability challenges in a global context.

UNIT- I

Introduction of sustainability- Need and concept of Sustainable Engineering, Social-environmental and economic sustainability concepts, Sustainable development and challenges, Multilateral Environmental acts and protocols-Clean Development Mechanism (CDM), Environmental legislations in India- Air Act and Water Act.

UNIT- II

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

UNIT- III

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

UNIT- IV

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

UNIT- V

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

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Text Books:

1. Allen D. T and ShonnardD. R., Sustainability Engineering Concepts, Design and Case Studies, 1st Ed, Prentice Hall, 2011.
2. Bradley A. S, Adebayo A. O and Maria. P., Engineering Applications in Sustainable Design and Development, 1st Ed, Cengage Learning, 2016.

Suggested Reading:

1. Rag R. L., Introduction to Sustainable Engineering, 2nd Ed, PHI Learning Pvt Ltd, 2016.
2. Krishna R. Reddy, Claudio Cameselle, Jeffrey A. Adams., Sustainable Engineering, 1st Edition, Wiley, 2019.

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20EGMO3

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

(**B.E/B.Tech II/III Year** -Common to all Branches)

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

Introduction

This course discusses the role of human values in one's family, in society and in nature. In 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: The objectives of this course are,

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

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

1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. They would have better critical ability.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

UNIT - I

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.
- 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.

UNIT – II

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.

UNIT – III

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.

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- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals.
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

UNIT – IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the 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.
- Holistic perception of harmony at all levels of existence.

UNIT – V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- 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.
- 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.

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:

Assessment by faculty mentor: 10 Marks
Self-assessment/Assessment by peers: 10 Marks
Socially relevant project/Group Activities/Assignments: 20 Marks
Semester end examination: 60 Marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

Suggested Reading:

1. A Nagaraj Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. Cecile Andrews, Slow is Beautiful
4. Gandhi - Romain Rolland (English)
5. Dharampal, "Rediscovering India"
6. E. FSchumacher. "Small is Beautiful"
7. J. C. Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
10. 10.Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. Maulana Abdul Kalam Azad, India Wins Freedom.
12. Vivekananda - Romain Rolland (English)
13. The Story of Stuff

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20CSC28

COMPILER DESIGN LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

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

Course Objectives: The objectives of this course are,

1. To define the rules for implementing lexical analyzer and to understand the concepts behind the working of compiler tools- Lex, Turbo C, Yacc.
2. To analyze and apply regular grammar for various source statements expression.
3. To implement front end of the compiler by means of generating intermediate codes, implement code optimization techniques and error handling.

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

1. Implement the rules for the analyzing phases of a compiler.
2. Apply various Syntax techniques on grammars to build the parsers.
3. Generate various intermediate code representations for source code.
4. Explore error recovery strategies and implement code optimization, code generation phases.
5. Examine the concepts of compiler tools: Lex, FlexVision, Yacc, Turbo C.

List of Programs:

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

Text Books:

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

Suggested Reading:

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

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20CSC29

ARTIFICIAL INTELLIGENCE LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Artificial Intelligence.

Course Objectives: The objectives of this course are,

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

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

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

Lab Experiments:

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

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2010.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, 3rd Edition, 2017.

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.

Online Resources:

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

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20CSE15

SOFT COMPUTING LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Linear Algebra & Calculus, Differential Equations and Transform Theory.

Course Objectives: The objectives of this course are,

1. To illustrate the concepts of simple neuron.
2. To learn the fundamentals of Neural Networks & Feed Forward Networks, Associative Memories & Artificial Neural Networks.
3. To understand the concepts of Fuzzy Logic and Fuzzy Systems, Genetic Algorithms and its design.

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

1. Implement McCulloh-Pitts model for Boolean operations.
2. Apply perceptron learning algorithm for a given problem.
3. Design and analyze various Neural Networks Architectures.
4. Apply concepts of fuzzy sets on real-time applications.
5. Implement Genetic Algorithms with its operators.
6. Apply soft computing strategies for various real time applications.

List of Experiments:

1. Implementation of Simple Neural Network (McCulloh-Pitts model) for realizing AND Operation and OR operation.
2. Implementation of Perceptron network for realizing NAND operation.
3. Implementation of ANDNOT using ADALINE network.
4. Implementation of XOR problem using MADALINE network.
5. Design and Develop the Back Propagation Algorithm.
6. Implementation of Bidirectional Associative Memory (BAM) network.
7. Implementation of Hopfield Network.
8. Implementation of Membership Functions in Fuzzy Sets.
9. Implementation of Kohonen Self-Organizing Feature Maps (KSOFM) network for Clustering.
10. Implement the Genetic Algorithm for the function $f(x) = x^2$.

Textbooks:

1. S.N. Sivanandam & S.N. Deepa, “Principles of soft computing”, Wiley publications, 2nd Edition, 2011.

Suggested Reading:

1. D.K Prathikar, “Soft Computing”, Narosa Publishing House, New Delhi, 2008.
2. S.N.Sivanandam, S.N.Deepa “Principles of Soft Computing” Second Edition, Wiley Publication 2016.
3. Satish Kumar, "Neural Networks -A classroom approach"; Second Edition, TMH, 2017.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs54/preview

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20CSE16

INTERNET OF THINGS LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Computer architecture and microprocessor, Programming for problem solving.

Course Objectives: The objectives of this course are,

1. To understand the basics of IoT and its components.
2. To impart practical knowledge on IoT applications.
3. To develop skills required for building real-time IoT based projects.

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

1. Use of various hardware and software IoT components.
2. Perform experiments by Interfacing I/O devices, sensors to Raspberry Pi/Arduino.
3. Understand and analyze communication protocols in IoT.
4. Monitor data and controlling of devices.
5. Develop Real time IoT based projects.

List of Experiments:

1. Introduction to IoT equipments and perform necessary software installation.
2. Write a program to interface LED/Buzzer with Arduino and to turn ON LED for 1sec after every 2 seconds.
3. Write a program to interface Digital sensor PIR with Arduino and to turn ON LED when motion detected.
4. Write a program to interface DHT22 sensor with Arduino and display temperature and humidity readings.
5. Write a program to interface motor using relay with Raspberry Pi. Turn ON motor when the temperature is high.
6. Write a program to interface LCD with Raspberry Pi and print temperature and humidity readings on it.
7. Write a program to interface flame/smoke sensor with Arduino /Raspberry Pi and give an alert message when flame/smoke is detected.
8. Implement any case study using Arduino/Raspberry Pi.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

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

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4. L.Fenzel, “What’s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”,Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo *et al*., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.

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20CSE17

ENTERPRISE APPLICATION DEVELOPMENT LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Internet and web technologies, OOPs, Database management systems.

Course Objectives: The objectives of this course are,

1. To acquire knowledge on MongoDB, ReactJS, Express, Node.js and Angular2 to develop web applications.
2. Ability to develop dynamic web content using web frameworks.
3. To understand the design and development process of a complete web application.

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

1. Prepare database connections with application servers.
2. Design user interfaces using ReactJS.
3. Construct strong expertise on Express framework to develop responsive web applications.
4. Create server side applications using Node.js
5. Develop SPA using Angular 2.
6. Invent next culture-shifting web applications.

List of Programs:

1. Installation, configuration and connection establishment of MongoDB.
2. CRUD operations on MongoDB.
3. Building and Deploying React App.
4. Demonstration of component intercommunication using ReactJS
5. Create Express application,
6. Demonstration of authentication and authorization using Express.
7. Data access using Node.js
8. Create a form to edit the data using Angular2
9. A case study on a single platform for all financial data for NSE India.

Textbook:

1. Amos Q. Haviv, MEAN Web Development, Second Edition, Packt Publications, November 2016
2. Vasan Subramanian, “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node”, 2nd Edition, APress.

Suggested Reading:

1. Shelly Powers, “Learning Node: Moving to the Server-Side”, 2nd Edition, O’REILLY, 2016.
2. Simon D. Holmes and Clive Harber, “Getting MEAN with Mongo, Express, Angular, and Node”, Second Edition, Manning Publications, 2019.
3. Brad Dayley, “Node.js, MongoDB and Angular Web Development”, 2nd Edition, Addison-Wesley Professional, 2017.

Online Resources:

1. https://www.mongodbtutorial.org/mongodb-crud/
2. https://reactjs.org/tutorial/tutorial.html
3. https://www.javatpoint.com/expressjs-tutorial
4. https://www.javatpoint.com/nodejs-tutorial
5. https://angular-training-guide.rangle.io/

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20CSE18

MACHINE LEARNING LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Artificial Intelligence, Machine learning.

Course Objectives: The main objectives of this course are,

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

Course Outcomes: On Successful completion of this course, student 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.

List of Experiments:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import scikitlearn, keras and tensorflows etc.
2. Build linear regression model using gradient descent, least squares, polynomial, LASSO and RIDGE approaches also compare all the algorithms and draw a table for all the metrics.
3. Demonstration of decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. 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 Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
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. Implementation of Gradient Descent Algorithm using Tensorflow.
8. Case study on supervised learning algorithms.
9. Demonstration of clustering algorithms - k-Means, Agglomerative and DBSCAN to classify for the standard datasets.

Text Books:

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

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20CSE19

DEVOPS LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Database management systems, Operating systems, OOPs.

Course Objectives: The objectives of this course are,

1. To explore the fundamental concepts in Project Life Cycle.
2. To develop skills using tools of DevOps.
3. To examine the application development with different automation tools.

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

1. Understand the phases of the software development life cycle.
2. Examine the different version control systems.
3. Recognize the importance of the build and deployment tools and test the software application.
4. Deployment of application in production environment.
5. Summaries the software configuration management.
6. Synchronize and provisioning using Puppet and Ansible.

List of Experiments:

1. Git installation and create a repository and perform fetch, pull, branching operations.
2. Jenkins Installation and implement continues Integration and Continues deployment, build a job using Jenkins.
3. To install and configure Docker for creating containers of different Operating System (Virtualization Concept)
4. Deployment Tool (Team City /Ansible) Install Docker and execute commands in a Docker and deploy the application in to Docker file
5. Test the Application using selenium tool.
6. Configuring and establish Connection between Agent and Master using Puppet
7. Install code monitoring tools ex: Nagios..Perform operations
8. Install issue tracker and monitor the workflow of any application and track the issues JIRA tool (Agile management tool)

Text Books:

1. Joakim Verona. “Practical Devops”, Second Edition. Ingram short title; 2nd edition, 2018.
2. Deepak Gaikwad, Viral Thakkar, “DevOps Tools from Practitioner's Viewpoint”. Wiley publications, 2019.

Suggested Reading:

1. Len Bass, Ingo Weber, Liming Zhu, “DevOps: A Software Architect's Perspective”. Addison Wesley, 1st Edition, 2015.

Online Resources:

1. https://www.coursera.org/learn/intro-to-devops
2. https://www.tutorialspoint.com/introduction-to-devops/index.asp

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20EGCO3

EMPLOYABILITY SKILLS

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Course Objectives: The objectives of this course are,

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

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

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 andRésumé 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.

Suggested Reading:

1. Leena Sen, “Communication Skills”, Prentice-Hall of India, 2005.
2. Dr. Shalini Verma, “Body Language - Your Success Mantra”, S Chand, 2006.
3. Edgar Thorpe and ShowickThorpe , “Objective English”, 2nd edition, Pearson Education, 2007.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, “The ACE of Soft Skills”, New Delhi: Pearson, 2010.
5. Gulati and Sarvesh, “Corporate Soft Skills”, New Delhi: Rupa and Co., 2006.
6. Van Emden, Joan, and Lucinda Becker, “Presentation Skills for Students”, New York: Palgrave Macmillan, 2004.
7. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Aggarwal, 2018.
8. Covey and Stephen R, “The Habits of Highly Effective People”, New York: Free Press, 1989.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
SCHEME OF INSTRUCTION AND EXAMINATION
VII-Semester of B.E Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VII

Sl.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	18BTO01	Basics of Biology	3	0	0	3	30	70	3
2	18CSC28	Compiler Design	3	0	0	3	30	70	3
3	18CSE XX	Professional Elective-IV	3	0	0	3	30	70	3
4	18CSE XX	Professional Elective-V	3	0	0	3	30	70	3
5	18XX OXX	Open Elective-II	3	0	0	3	30	70	3
PRACTICALS									
7	18CSC29	Compiler Design Lab	0	0	3	3	25	50	1.5
8		Professional Elective-IV Lab	0	0	3	3	25	50	1.5
9	18CSC30	Project : PART-1	0	0	4	-	50	-	2
TOTAL			**15**	**0**	**10**		**250**	**450**	**20**

PROFESSIONAL ELECTIVE-IV	
Course Code	**Title of the Course**
18CSE17	Data Science and Big Data Analytics
18CSE18	Machine Learning
18CSE19	Virtual Reality
18CSE20	Cyber Security

PROFESSIONAL ELECTIVE-V	
Course Code	**Title of the Course**
18CSE21	Software defined Networks
18CSE22	Human Computer Interaction
18CSE23	Neural Networks and Deep Learning
18CSE24	Devops
18CSE25	Nature Inspired Algorithms

OPEN ELECTIVE-II	
Course Code	**Title of the Course**
18ECO 01	Remote Sensing and GIS
18ECO 03	Design of Fault Tolerant Systems
18ECO 04	Basics of DSP
18CEO 02	Disaster Mitigation and Management
18EGO 01	Technical Writing Skills

PROFESSIONAL ELECTIVE-IV LAB	
Course Code	**Title of the Course**
18CSE26	Data Science and Big data Analytics Lab
18CSE27	Machine Learning Lab
18CSE28	Virtual Reality Lab
18CSE29	Cyber Security Lab

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

18BTO01

BASICS OF BIOLOGY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To understand the milestones reached by human in the field of biology.
2. Understanding the human body and its parts.
3. Understanding the human anatomy and medical devices.
4. To understand types of advanced therapies.
5. To understand the treatment of toxic pollutants in the environment.
6. To understand genome sequencing and NGS.

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

1. Provides information about how mankind gained knowledge from olden days to modern days.
2. Explain how the body parts working in the human system.
3. Engineer the medical devices.
4. Analyze the types of advanced treatments in the market.
5. Remediate the toxic pollutants.
6. Sequence the genome of different organisms.

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

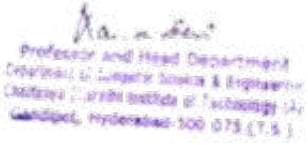
Medical Biotechnology and Bioremediation: Cells of Immune System, Etiology of cancer, Cancer treatment (Radiation Therapy); Stem Cells and its Clinical applications; Scaffolds and 3D printing of organs; Bio sensors and their applications; Parts of bioreactor and its types; Bioremediation.

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 / Suggested Reading:

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.
2. Shier, David, Butler, Jackie, Lewis, Ricki., "Hole's Human Anatomy & Physiology"., McGraw Hill 2012.
3. Bernard R. Glick, T. L. Delovitch, Cheryl L. Patten, "Medical Biotechnology", ASM Press, 2014.



18CSC28

COMPILER DESIGN

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

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

Course Objectives: The objectives of this course are

1. To 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. Identify synthesized and inherited attributes Syntax directed translation schemes and develop algorithms to generate code for a target machine

Course Outcomes: On Successful completion of this course, student 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 for Block structured and non-Block structured languages.
5. Explain the algorithms to generate code for a target machine code and evaluate.
6. Recognize the errors and apply the recovery strategies for the errors identified by the phases of a compiler.

UNIT - I

Introduction: overview and Phases of compilation, Boot strapping Porting, Compiler construction Tools, Applications of Compiler technology, Lexical Analysis: Role of lexical Analyzer, Input Buffering, Specification and Recognition of Tokens, Scanner generator (lex, flex).

UNIT - II

Syntax Analysis: LL(1) grammars and top-down parsing, operator grammars, LR(0), SLR(1), CLR(1), LALR(1) grammars and bottom up parsing, ambiguity and LR parsing, LALR(1) parser generator (YACC, BISON).

UNIT - III

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree, applications of SDD. **Symbol Table:** Symbol table structure, attributes and management, Run-time environment: Procedure activation, parameter passing, value return, memory allocation and scope.

UNIT - IV

Intermediate Code Generation: Translation of different language features, different types of intermediate forms. Code Improvement (optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc.

UNIT - V

Target Code generation: Factors effecting code generation and Basic blocks, Register allocation and target code generation. Instruction scheduling, loop optimization, code generation using dynamic programming, error recovery strategies in phases of compiler.

Text Books:

1. A.V. Aho, M.S. Lam, R. Sethi, and J.D. Ullman, "Compilers: Principles, Techniques, and Tools", Pearson Education, 2007 (second ed.).
2. K.D. Cooper, and L. Torczon, "Engineering a Compiler", Elsevier, 2004.
3. Santanu Chattopadhyay, "Compiler Design", PHI Learning Pvt. Ltd., 2015.

Suggested Reading:

1. Keith D Cooper & Linda Tarezon, "Engineering a Compiler", Morgan Kafman, Second edition.
2. K.Muneeswaran, "Compiler Design", first edition, Oxford University Press, 2012.
3. John R Levine, Tony Mason, Doug Brown, "Lex &YACC", Shroff Publishers

Online Resources:

1. http://iitmweb.iitm.ac.in/phase2/courses/106108113/

18CSC29

COMPILER DESIGN LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Pre-requisites: Basics of Data Structures, Algorithms and Automata Theory

Course Objectives: The objectives of this course are:

1. Defines the rules to implement Lexical Analyzer understand the concept behind the working ofcompiler tools Lex, Turbo C, Yacc.
2. Analyze and Apply regular grammar for various source statements expression
3. To implement front end of the compiler by means of generating Intermediate codes, implement code optimization techniques and error handling.

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

1. Implement the rules for the analysis phase of a compiler.
2. Apply various Syntax analysis techniques on grammars to build the parsers.
3. Generate various intermediate code representations for source code.
4. Explore error recovery strategies and implement Code Optimization, code generation phases.
5. Examine the concepts of compiler tools Lex, Flex Vision, Yacc, Turbo C.

List of Programs:

1. Design Token Separator for the given Expression
2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using JLex, flex or other lexical analyzer generating tools.
4. Build Top Down Parser table
5. Demonstration of working of Shift reduce parser
6. a. Implement Program to recognize a valid arithmetic expression that uses operator +, –, * and /.
   b. Program to recognize a valid variable which starts with a letter followed by any Number of letters or digits.
   c. Demonstration of Calculator using LEX and YACC tool
7. Build LR Parser
8. Simulation of Symbol table Management
9. Generation of a code for a given intermediate code
10. Demonstration of Code Optimization Techniques (Constant Folding).

Text Books:

1. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, Morgan Kafman, Second edition. Lex &Yacc, John R Levine, Tony Mason, Doug Brown, Shroff Publishers.

Suggested Reading:

2. Kenneth C Louden, “Compiler Construction: Principles and Practice”, Cengage Learning. Lex & YACC, John R Levine, Oreilly Publishers.

18CSC30

PROJECT : PART-1

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

The objective of Project Part -1 is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/ Modelling / Simulation / Experiment / Design /Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before the Department Review Committee.

Course Outcomes: By the end of course, students will be able to:

1. Review the literature related to the problem area / selected topic
2. Undertake problem identification, formulation and solution
3. Prepare synopsis of the selected topic
4. Gather the required data and Set up the environment for the implementation
5. Conduct preliminary analysis/modeling/simulation experiment
6. Communicate the work effectively in both oral and written forms

Guidelines for the award of Marks: Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Review Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

18CSE17

DATA SCIENCE AND BIG DATA ANALYTICS
(PROFESSIONAL ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Probability and Statistics, Data Base Management Systems.

Course Objectives: The objectives of this course are

1. Introduce a data analytics problem solving framework.
2. Develop technical skills in probability modeling and statistical inference for the practical application ofstatistical methods.
3. Use existing and develop new statistical tools for data science problems across different applieddomains.

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

1. Describe Data Discovery, Data Preparation, Model Planning and Building, communicate results,operationalize phases of data analytics life cycle and Evaluation of data using statistical methods, ANOVA.
2. Predict the approaches for grouping similar objects using Least Squares, Nearest Neighbors andidentify frequent patterns using Apriori algorithm, FP-Growth.
3. Examine Time Series Analysis using ARIMA and representation, processing and analysis of textualdata to derive useful insights using TFIDF.
4. Recall Velocity, variety, volume, veracity of big data. Examples of big data and Risks, Crowd sourcinganalytics of Big data technologies.
5. Outline the Architecture of Apache Hadoop HDFS and Map Reduce operations to perform filtering,Job Tracking and restructuring data.
6. Explain types, benefits of No SQL databases and identify applications of stream data model, query processing and optimization techniques.

UNIT-I

Data Analytics Life cycle: Data Analytics Life cycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize. Exploratory Data Analysis, Statistical Methods for Evaluation, ANOVA.

UNIT-II

Overview of Supervised Learning: Variable Types and Terminology, Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors, Model Selection and Bias Variance Tradeoff. Association Analysis: Association rules, Apriori algorithm, FP-Growth Technique.

UNIT-III

Time Series Analysis: Overview of Time Series Analysis, ARIMA Model. Text Analysis: Text Analysis Steps, Stop Word Removal, Tokenization, Stemming and Lemmatization, Representing Text: Term-Document Matrix, Term Frequency--Inverse Document Frequency (TFIDF).

UNIT-IV

Introduction to Big Data: Defining big data, 4 V's of big data, Big data types, Analytics, Examples of big data, Big data and Data Risk, Big data technologies, benefits of big data, Crowd sourcing analytics. Hadoop Distributed File Systems: Architecture of Apache Hadoop HDFS, Other File Systems, HDFS File Blocks, HDFS File Commands.

UNIT-V

No SQL Data Management: Types of NoSQL data bases, Benefits of No SQL. Map Reduce: Introduction, Map reduce example, Job Tracker, Map Operations. Data Stream Mining: The stream data model, streaming applications, continuous query processing and optimization, Distributed query processing.

Text Books:

1. EMC Education Services "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" Wiley Publishers, 2012.
2. Hastie, Trevor, et al., "The elements of statistical learning: Data Mining, Inference, and Prediction", Vol. 2. No. 1. New York: Springer, 2009.
3. V.K. Jain, "Big Data & Hadoop", Khanna Publishing House,2017.

Suggested Reading:

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
2. Mark Gardener, “Beginning R The statistical Programming Language”, Wiley, 2015.
3. Han, Kamber, and J Pei, “Data Mining Concepts and Techniques”, 3rd edition, Morgan Kaufman, 2012.
4. Big Data Black Book, DT Editorial Services, Wiley India.
5. V.K. Jain, “Data Science & Analytics”, Khanna Publishing House
6. Jeeva Jose, “Beginner’s Guide for Data Analysis using R Programming”, ISBN: 978-93-86173454.
7. Montgomery, Douglas C., and George C. Runger “Applied statistics and probability for engineers”, John Wiley & Sons, 6th edition, 2013.

18CSE18

MACHINE LEARNING
(PROFESSIONAL ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Linear Algebra and Probability theory basics

Course Objectives: The objectives of this course are:

1. Understand the need and elements of Machine Learning
2. Study various machine learning techniques
3. Design solutions for real world problems using machine learning techniques

Course Outcomes: On successful of the course student will be able to:

1. Define the basic concepts related to Machine Learning.
2. Recognize the underlying mathematical relationships within and across Machine Learning algorithms and their paradigms.
3. Determine the various applications of Machine Learning.
4. Model the problems using various machine learning techniques.
5. Design and develop solutions to real world problems using Machine Learning Algorithms.
6. Evaluate and interpret the results of the various machine learning technique

UNIT - I

Introduction to Machine Learning: Introduction, Classic and Adaptive machines, learning types, deep learning, bio-inspired adaptive systems, Machine Learning and big data; **Elements of Machine Learning:** Data formats, Learnability, Statistical learning concepts, Class balancing, Elements of Information theory.

UNIT - II

Feature Selection and Feature Engineering: Data sets, Creating training and test sets, managing categorical data, missing features, data scaling and normalization, Withering, Feature selection and filtering, PCA, Visualization of high-dimensional datasets; **Regression Algorithms**: Linear models for regression, Regression types; **Linear Classification Algorithms**: Linear classification, logistic regression, grid search, classification metrics, ROC curve.

UNIT - III

Naïve Bayes and Discriminant Analysis: Bayes theorem, Naïve Bayes classifiers, Discriminant analysis; **Support Vector Machines**: Linear SVM, Kernel-based classification; **Decision Trees and Ensemble Learning**: Binary Decision trees, Introduction to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier.

UNIT - IV

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

UNIT - V

Machine Learning Architectures: Data collection, Normalization and regularization, Dimensionality reduction, Data augmentation, Modeling/Grid Search/Cross-validation, Visualization, GPU support, Introduction to distributed architectures, Scikit-learn tools for ML architectures, pipelines, Feature unions

Text Books:

1. Giuseppe Bonaccorso, "Machine Learning Algorithms", 2nd Edition, Packt, 2018,
2. Tom Mitchel "Machine Learning", Tata McGraW Hill, 2017

Suggested Reading:

1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. ReemaThareja "Python Programming", Oxford Press, 2017
3. Yuxi Liu, "Python Machine Learning by Example", 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.geeksforgeeks.org/machine-learning/

18CSE19

VIRTUAL REALITY
(PROFESSIONAL ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Provide detailed understanding of the concepts of Virtual Reality and applications
2. Understand geometric modeling and virtual environment
3. Prepare the students to develop Virtual Reality applications

Course Outcomes: On successful of the course student will be able to:

1. List the virtual environment requirements and benefits of virtual reality
2. Familiarize with various VR technologies and models of interactions in VR systems
3. Simulate flight dynamics of an aircraft in virtual environment
4. Identify the virtual hardware and software for modeling real world environments
5. Develop Virtual Reality applications
6. Explore the applications of VR in training, engineering, entertainment and science.

UNIT - I

Introduction to Virtual Reality- Introduction, Computer Graphics, real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark. **3D Computer Graphics:** Introduction, virtual world space, positioning the virtual observer, perspective projection, human vision, stereo perspective projection, 3D clipping, color theory, simple 3D modelling, illumination models, reflection models, shading algorithms, radiosity, Hidden surface removal, realism0stereographic image.

UNIT - II

Geometric Modeling: Introduction, 2d to 3D, 3D space curves, 3D boundary representation, **Geometric Transformations:** Introduction, frames of reference, modeling transformations, instances, picking, flying, scaling the VE, collision detection; **Generic VR system**: Introduction, virtual environment, computer environment, VR technology, Model of interaction, VR systems.

UNIT - III

Virtual Environment: Introduction, dynamics of numbers, linear and non-linear interpolation, animation of objects, linear and non-linear translation, shape and object in between, free from deformation, particle system, **Physical Simulation:** Introduction, objects falling in a gravitational field, rot rotating wheels, elastic collisions, projectivities, simple pendulum, springs and flight dynamics of an aircraft.

UNIT - IV

VR Hardware and Software: Human factors-eys, ear and somatic senses; **VR Hardware**: Introduction, sensor hardware, hed-coupled displays, acoustic hardware, integrated VR system; **VR Software:** Modeling virtual world, physical simulation, VR toolkits, introduction to VRML.

UNIT - V

VR Applications: Engineering, Entertainment, Science, Training. **Future:** Virtual environment, modes of interaction.

Text Books:

1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anad R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi

Suggested Reading:

1. Adams, "Visualization of Virtual Reality", Tata McGraw Hill, 2000
2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006
3. William R Sherman, Alan B Craig, "Understanding Virtual Reality: Interface, Applications and Design", Morgan Kaufman, 2008

Online Resources:

1. www.vresources.org
2. www.vrac.iastate.edu
3. www.w3.org/MarkUp/VRM

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Scheme of Instruction and Syllabus of

M. Tech (CSE)

(With effect from 2020-21)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)

Affiliated to Osmania University,

Hyderabad – 500 075, Telangana State

Institute Vision:

1. To be a centre of Excellence in Technical Education and Research.

Institute Mission:

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

Department Vision:

To become a center of excellence in the field of Computer Science and Engineering that produces innovative, skillful, socially responsible and ethical professionals.

Department Mission:

1. To provide a curriculum that balances engineering fundamentals, modern technologies and research.
2. To provide opportunities for solving real world problems.
3. To provide opportunities for overall personal and social skill development.

M.Tech (CSE) Program Educational Objectives (PEO's)

1. Will be able to practice their profession with confidence and global competitiveness by making intellectual contributions.
2. Will pursue a life-long career of personal and professional growth with superior work ethics and character.
3. Will be engaged in research leading to innovations/products or become a successful entrepreneur.

M.Tech (CSE) Program Outcomes (PO's)

At the end of the program, students will be able to:

1. Apply the principles of Computer Science and Engineering to the appropriate problems
2. Investigate, analyze and formulate solutions to the complex real world problems
3. Demonstrate the use of modern tools and techniques in the field of Computer Science
4. Work with multidisciplinary groups in a collaborative manner to develop sustainable inclusive technologies
5. Communicate effectively and develop self-confidence and life-long learning

6 Able to possess leadership, project management and financial skills with professional ethics

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M.TECH (CSE)
SCHEME OF INSTRUCTION &EXAMINATIONS

SEMESTER–I

S.No	Course Code	Title Of Course	Scheme Of Instructions			Duration Of SEE In Hours	Scheme Of Examination		
			Hours Per Week				Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
		THEORY							
1	20CSC 101	Mathematical Foundation of Computer Science	3	-	-	3	40	60	3
2	20CSC 102	Advanced Data Structures	3	-	-	3	40	60	3
3	20CSEXXX	Elective -I	3	-	-	3	40	60	3
4	20CSEXXX	Elective -II	3	-	-	3	40	60	3
5	20MEC 103	Research Methodology and IPR	2	-	-	2	40	60	2
6	20XXXXXX	Audit Courses-1	2	-	-	2	-	50	Non Credit
PRACTICAL									
7	20CSC 103	Laboratory 1 (Advanced Data Structures)	-	-	4	-	50	-	2
8	20CSEXXX	Laboratory 2 (Based on Elective-I,III)	-	-	4	-	50	-	2
	Total		**16**	**-**	**8**	**-**	**300**	**350**	**18**

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

ELECTIVE-I,III		
S.No	**Course Code**	**Title Of Course**
1	20CSE101	Machine Learning
2	20CSE102	Internet of Things
3	20CSE103	Introduction to Intelligent Systems
4	20CSE104	Data Preparation and Analysis
5	20CSE105	Secure Software Design & Enterprise Computing (SSDEC)
6	20CSE106	Computer Vision

ELECTIVE -I ,III LAB		
S.No	**Course Code**	**Title Of Course**
1	20CSE107	Machine Learning Lab
2	20CSE108	Internet of Things Lab
3	20CSE109	Introduction to Intelligent Systems Lab
4	20CSE110	Data Preparation and Analysis Lab
5	20CSE111	SSDE Lab
6	20CSE112	Computer Vision Lab

ELECTIVE –II,IV,V		
S.No	**Course Code**	**Title Of Course**
1	20CSE113	Data Science & Big Data Analytics
2	20CSE114	Distributed Database Systems
3	20CSE115	Advanced Wireless and Mobile Networks
4	20CSE116	Human and Computer Interaction
5	20CSE117	GPU Computing
6	20CSE118	Digital Forensics
7	20CSE119	Mobile Applications and Services
8	20CSE120	Compiler for HPC
9	20CSE121	Open Source Technologies

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M.TECH (CSE)
SCHEME OF INSTRUCTION &EXAMINATIONS

II-SEMESTER

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination		
							Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	20CSC 104	Advanced Algorithms	3	-	-	3	40	60	3
2	20CSC 105	Soft Computing	3	-	-	3	40	60	3
3	20CSEXXX	Elective -III	3	-	-	3	40	60	3
4	20CSEXXX	Elective -IV	3	-	-	3	40	60	3
5	20XXXXXX	Audit Course 2	2	-	-	2	-	50	Non Credit
PRACTICAL									
7	20CSC 106	Laboratory 3 (AA& Soft Computing)	-	-	4	-	50	-	2
8	20CSEXXX	Laboratory 4 (Based on Electives-III)	-	-	4	-	50	-	2
9	20CSC 107	Mini Projects with seminar	-	-	4	-	50	-	2
TOTAL			**14**	**-**	**12**	**-**	**310**	**290**	**18**

- Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.

List of Audit Courses -1&2

S.No	Course Code	Title Of Course
1	20EGA101	English for research paper writing
2	20CEA101	Disaster mitigation and management
3	20EEA101	Sanskrit for technical knowledge
4	20ECA101	Value education
5	20EGA102	Indian constitution & fundamental rights
6	20ITA101	Pedagogy studies
7	20EGA103	Stress Management by Yoga
8	20EGA104	Personality Development through Life Enlightenment Skills.

III-SEMESTER

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination		
							Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	20CSEXXX	Elective -V	3	-	-	3	40	60	3
2	20CSXXX	Open Elective	3	-	-	3	40	60	3
3	20CSC 108	Dissertation Phase – I	-	-	20	-	100	-	10
TOTAL			**6**	**-**	**20**	**-**	**180**	**120**	**16**

ELECTIVE-V		
S.No	**Course Code**	**Title Of Course**
1	20CSE119	Mobile Applications and Services
2	20CSE120	Compiler for HPC
3	20CSE121	Open Source Technologies
4	NPTEL	Software Project Management
		Natural Language Processing
		Block Chain Architecture Design and Use cases
		Social Networks
		Virtual Reality

Open ELECTIVE -VI		
S.No	**Course Code**	**Title Of Course**
1	20CSO 101	Business Analytics
2	20MEO 101	Industrial Safety
3	20MEO 102	Introduction to Optimization Techniques
4	20CEO101	Cost Management of Engineering Projects
5	20MEO103	Composite Materials
6	20EEO101	Waste to Energy
7	20PYO 01	History of Science and Technology

****Students going for Internship / Industrial project, may complete these courses through NPTEL/ MOOCs**

IV-SEMESTER

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination		
							Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	20CSC 109	Dissertation Phase – II	0	0	32	3	100	100	16
TOTAL			**0**	**0**	**32**	**-**	**100**	**100**	**16**

SEMESTER-I

20CSC 101

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: UG level Course in Discrete Mathematics.

Course Objectives: The objectives of this course are

1. Gain knowledge in discrete and continuous probability and its applications.
2. Use Graph theory for solving real world problems.
3. Solve problems using counting technique.

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

1. Solve the probability function by inequalities.
2. Infer the data by hypothesis testing procedure.
3. Apply graphs models in real time applications.
4. Apply various counting techniques in solving combinatorial problems.
5. Design solutions using Recurrence Relations for real time problems.
6. Apply number theory to cryptography problems.

UNIT-I

Fundamentals: Probability mass, Density, Cumulative Distribution functions, Parametric families of distributions, Expected value, Variance, Conditional Expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov Chains.

UNIT-II

Statistical Inference: Introduction, Parameter Estimation, Hypothesis Testing, Least squares curve fitting, The Coefficients of Determination Confidence Intervals in Linear Regression, Trend Detection and Slope Estimation, Correlation Analysis.

UNIT-III

Graphs: Graphs and Graph Models, Special Types of Graphs, Applications of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problems, Planar Graphs, Graph Coloring, Applications of Graph Colorings, Spanning Trees.

UNIT-IV

Counting: Basics of Counting, the Pigeon hole Principle, Permutations and Combinations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients.

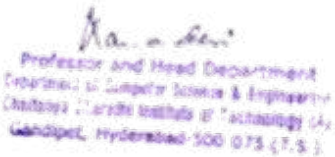
Advanced Counting Techniques: recurrence Relations, Solving Linear Recurrence Relations, Divide and Conquer Algorithms, Generating functions, Inclusion-Exclusion, Applications of Inclusion – Exclusion

UNIT-V

Number theory and cryptography: Fundamental algorithms involving numbers, cryptography computations, information security algorithms and protocols. Computer Science and Engineering Applications: HMM, Routing algorithms, Bayes Theorem.

Textbooks:

1. Kishor S. Trivedi, "Probability & Statistics with Reliability. Queuing, and Computer Science Applications", 2ndEdition, John Wiley and Sons Ltd.2016.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7thEdition, McGraw Hill Education (India) Private Limited, 2011.
3. M.T Goodrich, R.Tomasia, "Algorithm design- Foundations, analysis", and Internet algorithms, John Wiley,2002 .



Suggested Readings:

1. D.S. Malik and M.K. Sen., "Discrete Mathematics, Theory and Applications", Revised Edition, Cengage Learning, 2012.
2. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Academic Press, 2012.
3. Douglas B. West, "Introduction to Graph Theory, 2ndEdition", PHI.2015.
4. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", 2nd Edition, Pearson Education, 1985.

Online Resources:

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

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20CSC 102

ADVANCED DATA STRUCTURES

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: Undergraduate Course in Data Structures.

Course Objectives: The objectives of this course are

1. To use appropriate data structures and to design algorithms for a specific problem.
2. To analyze and implement dictionaries, hash algorithms skip list data structures as solutions to real-world problems.
3. To deal with text-processing algorithms and computational geometric concepts for efficient space utilization.

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

1. Analyze the significance of Dictionaries and apply them to solve real-world problems.
2. Apply various hashing techniques to perform linear and quadratic probing.
3. Construct Skip Lists in a randomized and deterministic way.
4. Develop algorithms for various tree data structures like red-black trees, B-trees and Splay trees.
5. Apply the text processing operations for efficient space utilization.
6. Analyze computational geometric problems in terms of priority and range search operations.

UNIT-I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation ofDictionaries; **Hashing**: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Recent trends in hashing.

UNIT-II

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

UNIT-III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B- Trees,Splay Trees.

UNIT-IV

Text Processing: String Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman coding algorithm.

UNIT-V

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad-trees, k-D Trees.

Textbooks:

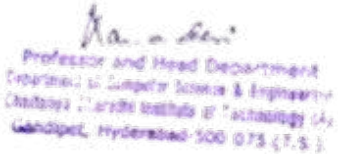
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in JAVA", 3rd Edition, Pearson,2004.
2. M T Goodrich and Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Suggested Readings:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++, 2ndEdition", Pearson, 2004.
2. SartajSahni, "Data structures, Algorithms and Applications in Java", 2ndEdition, Universities Press, 2005.

Online Resources:

1. https://www.cise.ufl.edu/~sahni/cop3530/presentations.htm.
2. http://www.nptelvideos.com/java



20CSE101

MACHINE LEARNING

Elective-I

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-requisites:UG level course in probability, linear algebra and calculus. Any Programming experience is essential.

Course objectives: The objectives of this course are

1. Introduce students to state-of-the-art methods.
2. Expose to Modern programming tools for data analysis.
3. To study various sampling and classification problems

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

1. Identify complexity of Machine Learning algorithms and their limitations.
2. Recognize the underlying mathematical relationships within and across Machine Learning algorithms and their paradigms.
3. Design and implement machine learning solutions to classification, regression, and clustering problems.
4. Evaluate and interpret the results of the algorithms.
5. Develop an appreciation for what is involved in learning from data.
6. Apply graphical models for probabilistic reasoning.

UNIT-I

Introduction: Learning, Types of Machine Learning.Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.Learning with Trees: Constructing Decision Trees, CART, Classification Example.

UNIT-II

Linear Discriminants: The Perceptron, Linear Separability, Linear Regression.
Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices,Deriving back Propagation
SUPPORT Vector Machines: Optimal Separation, Kernels.

UNIT-III

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison.

UNIT-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming.
Ensemble learning: Boosting, Bagging, Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis.

UNIT-V

Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.. Reinforcement Learning - The Learning Task, Q Learning.

Textbooks:

1. Tom M. Mitchell, "Machine Learning", Mc Graw Hill, 1997
2. Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009.

Suggested Readings:

1. Margaret H Dunham, "Data Mining", Pearson Edition., 2003.
2. GalitShmueli, Nitin R Patel, Peter C Bruce, "Data Mining for Business Intelligence", Wiley India Edition, 2007
3. RajjanShinghal, "Pattern Recognition", Oxford University Press, 2006.

Online resources:

1. NPTEL https://nptel.ac.in/courses/106106139/.

20CSE102

INTERNET OF THINGS

Elective-I

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Identify the vision and understand the basics of IoT.
2. To explore the use of Devices, Gateways in IoT and understand IoT protocols.
3. To introduce Node MCU, Raspberry Pi platform and Explore Industrial Automation, and Commercial Building Automation in IoT.

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

1. Understand an overview of IoT.
2. Use of devices and gateways in Service Oriented Architecture.
3. Analyze various communication protocols in sensor networks.
4. Design applications using Raspberry Pi and Node MCU.
5. Develop different IoT Automation Systems.
6. Apply IoT concepts in various domains such as Smart Cities, Home Automation, Weather Monitoring System, and Agriculture.

UNIT-I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators andTypes of Actuators.
Basics of Networking : IoT components, Functional Components of IoT, IoTinterdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT-II

Communication Protocols: 6LoWPAN, 6LoWPAN Routing Considerations,Loading Routing, RPL Routing, RFID, Functionality-based IoT Protocol Organization: MQTT, SMQTT, CoAP, XMPP, AQMP, Zigbee, Wireless HART, Z-Wave, Bluetooth, NFC, RFID.

UNIT-III

Sensor Networks: Target Tracking, Wireless Multimedia Sensor Networks(WMSNs), Nano networks, Underwater Acoustic Sensor Networks, Opportunistic localization, WSN Coverage, Stationary Wireless Sensor Networks, Mobile Wireless Sensor Networks, Delay Tolerant Networks, UAV Networks, FANETs: Flying Ad Hoc Networks, VANETs, Machine-to-Machine Communications, Interoperability in IoT, Introduction to SDN: SDN for IoT , Recent advances in IoT.

UNIT-IV

Introduction to Node MCU: Node MCU pin diagram, Integration of Sensors andActuators with Node MCU.
Introduction to Raspberry Pi: About the board, Linux on Raspberry Pi, RaspberryPi Interfaces, Programming Raspberry Pi with Python.

UNIT-V

IoT Systems: A Case Study.
Home Automation: Smart Lighting, Home Intrusion Detection , Smart Cities:
Smart Parking Environment: Weather Monitoring System, Weather Reporting
Bot, Air Pollution Monitoring, Forest Fire Detection, Agriculture: Smart Irrigation.

Textbooks:

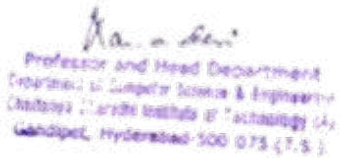
1. Raj and Anupama C. Raman," The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. ArshdeepBahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Readings:

1. Dr. SRN Reddy, RachitTirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. CunoPfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources :

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, "RPL: IPv6 Routing Protocol for LowPower and Lossy Networks", IETF, Standards Track, Mar. 2012.
3. Z. Shelby , K. Hartke, C. Bormann, "The Constrained Application Protocol (CoAP)",Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, "What's The Difference Between IEEE 802.15.4 And ZigBee Wireless?",Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo et al., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.



20CSE103

INTRODUCTION TO INTELLIGENT SYSTEMS

Elective-I

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites:UG level Course in Data Structures, Data Management, Probability and Statistics.

Course Objectives: The objectives of this course are

1. Understand the different learning techniques of AI systems.
2. Learn different knowledge representation techniques.
3. Developing systems to demonstrate intelligent behavior dealing with uncertainty.

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

1. Describe knowledge of the fundamental principles of intelligent systems.
2. Identify various search strategies to solve problems.
3. Compare and contrast knowledge representation schemes.
4. Appraise knowledge in Uncertainty and Probabilistic reasoning approaches.
5. Apply different learning techniques to solve complex problems.
6. Define the basic concepts of phases and applications of Natural Language processing.

UNIT-I

Introduction: History Intelligent Systems, Foundations of Artificial Intelligence, Sub areas of Al, Applications. **Problem Solving - State - Space Search and Control Strategies:** Introduction, General Problem Solving Characteristics of problem, Exhaustive Searches, Heuristic Search Techniques, Iterative - Deepening A*, Constraint Satisfaction. Game Playing, Bounded Look - Ahead Strategy and use of Evaluation Functions, Alpha Beta Pruning.

UNIT-II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau, A System in Propositional Logic, Resolution refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III

Expert System and Applications: Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools. Uncertainty Measure - Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainity Factor Theory, Dempster - Shafer Theory.

UNIT-IV

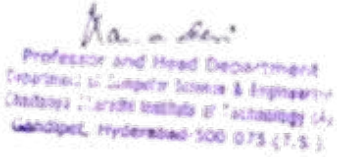
Machine - Learning Paradigms: Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering, Support Vector Machines.

Intelligent Agents: Agents vs Software programs, classification of agents, Multi-agent systems, Architecture of intelligent agents, Multi-agent application.

UNIT-V

Advanced Knowledge Representation Techniques: Case Grammars, SemanticWeb.

Natural Language Processing: Introduction, Sentence Analysis Phases,Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

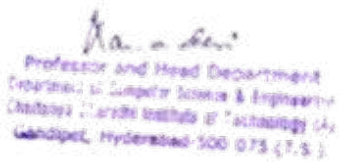


Text Books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.
2. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition, 2004.
3. Rich, Knight, Nair , Artificial Intelligence, Tata McGraw Hill, 3rd Edition 2009.

Online Resources :

1. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf.
2. http://www.cs.toronto.edu/~fbacchus/csc384/Lecture Hours/Lecture Hours.html.
3. https://nptel.ac.in/courses/106105077/.



20CSE104

DATA PREPARATION AND ANALYSIS

Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives:

1. Identify data gathering and preparation techniques for industrial and scientific applications.
2. Apply exploratory data analysis techniques to develop meaningful data visualizations.
3. Analyze various statistical significance based testing mechanisms and apply them to deal with real-world problems.

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

1. Identify and analyze various data gathering and preparation techniques to format, parse and transform data as required.
2. Apply data cleaning techniques on various data sets to perform consistency check, transformation, and segmentation processes.
3. Apply exploratory data analysis techniques to perform descriptive and comparative statistics on data.
4. Analyze different visualization techniques and apply the suitable one to deal with real-world problems.
5. Apply correlations, connectivity, and interactivity techniques on different data items for any given dataset.
6. Analyze various statistical significance based testing mechanisms and apply them to build regression models.

UNIT-I

Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.

UNIT-II

Data Cleaning: Consistency checking, Heterogeneous and missing data, DataTransformation and segmentation.

UNIT-III

Exploratory Analysis: Descriptive and comparative statistics, Clustering andassociation, Hypothesis generation.

UNIT-IV

Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.

UNIT-V

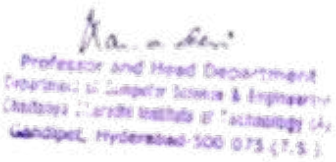
Statistical Significance, ANOVA, T-test, Building machine learning Regression models.

Textbooks:

1. Making sense of Data : "A practical Guide to Exploratory Data Analysis and Data Mining", by Glenn J. Myatt, 2007.
2. Trochim, W. M. K. “Data Preparation” Research Methods Knowledge Base 2nd Edition. Accessed 2/24/09.

Suggested Readings:

1. The visual display of quantitative information by edwardtufte, 2001.
2. "Visualizing Data:" Exploring and Explaining Data with the Processing Environment, by Ben Fry, 2008
3. Exploratory data Mining and data cleaning, by Tamraparnidasu, 2003.



Online Resources :

1. https://www.safaribooksonline.com/library/view/visualizingdata/9780596514556/ch08.html.
2. https://www.scribd.com/document/54993779/Making-Sense-of-Dataa-Practical-Guide-to-Exploratory-Data-Analysis-and-Data-Mining.

20CSE105

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites :UG level course in Computer Programming, Software Engineering.

Course Objectives:

1. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic.
2. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
3. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

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

1. Differentiate various software vulnerabilities and develop software to process vulnerabilities for an organization.
2. Evaluate various enterprise application design and development tools and standard practices.
3. Review techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
4. Know essential techniques for reducing and avoiding system and software security Problems.
5. Understand methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.
6. Solve enterprise scale problems emanating from lapses in security requirements and information system management practices.

UNIT-I

Secure Software Design : Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

UNIT-II

Enterprise Application Development : Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

UNIT-III

Enterprise Systems Administration : Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/ DHCP/Terminal Services/Clustering/Web/Email).

UNIT-IV

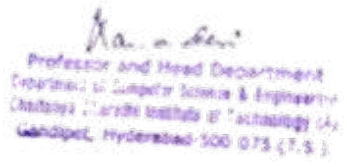
Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT-V

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Textbooks:

1. Theodor Richardson, Charles N Thies, "Secure Software Design", Jones & Bartlett, 2012.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley, 2015 E book.



Online Resources :

1. https://www.coursera.org/specializations/secure-software-design.

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20CSE106

COMPUTER VISION

Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre Requisites: UG level Course in Linear Algebra and Probability.

Course Objectives: The objectives of this course are

1. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

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

1. Explain the basic principles of image processing and its significance in real world.
2. Interpret and evaluate various approaches for image. transformation, segmentation, and restoration.
3. Choose object, scene recognition and categorization algorithms for real time images.
4. Analyze images and videos for problems such as tracking and structure from motion.
5. Explain recovery of 3D structure of ill-posed scenes.
6. Apply various techniques to build computer vision applications.

UNIT-I

Image Formation and Description: Fundamental steps of image processing, theimage model and Image acquisition, Sampling and quantization, Relationship between pixels. Sampling & Quantization, Elements of Digital Image Processing Systems.

Image Transforms: Digital Image Transforms - Fourier Transform, Extension to 2D.Properites of Fourier transformations.

UNIT-II

Image Enhancements: Histogram Equalization, Image Smoothing, ImageSharpening, Edge Detection.

Segmentation: Active contours, Split and merge, Mean shift and mode finding,

Normalized cuts.

Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation.

UNIT-III

Structure from motion: Triangulation, Two-frame structure from motion,Factorization, Bundle adjustment, constrained structure and motion

Dense motion estimation: Translational alignment, parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT-IV

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT-V

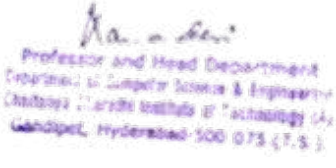
3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, Volumetric representations, Model-based reconstruction.

Textbooks:

1. R. C. Gonzalez and R. E. Woods “Digital Image Processing” Addison Wesley 2008.
2. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.

Suggested Readings:

1. “Pattern Recognition: Statistical. Structural and Neural Approaches”; Robert J. Schallkoff; John Wiley and Sons; 1992.
2. “Computer Vision: A Modern Approach”; D. A. Forsyth and J. Ponce; Pearson Education; 2003.



3. "Multiple View geometry". R. Hartley and A. "Zisserman. 2002 Cambridge university Press".
4. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_ee40.
2. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline.
3. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/ cil/ftp/ html/vision.html.

20CSE113

DATA SCIENCE AND BIG DATA ANALYTICS

Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: UG level Course in Database Management Systems.

Course Objectives: The objectives of this course are

1. Acquire knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
3. Evaluate data visualization techniques to deal with various design aspects.

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

1. Understand and explore big data Ecosystem using exploratory and statistical evaluation methods.
2. Analyze various machine learning algorithms and apply them to solve real-world problems.
3. Apply advanced analytical tools to perform logistic regression through experiments and extract meaningful data.
4. Apply data visualization techniques to evaluate models and to overcome data leakage problems.
5. Understand and apply Hadoop Ecosystem to explore bigdata analytics using Map-reduce techniques.
6. Analyze the significance of NoSQL database systems and apply them to perform bigdata analysis.

UNIT-I

Introduction: Big Data and Data Science Hype, History of past and current, AData Science Profile, Meta-Definition, Statistical Thinking, Exploratory Data Analysis, The Data Science Process.

UNIT-II

Algorithms: Machine Learning Algorithms, Three Basic Algorithms

Spam Filters, Naive Bayes, and Wrangling: Learning by Example, Naive Bayes,Laplace Smoothing, Comparing Naive Bayes to KNN.

UNIT-III

Logistic Regression: Thought Experiments, Classifiers, M6D LogisticRegression.

Extracting Meaning from Data: William Cukierski, The Kaggle Model, EthicalImplications of a Robo-Grader, Feature Selection, Google's Hybrid Approach to Social Research.

UNIT-IV

Data Visualization Techniques: Data Visualization History, Types of Visualization,Characteristics, Encoding schemes, Mapping variables to encodings, Visual encodings.

Data Leakage and Model Evaluation: Claudia's Data Scientist Profile, Data Mining Competitions, Characteristics of Good Modeler, Data Leakage, Avoid Leakage, Evaluating Mode.

UNIT-V

Introduction to Big Data: Defining big data, 4 V's of big data, Big data types,Analytics, Examples obig data, Big data and Data Risk, Big data technologies, The benefits of big data, Crowd sourcing analytics. Architecture of Apache Hadoop HDFS, **No SQL Data Management:** Types of NOSQL data bases Benefits of NO SQL, **Map Reduce:** Introduction, Map reduce example, Job Tracker, Map .

Textbooks:

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, Straight Talk From The Frontline, O'Reilly, 2014.
2. "Big Data & Hadoop", V.K. Jain, Khanna Publishing House, 2017.

Suggested Readings:

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. "Mining of Massive Datasets", v2.1, Cambridge UniversityPress, 2014.
2. Foster Provost and Tom Fawcett, Data Science for Business, What You Need to Know about Data Mining and Data-Analytic Thinking, O'Reilly, 2013.
3. Samir Madhavan, "Mastering Python for Data Science, Packt Publishing, 2015.
4. "Big Data Black Book, DT Editorial Services," Wiley India
5. "Data Science & Analytics", V.K. Jain, Khanna Publishing House Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454, 2018.
6. Montgomery, Douglas C. and George C. Runger, Applied statistics and probability for engineers. John Wiley & Sons, 6th edition, 2013.

Online Resources:

1. http://datasciencemasters.org.
2. http://learnds.com/
   https://www.datascienceweekly.org

20CSE114

DISTRIBUTED DATABASE SYSTEMS

Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Acquire insight into difference between the centralized databases and distributed databases.
2. Understand distributed DBMS architecture, query decomposition and data localization.
3. Learn the techniques of transaction management, distributed concurrency control, client/server architectures and distributed multi-DBMSs.

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

1. Differentiate key concepts and techniques for centralized. databases and distributed databases.
2. Analyze and design distributed database systems based on the principles of distributed indexing, query evaluation, data replication.
3. Implement storage, indexing, query evaluation and query optimization techniques.
4. Implement the concepts of transaction management, concurrency. control, crash recovery, deadlocks and catalog management.
5. Apply suitable architecture for distributed databases and concepts of inter-operability of databases.

UNIT-I

Introduction: Distributed data processing; what is a DDBS; Advantagesand disadvantages of DDBS. Problem areas; Overview of database and computer network concepts,DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

UNIT-II

Distributed Database Design Alternative design strategies; Distributed design issues; Fragmentation; Data allocation SEMANTICS DATA CONTROL View management; Data security; Semantic Integrity Control

Query Processing Issues Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

UNIT-III

Distributed Query Optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms.

Transaction Management The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models

Concurrency Control Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT-IV

Reliability issues in DDBSs: Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

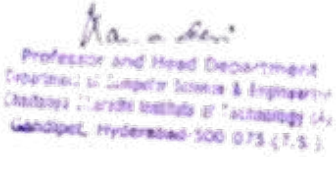
UNIT-V

Parallel Database Systems: Parallel architectures; parallel query processing and optimization; load balancing.

Advanced Topics: Mobile Databases, Distributed Object Management, Multi-databases.

Suggested Readings:

1. "Principles of Distributed Database Systems", M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. "Distributed Database Systems", D. Bell and J. Grimson, Addison-Wesley, 1992.



20CSE115

ADVANCED WIRELESS AND MOBILE NETWORKS

Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-requisites: Undergraduate course in Computer Networks.

Course Objectives:

1. Familiarity with the wireless/mobile market and the future needs and challenges.
2. Familiarity with key concepts of wireless networks, standards, technologies and their basic operations.
3. Learn how to design and analyze various medium accesses, evaluate MAC and network protocols using network simulation software tools.

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

1. Identify the knowledge of wireless networking and its standards.
2. Recognize different cellular technologies (like 3G, 4G, 5G) and WLAN, WPAN, WWAN for performance analysis.
3. Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
4. Analyze various wireless network transmission to build effective communication.
5. Relate Security techniques to resolve network vulnerabilities.
6. Develop mobile applications to solve some of the real-world problems.

UNIT-I

Introduction: Wireless Networking Trends, Key Wireless Physical LayerConcepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, 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.

UNIT-II

Wireless Cellular Networks: WLAN ,3G, 4G and 5G introduction,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.

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.

UNIT-IV

WIRELESS PANs Bluetooth AND Zigbee, Introduction to Wireless Sensors.
Tiny OS Overview.

UNIT-V

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

Textbooks:

1. Schiller J., "Mobile Communications," Addison Wesley 2000
2. Stallings W., "Wireless Communications and Networks", Pearson Education 2005

Suggested Readings:

1. Stojmenic Ivan, "Handbook of Wireless Networks and Mobile Computing", John Wiley and Sons Inc 2002
2. Yi Bing Lin and ImrichChlamtac, "Wireless and Mobile Network Architectures", John Wiley and Sons Inc 2000
3. Pandya Raj, "Mobile and Personal Communications Systems and Services', PHI 20.

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20CSE116

HUMAN AND COMPUTER INTERACTION

Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Learn the foundations of Human Computer Interaction.
2. Be familiar with the design technologies for computer interaction and guidelines for web user interface.
3. Learn the ecosystem and tools of mobile Human Computer interaction.

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

1. Understand the structure of models and theories of human computer interaction.
2. Understand the vision of a computer user.
3. Understand the recognition and remembrance limitations of a computer user.
4. Understand the mobile ecosystem and use the corresponding tools for mobile design.
5. Design an interactive web interface on the basis of models studied.

UNIT-I

Foundations**:** The human, the computer, The Interaction, Paradigms
Introduction**:** Our perception is biased; our vision is optimized to see structure.

UNIT-II

We Seek and Use Visual Structure, Our Color Vision is Limited, Our Peripheral Vision is Poor, Reading is Unnatural, Our Attention is Limited; Our Memory is Imperfect, Limits on Attention Shape Our Thought and Action.

UNIT-III

Recognition is Easy, Recall is Hard, Problem Solving and Calculation are Hard, Many Factors Affect Learning, Human Decision Making is Rarely Rational.

UNIT-IV

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile
Applications: Widgets, Applications, Games- Mobile Information Architecture,
Mobile Design: Elements of Mobile Design, Tools.

UNIT-V

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.Case Studies.

Textbooks:

1. "Designing with the Mind in Mind – Simple Guide to Understanding", 2nd edition, Jeff Johnson, Elsevier Inc., 2010.
2. "Human Computer Interaction", 3rd edition, Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, Pearson Education Limited, 2004.
3. Brian Fling, “Mobile Design and Development”, First Edition , O Reilly Media Inc., 2009.
4. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O Reilly, 2009.

Suggested Readings:

1. "Designing the User Interface", 5th Edition, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Pearson Education Limited, 2013.
2. "Mind Design II, 2nd Edition", Revised and enlarged edition, John Haugeland, The MIT Press, 1997.

Online Resources :

1. https://nptel.ac.in/courses/106103115/
2. https://www.interaction-design.org/courses/human-computer-interaction?ad-set=human-computer-interactioncourse&gclid= EAIaIQobChMIkJu W09jM4QIVgTgrCh0PuwtXEAAYASAAEgLPhPD_BwE

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20CSE117

GPU COMPUTING

Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: UG level Course in Computer Graphics, Animation, ComputerVision, C Language.

Course Objectives:

1. To learn parallel programming with Graphics Processing Units (GPUs).
2. Understand and Identify key elements of computer graphics pipeline and GPU hardware.
3. Recognize the computing problems and implement optimization procedures that will benefit GPU computing.

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

1. List out CPU/GPU comparisons and identify the features of parallel programming.
2. Write simple programs using CUDA programming model.
3. Distinguish various memory hierarchies and carryout performance evaluation with different memories.
4. Illustrate synchronization concepts in CPU and GPU.
5. Point out advanced topics in multi-GPU processing and heterogeneous processing.
6. Develop programs using GPUs for real world problems in image processing, simulation and deep learning.

UNIT-I

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs.Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming

CUDA: CUDA Open CL / Open ACC, Hello World, Computation Kernels, Launchparameters, Thread hierarchy, Warps / Wave fronts, Thread blocks / Workgroups, **Streams:** Streaming multiprocessors, 1D / 2D /3D thread mapping, Deviceproperties, Simple Programs.

UNIT-II

Memory: Memory hierarchy, DRAM / global, local / shared, private / local,textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices,

Matrices: Programs with matrices, Performance evaluation with differentmemories.

UNIT-III

Synchronization: Memory Consistency, Barriers (local versus global), Atomics,Memory fence.

Prefix sum, Reduction, Synchronization across CPU and GPU Programs for concurrent Data Structures such as Work-lists, Linked-lists.

Functions: Device functions, Host functions, Kernels ,functions, Usinglibraries(such as Thrust), developing libraries.

UNIT-IV

Debugging GPU Programs: Profiling, Profile tools, Performance aspects **Streams:** Asynchronous processing, tasks, Task-dependence, Overlapped datatransfers, Default Stream, Synchronization with streams.

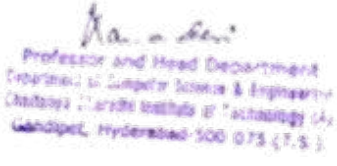
Events: Event-based-Synchronization - Overlapping data transfer and kernelexecution, pitfalls.

UNIT-V

Advanced topics: Dynamic parallelism, Multi-GPU processing, HeterogeneousProcessing.

Textbooks:

1. "CUDA Programming: A Developer's Guide to Parallel ComputingWith GPUs", Shane Cook, Morgan Kaufman, 2012 (ISBN: 978-0124159334)
2. "Programming Massively Parallel Processors: A Hands-on Approach",David Kirk, Wen-meiHwu, Morgan Kaufman, 2010 (ISBN: 978-0123814722).



Suggested Readings:

1. "CUDA by Example: An Introduction to General Purpose GPU Programming; Jason Sanders, Edward Kandrot; Addison-Wesley; 2011(ISBN978-0-13-138768-3)
2. The CUDA Handbook: A Comprehensive Guide to GPU Programming";Nicholas Wilt; Addison Wesley; 2013(ISBN: 978-0321809469)

Online Resources :

1. CUDA C Programming Guide NVIDIA's Parallel Forall Blog
2. https://devblogs.nvidia.com/calibrating-videos-vrworks-360-video
3. Mapping from GPU name to Compute Capability.

20CSE118

DIGITAL FORENSICS

Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: UG level Course in Operating Systems, Computer Networks.

Course Objectives:

1. To provide basics of the rapidly changing and fascinating field of Digital forensics.
2. To collect, process, analyze and present computer forensic evidence.
3. To learn about network forensics, mobile forensics and Legal Aspects of Digital Forensics.

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

1. Explain the fundamentals of digital forensics.
2. Choose the methods for Collecting, preserving and recovering the evidence for use in investigations.
3. Explain the need to maintain the chain of evidence in criminal investigations and apply this in the context of simple case studies.
4. Analyze data acquired from various crime scene scenarios.
5. Describe the Legal Aspects of Digital Forensics.
6. Demonstrate the concept of Network Forensics and Mobile Forensics.

UNIT-I

Digital forensics fundamentals: Forensics science, digital forensics, Uses of Digital Forensics, The Digital Forensics Process, Use of Computer forensics in law Enforcement, Computer forensics assistance to Human resources/ employment proceeding, Computer forensics services, Benefits of professional forensics methodology.

UNIT-II

Data recovery: Data recovery defined, Data backup and data recovery, the role of backup in data recovery, Data recovery solution, Hiding and Recovering Hidden Data. Evidence collection and data seizure: Why collect evidence, Collection options, obstacles, Types of evidence, rules of evidence, Volatile evidence, general procedure, Collection and archiving, methods of collection, artifacts, Collection steps, controlling contamination: The chain of custody

UNIT-III

Duplication and preservation of digital evidence: Preserving the digital crime scene, Computer evidence processing steps, Legal aspects of collection and preserving Computer forensics evidence Computer image verification and authentication Special needs of evidential authentication, Practical consideration, implementation.

UNIT-IV

Computer Forensics Analysis - Discovery of electronic evidence, identification of data, reconstructing past events, Investigating Live Systems (Windows &UNIX).
Network forensics: Network Security Tools, Network Attacks, Network Evidence and Investigations.

UNIT-V

Mobile forensics: Collecting and Handling Cell Phones as Evidence, Cell Phone Forensic Tools.
Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

Textbooks:

1. John Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, First Edition 2015.
2. John Sammons, “The Basics of Digital Forensics”, The Primer for Getting Started in Digital Forensics, 2nd Edition, Syngress (2014).

3. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, TataMcGrawHill, 2006.

Suggested Readings:

1. Marjie T. Britz, “Computer Forensics and Cyber Crime An Introduction”, 3rd Edition, Pearson Education 2013.
2. Cory Altheide, Harlan Carvey, “Digital Forensics with Open Source Tools”, Elsevier Publications, 2011.
3. Brian Carrier, “File System Forensic Analysis”, Pearson Education, 2005.

Online Resources:

1. https://www.cs.nmt.edu/~df/lectures.html
2. http://www.cyberforensics.in/
3. https://www.ncdrc.res.in/

20CSE119

MOBILE APPLICATIONS AND SERVICES

Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites: UG level Course in Wireless Communication and MobileComputing.

Course Objectives: The objectives of this course are

1. This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
2. It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets
3. It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile.

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

1. Identify the target platform and users and be able to define and sketch a mobile application.
2. Design the User Interface for mobile applications.
3. Develop database management system to retrieve and/or store data for mobile application.
4. Analyze Android networking and Internet services use in Mobile Apps.
5. Illustrate the packaging and deploying mobile apps with performance best practices and location based services.
6. Evaluate the development process of mobile application with security concepts.

UNIT-I

Introduction: Introduction to Mobile Computing, Introduction to AndroidDevelopment Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User

UNIT-II

More on UIs: Voice UIs and Mobile Apps, Text-to-Speech Techniques, Designingthe Right UI, Multichannel and Multimodal UIs . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

UNIT-III

Communications via Network and the Web: State Machine, CorrectCommunications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms.

UNIT-IV

Putting It All Together: Packaging and Deploying, Performance Best Practices,Android Field Service App, Location Mobility and Location Based Services

UNIT-V

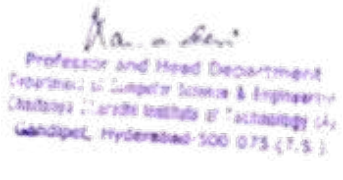
Platforms and Additional Issues: Development Process, Architecture, Design,Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions.

Textbook:

1. Wei-Meng Lee, "Beginning Android 4 Application Development", 2012 by John Wiley & Sons.

Suggested Readings:

1. Jeff Mc Wherter, "Scott Gowell, PROFESSIONAL Mobile Application Development", Wrox, 1 edition, 2012.
2. James C Sheusi, Android Application Development for Java Programmers, Cengage Learning, 2013.



Online Resources:

1. https://nptel.ac.in/courses/106106147/6
2. https://nptel.ac.in/courses/106106156/30

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20CSE120

COMPILER FOR HPC

Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites :UG Level course in Data Structure, Compiler Design, Theory ofComputation.

Course Objectives:

1. To introduce the structure of compilers and high-performance compiler design to the field of Computer Science.
2. Analyze the basic steps involved in converting a source language to target code or target language.
3. Understands the concepts of cache coherence and parallel loops in compilers are included. Gain the knowledge to write a compiler program or can able to build a compiler.

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

1. Identify the basic concepts needed for the development of a compiler structure of a compiler
2. Explore the concepts of Parallel loops, data dependency, exception handling and debugging in a compiler.
3. Interpret and analyze the concepts involved in loop structuring and concurrency analysis.
4. Differentiate the various types of Machines, and the techniques like Vector Code from Sequential Loops for all Loops, Round off Error, Exceptions, and Debuggers, Multi.
5. Elaborate the Message passing Machines and Scalable Shared Machines
6. Determine the recent trends in compilers for efficient compiler building.

UNIT-I

High-Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance, Compiler transformation for high performance computing.
Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph

UNIT-II

Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use-Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis.

UNIT-III

Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations.
Optimizing for Locality: Single Reference to Each Array, Multiple References,General Tiling, Fission and Fusion for Locality

UNIT-IV

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency fromParallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

UNIT-V

Message -Passing Machines:, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics. Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines. Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine, Nvidiacuda parallel computing.

Textbooks:

1. Michael Wolfe, "High-Performance Compilers for Parallel Computing", Pearson, 2007.
2. "Compiler transformation for High performance computing" –DAVID F. BACON, SUSAN L, 1994.

Online Resources :

1. www.springer.com/gp/book/9783540280095
2. www.chpc.utah.edu/documentation/software/compilers.php
3. https ://www.aspsys.com/solutions/software-solutions/hpc-compilers
4. https://link.springer.com/book/10.1007%2fBFboo17241.

20CSE121

OPEN SOURCE TECHNOLOGIES

Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Familiarity with Open Source Technologies
2. Study some FOSS Projects to under the principles, methodologies of FOSS.
3. Understand the policies, licensing procedures and ethics of FOSS.

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

1. Identify various OSS tools, platforms, licensing procedures, and development models, ethics
2. Describe various OSS projects, development models and project management
3. Adapt to the usage of OSS tools and technologies.
4. Distinguish between Proprietary and Open Source tools, development methods
5. Evaluate various Open Source projects like Linux, Apache, GIT
6. Practice Open Source principles, ethics, and models.

UNIT-I

Introduction to Open Source: Open Source, need and principles of OSS, OpenSource Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT–II

Fault Tolerant Design: Principles and Open Source Methodology- History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT–III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC,LibreOffice.

UNIT–IV

Open Source Project: Starting and Maintaining an Open Source Project, OpenSource Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT–V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government,Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Textbooks:

1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press, 2008.

Suggested Reading:

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills, 2015.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media, 2004.

3. Dan Woods, GautamGuliani, “Open Source for the Enterprise”, O’Reilly Media.
4. Bernard Golden, “Succeeding with Open Source”, Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, “Perspectives on Free and Open Source Software”, MIT press.

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20CSE107

MACHINE LEARNING LAB

Elective-I

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Pre Requisites: UG level Course in Probability and Statistics, Proficiency inprogramming basics.

Course Objectives:The objectives of this course are

1. To implement the machine learning algorithms
2. Implement the machine learning concepts in any suitable language of choice.
3. To explore Deep learning technique and various feature extraction strategies.

Course outcomes: On Successful completion of the course, students will be able to

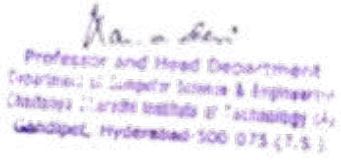
1. Apply mathematical foundations, algorithmic principles, and computer science theory to the modeling of computer- based systems.
2. Identify and utilize modern tools that are useful for data analysis.
3. Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
4. Implement unsupervised learning algorithms.
5. Implement and evaluate various Machine Learning approaches.
6. Design and develop solutions to real world problems using ML techniques.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (https:// archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.



Textbooks:

1. Tom M. Mitchell, “Machine Learning”, India Edition, McGraw Hill Education 2013.
2. Herbert Schildt& Dale Skrien, “Java Fundamentals-A Comprehensive Introduction”, 2013 Edition, Tata McGraw-Hill.
3. Herbert Schildt, “The Complete Reference Java”, 7 Edition, Tata McGraw-Hill 2007.
4. ReemaThareja “Python Programming”, Oxford Press, 2017.
5. Mike McGrath “Python in easy steps: Makes Programming Fun”, Kindle Edition, 2017.

Online Resources:

1. http://www.cs.cmu.edu/~tom/mlbook-chapter-slides.html
2. http://www.cs.cmu.edu/afs/cs.cmu.edu/user/mitchell/ftp/mlbook.html

20CSE108

INTERNET OF THINGS LAB

Elective-I

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Pre-requisites: UG level Course in CAMP, Programming Basics.

Course Objectives: The objectives of this course are

1. Identify the vision and understand the basics of IoT.
2. Impart necessary and practical knowledge of components of Internet of Things.
3. Develop skills required to build real-time IoT based projects.

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

1. Understand internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Analyze the use of communication protocols in IoT.
4. Remotely monitor data and control devices.
5. Develop real time IoT based projects.

LIST OF PRACTICALS

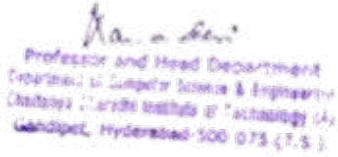
1. Introduction ofIoTequipment's and perform necessary software installation.
2. Write a program to interface LED/Buzzer with Arduino and to turn ON LED for 1sec after every 2 seconds.
3. Write a program to interface Digital sensor PIR with Arduino and to turn ON LED when motion detected.
4. Write a program to interface DHT22 sensor with Arduino and display temperature and humidity readings.
5. Write a program to interface motor using relay with Raspberry Pi. Turn ON motor when the temperature is high.
6. Write a program to interface LCD with Raspberry Pi and print temperature and humidity readings on it.
7. Interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth.
8. Write a program to interface flame/smoke sensor with Arduino / Raspberry Pi and give an alert message when flame/smoke is detected.
9. Install MySQL database on Raspberry Pi and perform basic SQL queries.
10. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
11. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
12. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data local/cloud server.
13. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from local/cloud server.
14. Implement any case study using Arduino/Raspberry Pi.

Textbooks:

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Readings:

1. Dr. SRN Reddy, RachitTirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. CunoPfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.



Online Resources:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik, JP. Vasseur, R. Alexander, "RPL: IPv6 Routing Protocol for LowPower and Lossy Networks", IETF, Standards Track, Mar. 2012.
3. Z. Shelby , K. Hartke, C. Bormann, "The Constrained Application Protocol (CoAP)",Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, "What's The Difference Between IEEE 802.15.4 And ZigBee Wireless?",Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo et al., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22 -33, March 2015.

20CSE109

INTRODUCTION TO INTELLIGENT SYSTEMS LAB

Elective-I

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Pre Requisites: Basics of python programming.

Course Objectives: The objectives of this course are

1. Design and analyze various computing algorithms and techniques using Python/Scilab.
2. Able to apply different learning algorithms to solve real time problems.
3. Recognize the underlying mathematics and logic behind various AI techniques.

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

1. Write programs in Python/Prolog language.
2. Recognize the underlying mathematics and logic behind various computing algorithms under AI system.
3. Apply variety of uncertain algorithms to solve problems.
4. Describe and apply various techniques for logic programming and machine learning.
5. Implement problems using game search algorithms.
6. Develop solutions for real world problems using NLP.

Lab Experiments:

1. Implement an 8-puzzle solver using Heuristic search technique.
2. Implement the Constraint Satisfaction problem using backtracking.
3. Implement a program for game search.
4. Build a bot to implement any game using easy AI library(ex.. tic-tac-toe, game of bones).
5. Implement a Bayesian network from a given data.
6. Infer the data from the Bayesian network.
7. Implement an application to classify data using Support Vector Machines.
8. Develop a NLP application to perform the following tasks.
    a. Tokenizing text data.
    b. Converting words to their base forms using stemming.
    c. Converting words to their base forms using lemmatization.
    d. Dividing text data into chunks.
9. Implement a case study on sentiment analysis.
10. Implementation of any case study using AI techniques.

Textbooks:

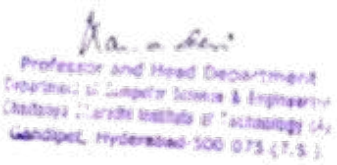
1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.
2. Prateek Joshi, "Artificial Intelligence with Python:" A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers, Packt publishing, January 2017.

Suggested Readings:

1. Prateek Joshi, Artificial Intelligence with Python – Heuristic Search [Video], PACKT, 2017.

Online Resources:

1. https://www.researchgate.net/file.PostFileLoader.html?id...assetKey
2. http://artint.info/AIPython/aipython.pdf.



20CSE110

DATA PREPARATION AND ANALYSIS LAB

Elective-III

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Course Objectives: The objectives of this course are

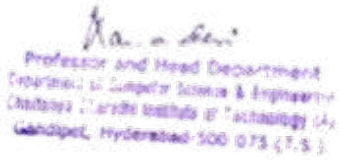
1. Identify data gathering and preparation techniques for industrial and scientific applications.
2. Apply exploratory data analysis techniques to develop meaningful data visualizations.
3. Analyze various statistical significance based testing mechanisms and apply them to deal with real-world problems.

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

1. Differentiate between numerical and categorical attributes and apply various pre-processing techniques to clean any chosen dataset.
2. Apply discretization and clustering techniques on preprocessed data.
3. Apply Association Rule mining technique to explore relationships among various attributes.
4. Apply exploratory data analysis techniques to develop meaningful data visualizations.
5. Apply various file-processing operations to deal with real-world datasets.
6. Create applications to deal with interactive datasets suitable to explore the significance of variables.

List of programs: Implement the following programs

1. Load any one dataset and perform following activities
2. List all the categorical (or nominal) attributes and the real-valued attributes separately.
3. What attributes do you think might be crucial in building the any data set?
4. Apply the cleaning process for the dataset (Replace Missing values).
5. Do you really need to input so many attributes to get good results? May be only a few would do. For example, you could try just having some combination of attributes, the class attribute (naturally)). Try out some combinations. (You had removed two attributes from the data set. Remember to reload the arff data file to get all the attributes initially before you start selecting the ones you want.)
6. Implement the discretization on any data set.
7. Demonstrate performing clustering on data sets.
8. Perform data pre-processing tasks and demonstrate performing association rule mining on data sets.
9. Load the mlb dataset and write a program to: Explore how relationships can be instantly and powerfully conveyed through the spatial arrangement of data,visual elements such as icons and lines, and most significantly, the use of animation.
    a. Loading Text Data.
    b. Files Too Large for loadStrings( )
    c. Reading Files Progressively.
    d. Reading Files Asynchronously with a Thread.
    e. Parsing Large Files As They Are Acquired.
    f. Load Milk, Tea, and Coffee dataset and perform the following activities
    g. Write a program to Acquiring a table of data from a text file.
    h. Write a program to perform parsing the contents of the file into a usable data structure.
    i. Write a program to calculate the boundaries of the data to facilitate representation.
    j. Write a program to find a suitable representation and considering alternatives.
    k. Write a program to refine the representation with consideration for placement, type, line weight, and color.
10. Design an application by providing a means of interacting with the data so that the variables can be compared against one another or against the average of the whole data set.



Textbooks:

1. Glenn J. Myatt, "Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining", John Wiley & Sons, Inc,2007.
2. Ben Fry, "Visualizing Data: Exploring And Explaining Data With The Processing Environment", O'Reilly Media, Inc, 2007.

Suggested Readings:

1. Robert Wysocki, "Effective Project Management: " Traditional, Agile, Extreme, Sixth edition, Wiley India, rp2011.
2. Watts S. Humphrey "An Introduction to the Team Software Process", Pearson Education, 2000.
3. James R. Persse, Process Improvement essentials, O'Reilly, 2006.
4. Bob Hughes & Mike Cotterell, "Software Project Management", fourth Edition, TMH, 2006.
5. Andrew Stellman& Jennifer Greene, Applied Software Project Management, O'Reilly, 2006.

Online Resources:

1. https://www.safaribooksonline.com/library/view/visualizing- data/ 9780596514556/ch08.html.
2. https://www.scribd.com/document/54993779/Making-Sense-of-Data-a-Practical-Guide-to-Exploratory-Data-Analysis-and-Data- Mining.

20CSE111

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING LAB

Elective-III

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Pre-Requisites :UG level Course in Computer Programming, Software Engineering, JAVA, J2EE.

Course Objectives:

1. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic.
2. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
3. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

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

1. Develop a security model for any enterprise based application on its threats and vulnerabilities.
2. Implement methodologies and tools to design secure software enterprise application.
3. Compare different types of threats and attacks.
4. Implement the various security algorithms to be implemented for secured computing and computer networks.
5. Evaluate various methods of authentication and access control for web based applications.
6. Analyze and apply different anti-intrusion techniques.

List of Experiments:

1. Study of multi-tier software environment.
2. Study of web servers / web browser and Tools for enterprise software Development and deployment.
3. Develop a package using JDBC
4. Develop a package using servlets / JSP.
5. Study of System threat attacks - Denial of Services.
6. Implementation of S-DES algorithm for data encryption .
7. Implementation of Asymmetric Encryption Scheme – RSA.
8. Study of Symmetric Encryption Scheme – RC4.
9. Study of Techniques uses for Web Based Password Capturing.
10. Study of Anti-Intrusion Technique – Honey Pot.

Suggested Readings:

1. Paul J Perrone, Venkata S.R. Krishna R and Chayanti, “Building Java Enterprise Systems with J2EE”, Techmedia , New Delhi, 2000.
2. George Reese, “ Database programming, with JDBC and Java” Second Edition, O’Reiliy Publishers, New Delhi, 2000.

20CSE112

COMPUTER VISION LAB

Elective-III

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Prerequisites: Basics of programming languages.

Course Objectives: The objectives of this course are

1 To make students acquainted with practical aspects of computing with images.
2 To improve quality of image by applying enhancement techniques.
3 To understand Feature Extraction algorithms.

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

1. Identify the fundamental issues and challenges of computer vision.
2. Apply image enhancement techniques.
3. Detect edges using various kernels and transformations.
4. Apply histogram processing and conversion between various colour spaces.
5. Analyze datasets using classification and clustering.
6. Evaluate computer vision system for real world problems.

Description : Use any tool like OpenCV/ Scilab/ python/R Programming etc.,

List of Programs

Familiarization of the tool used for computer vision.

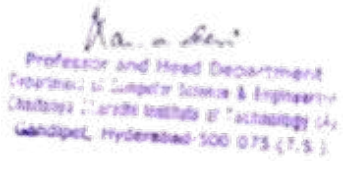
1. Implement basic image operations
a. Loading and displaying an image.
b. Color formats
c. Image enhancement.
2. Implement smoothing filters on an image using
d. Gaussian filter
e. Median filter
f. Mean Filter
3. Demonstrate fourier Transformations.
4. Implement histogram calculation and equalization for the given image.
5. Implement morphological operations like dilation, erosion, opening and closing on the given image.
6. Implement edge detection on images using any two edge detection masks.
7. Detection of motion from structure .
8. Implement texture extraction of a given image.
9. Case Study :Object detection like recognizing pedestrians..
10. Case Study :Face recognition of an image using K-Means clustering.
11. Case Study :Dimensionality reduction using PCA for the givenimages.
12. Case Study :Demonstrate model based reconstruction using tensorflow.

Textbooks:

1. Gary Bradski and Adrian Kaehler, "Learning OpenCV", O'Reilly Media, Inc., 1st Edition, 2008.
2. Talita Perciano and Alejandro C Frery, "Introduction to Image Processing Using R:" Learning by Examples, Springer, 1st Edition, 2013.
3. "Computer Vision: Algorithms and Applications" by Richard Szeliski; Springer-Verlag London Limited 2011.

Suggested Readings:

1. R C Gonzalez and R E woods, "Digital Image Processing", Addison Pearson, 3rd Edition, 2013.
2. David A.Forsyth and Jean Ponce, Computer Vision-A Modern Approach, PHI, 1st Edition, 2003.



Online Resources:

1 https://atoms.scilab.org/toolboxes/IPCV/1.1
2 https://docs.opencv.org/2.4/doc/tutorials/tutorials.html.

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20CSC 103

ADVANCED DATA STRUCTURES LAB

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Prerequisites: Undergraduate course on Data Structures.

Course Objectives: The objectives of this course are

1. To use appropriate data structures and to design algorithms for a specific problem.
2. To analyze and implement dictionaries, hash algorithms skip list data structures as solutions to real-world problems.
3. To deal with text-processing algorithms and computational geometric concepts for efficient space utilization.

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

1. Analyze and implement various data structures like stacks, queues and priority queues using arrays.
2. Analyze and implement various data structures like stacks, queues and priority queues using linked list.
3. Implement Dictionary ADT using Linear and quadratic probing operations.
4. Construct a skip list data structure and perform various operations on it.
5. Analyze and implement various binary tree operations.
6. Analyze and implement the significance of various text processing operations for pattern matching.

List of Programs:

1. Implement StackADT using an array.
2. Implement QueueADT using an array .
3. Implement StackADT using a singly linked list.
4. Implement QueueADT using a singly linked list.
5. Implement priority queue ADT.
6. Implement all the functions of a dictionary (ADT) using Linear Probing.
7. Implement all the functions of a dictionary (ADT) using Quadratic Probing.
8. Implement skip list data structure with the following operations.
9. Construct, Search, Update.
10. Implement a binary search data structure to perform the following operations.
11. Construct a binary search tree of elements.
12. Search for a key element in the above binary search tree.
13. Delete an element from the above binary search tree.
14. Implement KMP algorithm for pattern matching.
15. Implement Boyer-Moore algorithm for pattern matching

Textbooks:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in JAVA", 3rdEdition, Pearson,2004.
2. M T Goodrich and Roberto Tamassia, "Algorithm Design", John Wiley, 2002.

Suggested Readings:

1. S.Sahni, "Data structures, Algorithms and Applications in Java", 2ndEdition, Universities Press,2005.
2. A.Drozdek, "Data Structures and Algorithms in java", 3rd Edition, Cengage Learning,2008.
3. J.R.Hubbard, Data Structures with Java, 2ndEdition, Schaum's Outlines, TMH, 2007.

SEMESTER - II

20CSC 104

ADVANCED ALGORITHMS

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites: UG level course in Algorithm Design and Analysis.

Course Objectives:

1. Introduce advanced methods of choosing, designing and analyzing algorithms.
2. Familiarize with basic paradigms and data structures used to solve advanced algorithmic problems.
3. Understand different classes of problems concerning their computation difficulties.

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

1. Define and discuss the different problems solved by using algorithmic paradigms.
2. Apply the suitable data structure for solving a problem using various strategies.
3. Differentiate the complexities of a problem solved in various approaches.
4. Evaluate various algorithmic design techniques.
5. Design appropriate mathematical notation to solve a problem using algorithmic paradigms.
6. Develop solutions for real world problem.

UNIT-I

Sorting: Review of various sorting algorithms, topological sorting

Graph: Definitions and Elementary Algorithms: Shortest path by BFS,shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT-II

Matroids: Introduction to greedy paradigm, algorithm to compute a maximumweight maximal independent set. Application to MST.

Graph Matching: Algorithm to compute maximum matching. Characterization ofmaximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT-III

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide andconquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT-IV

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamicprogramming paradigm-Optimal Binary Search Tree, 0/1 Knapsack Problem, Longest Common Subsequence, Matrix Chain Multiplication .

Modulo Representation of integers/polynomials: Chinese Remainder Theorem,Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

UNIT-V

Linear Programming: Geometry of the feasibility region and Simplex algorithm **NP-completeness:** proof of NP-hardness and NP-completeness-Clique Problem,Vertex-Cover Problem, Subset-Sum Problem.

Approximation algorithms: Introduction, Vertex-Cover Problem

Textbooks:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition,The MIT Press, 2009.

Suggested Readings:

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Addison-Wesley Publication, Originally published on 1974.
2. Jon Kleinberg, Eva Tardos, "Algorithm Design", Pearson Addison-Wesley Publication, 2009.

Online Resources :

1. https://nptel.ac.in/courses/106104019/

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20CSC 105

SOFT COMPUTING

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites :UG level course in Basic knowledge of mathematics.

Course Objectives:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.

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

1. Identify and describe soft computing techniques and their roles in building Intelligent Machines.
2. Comprehend appropriate learning rules for each of the neural network architectures and learn several neural network paradigms, its applications and limitations.
3. Apply fuzzy logic and reasoning to handle uncertainties and solve various engineering problems.
4. Apply genetic algorithms to combinatorial optimization problems.
5. Evaluate and compare solutions by various soft computing approaches for a given problem.
6. Recognize the underlying mathematics and logic behind various soft computing algorithms.

UNIT-I

Introduction: Evolution of Computing: Soft Computing Constituents, FromConventional AI to Computational Intelligence, Hard vs Soft computing.

UNIT-II

Artificial Neural Networks: Fundamental concepts, Evolution of neural networks,Basic models of artificial neural network, Important terminologies of ANNs. McCulloch-Pitts neuron, Linearseparability, Hebb network.Supervised Learning Neural Networks:Perceptron networks, Adaptive linear neuron(Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network

UNIT-III

Unsupervised Learning Neural Networks: Kohonenself organizing networks,Adaptive resonance theory.
Associate Memory Networks: Bidirectional associative memory network,Hopfield networks.

UNIT-IV

Fuzzy logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, MembershipFunctions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-V

Genetic algorithms: Introduction to Genetic Algorithms (GA), Applications ofGA in Machine Learning :Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Machine Learning Approach to Knowledge Acquisition.

Textbooks:

1. S.N. Sivanandam& S.N. Deepa, "Principles of soft computing", Wiley publications, 2nd Edition, 2008.
2. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro :Fuzzy and Soft Computing , Prentice:Hall of India, 2003.

Suggested Readings:

1. LiMin Fu, "Neural Networks in Computer Intelligence",McGraw-Hill edition, 1994.
2. Simon Haykins, "Neural Networks a Comprehensive Foundation", PHI, second edition
3. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications , Prentice Hall, 1995.
4. MATLAB Toolkit Manual.

Online Resources :

1. www.soukalfi.edu.sk/01_NeuroFuzzyApproach.pdf
2. https://drive.google.com/file/d0B0z1VRAPGVkT2MyTXlwdE9XWXc/view?usp=sharing
3. https://github.com/rohanchikorde/Data-Sciencebooks/blob/master/ python-machine-learning-2nd.pdf
4. http://www.myreaders.info/html/soft_computing.html

Professor and Head Department
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Gandipet, Hyderabad-500 075 (T.S.)

20CSC 106

ADVANCED ALGORITHM and SOFT COMPUTING LAB

Instruction	4 hrs per week
Duration of End examination	3 hrs
Continuous Internal Evaluation	50
Credits	2

Pre-Requisites :UG level course in Design and analysis of algorithm Lab usingany programming Language.

Course Objectives:

1. Familiarize with efficient utilization of programming language constructs and strategies to solve real time problems.
2. Fundamentals of Neural Networks & Feed Forward Networks, Associative Memories & ART Neural Networks.
3. Fuzzy Logic and Fuzzy Systems; Genetic Algorithms and its design.

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

1. Describe and analyze various advanced Algorithms.
2. Implement various algorithmic design techniques.
3. . Design and identify the suitable algorithmic paradigm to solve real world problems
4. Design and analyze various Neural Networks Architectures.
5. Implement fuzzy sets and Genetic Algorithms with its operators.
6. Apply soft computing strategies for various real time applications

List of Experiments:

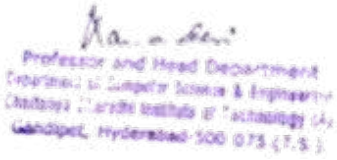
1. Implementation of Sorting- heap sort, quick sort, topological sort.
2. Implementation of Minimum Spanning Trees.
3. Implementation of Maximum Sub-Array Problem, Stassen's Matrix Multiplication
4. Implementation of Shortest Path Algorithms.
5. Implementation of Longest Common Subsequence.
6. Implementation of Matrix Chain Multiplication, Simplex Algorithm.
7. Implementation of Simple Neural Network (McCulloh-Pitts model) for realizing AND Operation and OR operation using Perceptron learning algorithm.
8. Implementation of XOR problem using MADALINE network.
9. Design and implementing the back Propagation algorithm for training a non-linear network.
10. Implementation of BAM network.
11. Implementation of KSOFM network for Clustering.
12. Implement the Genetic Algorithm for TSP.

Textbooks:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press., 2009.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition, Pearson, 2004.
3. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication 2016.
4. Satish Kumar, –"Neural Networks -A classroom approach"; Second Edition, TMH, 2017.

Online Resources :

1. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms. html
2. https://www.geeksforgeeks.org/top-algorithms-and-data-structures-for-competitive-programming/
3. http://www. nptelvideos . com/java/java _ video _ Lecture Hours_tutorials.php
4. https://nptel.ac.in/courses/106104019/



20MEC103

RESEARCH METHODOLOGY AND IPR

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	20
Credits	2

Course Objectives: The objectives of this course are

1. Motivate to choose research as career.
2. Formulate the research problem, prepare the research design.
3. Identify various sources for literature review and data collection report writing.
4. Equip with good methods to analyze the collected data.
5. Know about IPR copyrights.

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

1. Define research problem, review and asses the quality of literature from various sources.
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs.
3. Collect the data by various methods: observation, interview, questionnaires.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square.
5. Understand apply for patent and copyrights.

UNIT-I

Research Methodology: Objectives and Motivation of Research, Types ofResearch, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem, Selection of Research Problem, Necessity of Defining the Problem.

UNIT-II

Literature Survey Report writing: Literature Survey: Importance and purposeof Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report.

Research Proposal Preparation: Writing a Research Proposal and ResearchReport, Writing Research Grant Proposal.

UNIT-III

Research Design: Meaning of Research Design, Need of Research Design,Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT-IV

Data Collection and Analysis: Methods of data collection, importance ofParametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test.

UNIT-V

Patents and Copyright: Patent: Macro economic impact of the patent system,Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection.

Textbooks:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Readings:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
2. MLA Hand book for writers of Research Papers, East West PressPvt. Ltd, New Delhi, 7th Edition, 2008.
3. Lauri Rozakis, Schaum's, Quick Guide to Writing Great ResearchPapers, Tata McGraw Hills Pvt. Ltd, New Delhi, 2007.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

20EGA101

ENGLISH FOR RESEARCH PAPER WRITING
((MTech Audit Course I/II Sem- Common to all branches)

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. To the various purposes of Research Papers and help them infer the benefits and limitations of research.
2. To developing the content, formulating a structure and illustrating the format of writing a research paper.
3. In differentiating between qualitative and quantitative research types.
4. To constructing paragraphs and developing thesis statement.
5. To producing original research papers while avoiding plagiarism.

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

1. Illustrate the nuances of research paper writing and draw conclusions about the benefits and limitations of research.
2. Classify different types of research papers and organize the format and citation of sources.
3. Review the literature and categorize between different types of research.
4. Draft paragraphs and write thesis statement in a scientific manner.
5. Develop an original research paper while acquiring the knowledge of how and where to publish their papers.

UNIT- I

Academic Writing: Meaning & Definition of a research paper; Purpose of a research paper – Scope, Benefits, Limitations and outcomes.

Unit -II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT -III

Research Methodology Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT- IV

Process of Writing a research paper Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading. IEEE Style.

UNIT- V

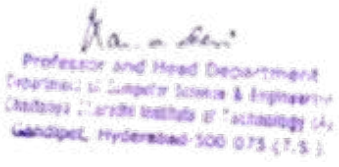
Research Paper Publication Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits.

Textbook:

1. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4thEdition.

Suggested Readings:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
2. MLA Hand book for writers of Research Papers, East West Press Pvt. Ltd, New Delhi, 7thEdition.
3. Lipson, Charles(2011), Cite Right: A Quick Guide to Citation Styles; MLA, APA, Chicago, the n)Sciences, Professions, and more (2nd Edition). Chicago [u.a] :Univ of Chicago Press.



Online Resources:

1. NPTEL https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. NPTEL: https://nptel.ac.in/courses/121/106/121106007/
3. https://www.classcentral.com/course/swayam-introduction-to-research-5221

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20CEA101

DISASTER MITIGATION AND MANAGEMENT

(M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions.

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

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management.
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same.
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT-I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT-IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological,economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V

Concept of Disaster Management: Disaster management cycle – its phases;prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programs in India and the activities of National Disaster Management Authority.

Textbooks:

1. Pradeep Sahni," Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh," Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Readings:

1. Ministry of Home Affairs". Government of India, "National disaster management plan, Part I and II", Latest 2016.
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. http://www. indiaenvironmentportal .org . in/files/file/ disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs, 2003.

20EEA101

SANSKRIT FOR TECHNICAL KNOWLEDGE

(MTech. Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives:The objectives of this course are

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects.
3. To explore the huge knowledge from ancient Indian literature.

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

1. Develop passion towards Sanskrit language.
2. Decipher the latent engineering principles from Sanskrit literature.
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress.
5. Explore the avenue for research in engineering with aid of Sanskrit.

UNIT-I

Introduction to Sanskrit language: Sanskrit Alphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/ Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic sciences: Brahmagupthas lemmas (second degreeindeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):
Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower-Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingalachandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures
Chemical laboratory location and layout-equipment-distillation vessel-kosthiyanthram-

Textbooks:

1. M Krishnamachariar, History of Classical Sanskrit Literature, TTD Press, 1937.
2. M.R. Kale, A Higher Sanskrit Grammar: For the Use of School and
3. College Students, MotilalBanarsidass Publishers, ISBN-13: 978-8120801783,2015.
4. Kapail Kapoor, Language, Linguistics and Literature: The Indian
5. Perspective, ISBN-10: 8171880649, 1994.
6. Pride of India, SamskritaBharati Publisher, ISBN: 81-87276-27-4, 2007
7. Shri RamaVerma, Vedas the source of ultimate science, Nag publishers, ISBN:81-7081-618-1,2005.

20ECA101

VALUE EDUCATION

(MTech Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives : The objectives of this course are

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals.
3. Cultivate individual and National character.

Course outcomes: On Successful completion of the course, students will be able to

1. Gain necessary Knowledge for self-development.
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life.
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept ofhumanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivationof values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitudeand Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books: Self-management and Good health; and internal & externalCleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Characterand Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Suggested readings:

1. Chakroborty, S.K. “Values & Ethics for organizations Theory and practice”, Oxford University Press, New Delhi, 1998.
2. Jaya DayalGoyandaka, “Srimad Bhagavad Gita”, with Sanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

20EGA102

INDIANCONSTITUTION & FUNDAMENTAL RIGHTS
(MTech Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

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

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

UNIT-I
History of making of the Indian constitutions - History, Drafting Committee(Composition & Working).
Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II
Contours of Constitutional Rights and Duties - Fundamental Rights, Right toEquality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III
Organs of Governance - Parliament: Composition, Qualifications, Powers andFunctions
Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT-IV
Local Administration - District's Administration head: Role and importance.
Municipalities: Introduction, Mayor and role of Elected Representative, CEO of
Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat,
Elected Officials and their roles, CEO Zilla Panchayat: positions and role. Block level: Organizational Hierarchy (Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V
Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Readings:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:

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

20ITA101

PEDAGOGY STUDIES
Audit Course-2)

Instruction	2 Hours per week
Duration of End Exam	2 Hours
Semester End Examination	50 Marks
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

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

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background,Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for thein depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow upsupport - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy
-Teacher education - Curriculum and assessment – Dissemination and research impact.

Textbooks:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance ofevaluation", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Readings:

1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID, 2003.

2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33(3):272-282,2013.
3. Alexander R J, "Culture and Pedagogy: International Comparisons in
4. Primary Education", Oxford and Boston: Blackwell, 2001.
5. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

20EGA103

STRESS MANAGEMENT BY YOGA

(**(MTech Audit Course I/II Sem -** Common to all branches)

Instruction	2 Hours per week
Duration of End examination	2 Hours
Semester end examination	50 Marks
CIE	-
Credits	-

Course Objectives : The objectives of this course are

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

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

1. To understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT 1:

Meaning and definition of Yoga - Historical perspective of Yoga - Principles ofAstanga Yoga by Patanjali.

UNIT 2:

Meaning and definition of Stress - Types of stress - Eustress and Distress.Anticipatory Anxiety and Intense Anxiety and depression.Meaning of Management- Stress Management.

UNIT 3:

Concept of Stress according to Yoga - Stress assessment methods - Role ofAsana, Pranayama and Meditation in the management of stress.

UNIT 4:

Asanas- (5Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT-V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama – Kapalabhati, Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxationtechnique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Suggested Readings:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur, 2019.
2. "Rajayoga or Conquering the Internal Nature"by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata, 1998.
3. Nagendra H.R nadNagaratna R, Yoga Perspective in Stress Management, Bangalore, Swami Vivekananda Yoga Prakashan, 2014.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

20 EGA104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

(MTech. Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of end examination	2 Hours
Semester End Examination	50 Marks
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom among themselves.

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

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. To practice emotional self-regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT-I

Neetisatakam – Holistic development of personality - Verses 19, 20, 21, 22(Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT-II

Neetisatakam – Holistic development of personality (cont'd) - Verses 52, 53, 59(dont's) - Verses 71,73,75& 78 (do's) - Approach to day to day works and duties.

UNIT-III

Introduction to Bhagavadgeetha for Personality Development - Shrimad BhagawadGeeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT-IV

Statements of basic knowledge - Shrimad BhagawadGeeta: Chapter 2- Verses56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad BhagawatGeeta.

UNIT-V

Role of Bahgavadgeeta in the present scenario - Chapter 2 – Verses 17 - Chapter3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Suggested Readings:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata, 2016.
2. Bhartrihari'sThree Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi , 2010.

Online Courses:

1. NTPEL: http://nptel.ac.in/downloads/109104115

20CSO 101

BUSINESS ANALYTICS

(Open Elective)

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Understanding the basic concepts of business analytics and applications.
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics.
3. Prepare the students to model business data using various data mining, decision making methods.

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

1. Identify and describe complex business problems in terms of analytical models.
2. Apply appropriate analytical methods to find solutions to business problems that achieve stated objectives.
3. Interpret various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques.
5. Model the business data using various business analytical methods and techniques.
6. Create viable solutions to decision making problems.

UNIT-I

Introduction to Business Analytics: Introduction to Business Analytics, needand science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

UNIT-II

Descriptive Analytics: Introduction, data types and scales, types of measurementscales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization.

UNIT-III

Forecasting Techniques: Introduction, time-series data and components,forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

UNIT-IV

Decision Trees: CHAID, Classification and Regression tree, splitting criteria,Ensemble and method and random forest. Clustering: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, Prescriptive Analytics- Linear Programming(LP) and LP model building,

UNIT-V

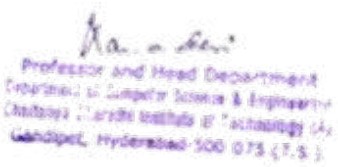
Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process,cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox.

Textbooks:

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015

Suggested Readings:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015.



Online Resources::

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

Professor and Head Department
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20MEO 101

INDUSTRIAL SAFETY

(Open Elective)

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

Course Objectives: The objectives of this course are

1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering.
3. About wear and corrosion along with preventive steps to be taken
4. The basic concepts and importance of fault tracing.
5. The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry.

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

1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc.

UNIT-I

Industrial safety: Accident, causes, types, results and control, mechanical andelectrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT-II

Fundamentals of Maintenance Engineering: Definition and aim of maintenanceengineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III

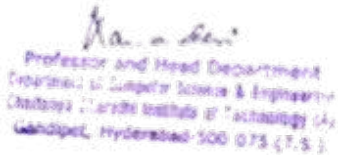
Wear and Corrosion and their Prevention: Wear- types, causes, effects, wearreduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT-IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept,need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V

Periodic and Preventive Maintenance: Periodic inspection-concept and need,degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance



Textbooks:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company, 2012.
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication, 2001.

Suggested Readings:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services, Copy Right 2002.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London, originally published 1975

20MEO102

INTRODUCTION TO OPTIMIZATION TECHNIQUES

(Open Elective)

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

Course Objectives: The objectives of this course are

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

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

1. Formulate a linear programming problems (LPP).
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully.
4. Apply queing and inventory concepts in industrial applications.
5. Apply sequencing models in industries.

UNIT-I

Operations Research: Definition, scope, Models, Linear programming problems(LPP), Formulation, Graphical Method, and Simplex Method.

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

Project Management: Definition, Procedure and Objectives of ProjectManagement, 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.

UNIT-IV

Queuing Theory and Inventory: Kendols Notation, single server models,Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT-V

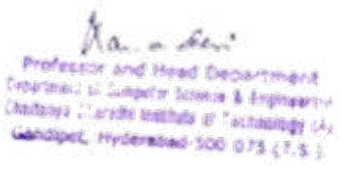
Sequencing Models: Introduction, Objectives, General assumptions, processing'n' jobs through two Machines, processing 'n' jobs through three machines.

Textbooks:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008

Suggested Readings:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India 2010



20CEO101

COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective)

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

Course Objectives: The objectives of this course are

1. To enable the students to understand the concepts of Project management.
2. To provide knowledge on concepts of Project Planning and scheduling.
3. To create an awareness on Project Monitoring and Cost Analysis.
4. To provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis.
5. To train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

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

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and leveling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT-I

Project Management: Introduction to project managements, stakeholders, roles,responsibilities and functional relationships.Principles of project management, objectives and project management system. Project team, organization, roles, responsibilities. Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II

Project Planning and Scheduling: Introduction for project planning, definingactivities and their interdependency, time and resource estimation. Work break down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost. Project direct and indirect costs.

UNIT-IV

Resources Management and Costing-Variance Analysis: Planning, EnterpriseResource Planning, Resource scheduling and levelling. Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis.Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement.

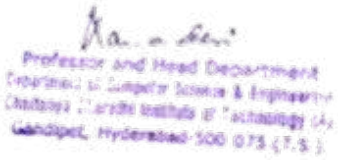
UNIT-V

Budgetary Control: Flexible Budgets; Performance budgets; Zero-basedbudgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management: Linear Programming, PERT/CPM,Transportation Assignment problems, Simulation, Learning Curve Theory.

Suggested Readings:

1. Charles T Horngren “Cost Accounting A Managerial Emphasis”, Pearson Education; 14 edition (2012),



2. Charles T. Horngren and George Foster, “Advanced Management Accounting” Prentice-Hall; 6th Revised edition (1 February 1987)
3. Robert S Kaplan Anthony A. Atkinson, “Management & Cost Accounting” , Pearson; 2 edition (18 October 1996)
4. K. K Chitkara, “Construction Project Management: Planning, scheduling and controlling”, Tata McGraw-Hill Education. (2004).
5. Kumar NeerajJha “Construction Project Management Theory and Practice”,Pearson Education India; 2 edition (2015)

20MEO103

COMPOSITE MATERIALS

(Open Elective)

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

Course Objectives: The objectives of this course are

1. Composite materials and their constituents.
2. Classification of the reinforcements and evaluate the behavior of composites.
3. Fabrication methods of metal matrix composites.
4. Manufacturing of Polymer matrix composites.
5. Failure mechanisms in composite materials.

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

1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT-I

Introduction: Definition – Classification and characteristics of Compositematerials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT-II

Reinforcements: Preparation-layup, curing, properties and applications of glassfibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusiontechnique, Cladding – Hot isostatic pressing. Properties and applications.Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV

Manufacturing of Polymer Matrix Composites: Preparation of Mouldingcompounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT-V

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximumstrain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength;

Textbooks:

1. R.W.Cahn – VCH , “Material Science and Technology”, (Vol 13) Composites , West Germany, Sept. 1993.
2. WD Callister, Jr., Adapted by R. Balasubramaniam , “Materials Science and Engineering, An introduction”., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Readings:

3. Ed-Lubin, “Hand Book of Composite Materials”
4. K.K.Chawla, “Composite Materials”.
5. Deborah D.L. Chung, “Composite Materials Science and Applications”
6. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, “Composite Materials Design and Applications”

20EEO 101

WASTE TO ENERGY

(Open Elective)

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

Course objectives: The objectives of this course are

1. To know the various forms of waste.
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course outcomes: On Successful completion of the course, students will be able to

1. Understand the concept of conservation of waste.
2. Identify the different forms of wastage.
3. Chose the best way for conservation to produce energy from waste.
4. Explore the ways and means of combustion of biomass.
5. Develop a healthy environment for the mankind.

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based,Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal –Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraftgasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exoticdesigns, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V

Biogas: Properties of biogas (Calorific value and composition) - Biogas planttechnology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. "Non Conventional Energy", Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. "Biogas Technology - A Practical Hand Book" - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Suggested Readings:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

20PYO101

HISTORY OF SCIENCE AND TECHNOLOGY

(Open Elective)

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

Course Objectives: The objectives of this course are

1. Gains the knowledge about origin of science in the Stone Age and its progress during Antiquity period.
2. Familiar with scientific views in the Medieval period and during the Industrial revolution.
3. Aware of modern scientific developments from 19th century onwards.

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

1. Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
2. Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
3. Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
4. Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.
5. Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.

UNIT-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization ,Major advances. Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe ,Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances. The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 AD – 1734): Europeandomination, The scientific method, Major advances. The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD):philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances. Rise of **Modern Science and Technology (1895AD – 1945 AD):** The growth of 20thcentury science, New philosophies, Quantumreality, Energy sources, Electricity: a revolution in technology, Major advances.

UNIT-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science,Specialization and changing categories, Technology changes society, Major advances.; **The Information Age (1973 AD – 2015 AD):**Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Textbooks:

1. Bryan and Alexander Hellemans, “The History of Science and Technology”, Houghton Mifflin Company, 2004.
2. JD Bernal, “Science in History”, 4 volumes, Kindle Edition.

Suggested Readings:

1. Kara Rogers, “The 100 Most Influential Scientists of All Time”, Britannica Educational Publishing, 2010
2. Alberto Hernandez, “A Visual History of Science and Technology”, The Rosen Publishing Group, 2016

20CSC 107

MINI PROJECT with SEMINAR

Instruction	4 Hours per week
Duration of End examination	-
Semester end examination	-
CIE	50 Marks
Credits	2

Pre-requisites: Basic knowledge of problem solving, Software Engineering

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

1. Demonstrate a sound technical knowledge of their selected project topic
2. Undertake problem identification, formulation and solution
3. Design engineering solutions to complex problems using a systems approach
4. Analyze and interpret the results using appropriate modern tools
5. Communicate with engineers and the community at large in written an oral forms.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer

Guidelines:

- As part of the the curriculum in II-Semester, each student shall do a mini project. Generally student should work 3 to 4 weeks of prior reading, 12 weeks of active research, and and finally a presentation of their work for assessment
- Each student will be allotted to a faculty supervisor for monitoring the mini project work.
- Students are advised to select the mini project in such a way that they can demonstrate their competence in research techniques for the challenging issues/problems, and get an opportunity to contribute something more original.
- Mini projects shall have disciplinary/industry relevance.
- The students can select a mathematical modeling based/Experimental investigation or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, detailed discuss on results, conclusions and references.

Department Committee: Supervisor and two faculty coordinators

Guidelines for awarding marks (CIE):	**Max. Marks: 50**	
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Writing

Professor and Head Department

20CSC 108

DISSERTATION PHASE-I

Instruction	20 Hours per week
Duration of End examination	-
Semester end examination	-
CIE	100 Marks
Credits	10

Pre-requisites: Research Methodologies and IPR, Basic knowledge of problem solving,

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

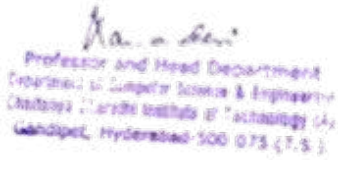
1. Inculcate the culture of self-learning on various topics
2. Review literature such as books, journal, technical documents related to problem specific domain
3. Analyze the complex real world problems
4. Formulate the solutions using the appropriate methodology
5. Design and represent solutions using the appropriate design diagrams
6. Develop research culture, communicate with engineers and the community at large in written an oral forms.

Guidelines:

- The dissertation topic shall be a complex real world problem with research potential and should involve scientific research.
- Student shall carry out literature review, gather or generate the required data and analyze data, determine the suitable solution and must preferably bring out the individual contrition.
- Seminar shall be based on the area in which the student has undertaken the dissertation work.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature reviewed.
- The preliminary results (if available) of the problem along with the design may also be discussed in the report
- The work carried out by the student shall be presented in front of the Committee consisting of Head, Chairman-BoS, Supervisor and Project Coordinator
- Students shall be in regular contact with their supervisor and the topic of dissertation must be mutually decided by the supervisor and the student.

CIE Assessment Guidelines Max Marks: 100		
Evaluation by	**Max. Marks**	**Evaluation Criteria**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the topic
	10	PPT Preparation(s)
	10	presentation(s)
	10	Question and Answers
	10	Report preparation

Note : Department committee has to assess the Every two weeks.



20CSC 109

DISSERTATION PHASE-II

Instruction	32 Hours per week
Duration of SEE	3
SEE	100 Marks
CIE	100 Marks
Credits	16

Pre-requisites: Research Methodologies and IPR, Basic knowledge of problem solving,Technical Writing

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

1. Use different experimentation techniques and technologies
2. Develop experimental set up/ Environment test rig
3. Conduct experiments by using the benchmark data sets
4. Analyze and interpret the results by using appropriate modern tools
5. Communicate effectively with technical reports and oral presentation
6. Make research contributions by publishing their work to the research community

Guidelines:

- It is a continuation of Project work started in semester III-Semester.
- Students have to submit the report in a prescribed format and also present a seminars
- The dissertation work shall be presented in a standard format as provided by the department.
- Students have to prepare a detailed project report report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology experimental set up or numerical details as the case may be) of solution and results and discussions.
- The report must also bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD, and BoS Chairperson), supervisor/Co-Supervisor.
- Students should be in regular contact with their supervisor/Co-Supervisor.

CIE Assessment Guidelines		**Max Marks: 100**
Evaluation by	**Max. Marks**	**Evaluation Criteria**
Supervisor	05	Review-1
	10	Review-2
	10	Review-3
	15	Final presentation with the draft copy of the report in a standard format
	10	Submission of the report
Department Committee	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of work which may lead to publication
	10	Analytical Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

SEE Assessment Guidelines		**Max Marks: 100**
Evaluation by	**Max. Marks**	**Evaluation Criteria**
Supervisor	20	Power Point Presentation
	40	Quality of dissertation report and Evaluation
Department Committee	20	Quality of the Dissertation: • Innovations • Applications • Live Research work • Scope for future study • Application to Society • Regularity and Punctuality
	20	Viva-Voce

Note: Department Committee shall assess the progress of the student for every TWO weeks.