



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE STRUCTURE AND SYLLABUS

For UG – R20

B. TECH - INFORMATION TECHNOLOGY

(Applicable for batches admitted from 2020-2021)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

KAKINADA - 533 003, Andhra Pradesh, India



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DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE STRUCTURE

| I Year – I SEMESTER | | | | | | |
|----------------------|-------------|--|-------------|---|---|---------|
| S. No | Course Code | Courses | L | T | P | Credits |
| 1 | HS | Communicative English | 3 | 0 | 0 | 3 |
| 2 | BS | Mathematics - I (Calculus And Differential Equations) | 3 | 0 | 0 | 3 |
| 3 | BS | Applied Physics | 3 | 0 | 0 | 3 |
| 4 | ES | Programming for Problem Solving using C | 3 | 0 | 0 | 3 |
| 5 | ES | Computer Engineering Workshop | 1 | 0 | 4 | 3 |
| 6 | HS | English Communication Skills Laboratory | 0 | 0 | 3 | 1.5 |
| 7 | BS | Applied Physics Lab | 0 | 0 | 3 | 1.5 |
| 8 | ES | Programming for Problem Solving using C Lab | 0 | 0 | 3 | 1.5 |
| Total Credits | | | 19.5 | | | |

| I Year – II SEMESTER | | | | | | |
|----------------------|-------------|--|-------------|---|---|---------|
| S. No | Course Code | Courses | L | T | P | Credits |
| 1 | BS | Mathematics – II (Linear Algebra And Numerical Methods) | 3 | 0 | 0 | 3 |
| 2 | BS | Applied Chemistry | 3 | 0 | 0 | 3 |
| 3 | ES | Computer Organization | 3 | 0 | 0 | 3 |
| 4 | ES | Python Programming | 3 | 0 | 0 | 3 |
| 5 | ES | Data Structures | 3 | 0 | 0 | 3 |
| 6 | BS | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 7 | ES | Python Programming Lab | 0 | 0 | 3 | 1.5 |
| 8 | ES | Data Structures Lab | 0 | 0 | 3 | 1.5 |
| 9 | MC | Environment Science | 2 | 0 | 0 | 0 |
| Total Credits | | | 19.5 | | | |



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| II Year – I SEMESTER | | | | | | |
|-----------------------------|--------------------|---|-------------|----------|----------|----------------|
| S.No | Course Code | Courses | L | T | P | Credits |
| 1 | BS | Mathematics III | 3 | 0 | 0 | 3 |
| 2 | IT | Object Oriented Programming through C++ | 3 | 0 | 0 | 3 |
| 3 | IT | Operating Systems | 3 | 0 | 0 | 3 |
| 4 | IT | Database Management Systems | 3 | 0 | 0 | 3 |
| 5 | IT | Discrete Mathematics and Graph Theory | 3 | 0 | 0 | 3 |
| 6 | IT | Object Oriented Programming through C++ Lab | 0 | 0 | 3 | 1.5 |
| 7 | IT | Operating Systems Lab | 0 | 0 | 3 | 1.5 |
| 8 | IT | Database Management Systems Lab | 0 | 0 | 3 | 1.5 |
| 9 | SO | Skill Oriented Course I 1) Animations- 2D Animation 2) Distributed Technologies- NoSQL | 0 | 0 | 4 | 2 |
| 10 | MC | Constitution of India | 2 | 0 | 0 | 0 |
| Total Credits | | | 21.5 | | | |

| II Year – II SEMESTER | | | | | | |
|------------------------------|--------------------|--|-------------|----------|----------|----------------|
| S.No | Course Code | Courses | L | T | P | Credits |
| 1 | BS | Statistics with R | 2 | 0 | 2 | 3 |
| 2 | IT | Principles of Software Engineering | 3 | 0 | 0 | 3 |
| 3 | IT | Automata Theory and Compiler Design | 3 | 0 | 0 | 3 |
| 4 | ES | Java Programming | 3 | 0 | 0 | 3 |
| 5 | HS | Managerial Economics and Financial Accountancy | 3 | 0 | 0 | 3 |
| 6 | IT | UML Lab | 0 | 1 | 2 | 2 |
| 7 | IT | FOSS Lab | 0 | 0 | 2 | 1 |
| 8 | ES | Java Programming Lab | 0 | 0 | 3 | 1.5 |
| 9 | SO | Skill Oriented Course II 1) Animations- 3D Animation OR 2) Distributed Technologies- MongoDB | 0 | 0 | 4 | 2 |
| Total Credits | | | 21.5 | | | |
| 10 | Minor | Object Oriented Programming through C++ ^{\$} | 3 | 0 | 2 | 3+1 |
| 11 | Honors | Any course from the Pool, as per the opted track | 4 | 0 | 0 | 4 |

\$- Integrated Course



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| III B. Tech – I Semester | | | | | | |
|---------------------------------|----------------------------|---|----------------|---|---|-------------|
| S.No | Course Code | Courses | Hours per week | | | Credits |
| | | | L | T | P | C |
| 1 | PC | Computer Networks | 3 | 0 | 0 | 3 |
| 2 | PC | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 |
| 3 | PC | Data Mining Techniques | 3 | 0 | 0 | 3 |
| 4 | Open Elective/Job Oriented | Open Elective-I Open Electives offered by other departments/ DevOps (Job Oriented course) | 3 | 0 | 0 | 3 |
| 5 | PE | Professional Elective-I 1. Artificial Intelligence 2. Agile Software Process 3. Distributed Systems 4. Advanced Unix Programming | 3 | 0 | 0 | 3 |
| 6 | PC | Data Mining Techniques with R Lab | 0 | 0 | 3 | 1.5 |
| 7 | PC | Computer Networks Lab | 0 | 0 | 3 | 1.5 |
| 8 | SO | Skill Oriented Course - III 1. Animation course: Animation Design OR 2. Continuous Integration and Continuous Delivery using DevOps | 0 | 0 | 4 | 2 |
| 9 | MC | Employability Skills-I | 2 | 0 | 0 | 0 |
| 10 | PR | Summer Internship 2 Months(Mandatory) after second year(to be evaluated during V semester | 0 | 0 | 0 | 1.5 |
| Total credits | | | | | | 21.5 |
| 11 | Minor | Computer Networks [§] | 3 | 0 | 2 | 3+1 |
| 12 | Honors | Any course from the Pool, as per the opted track | 4 | 0 | 0 | 4 |

§- Integrated Course


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| III B. Tech – II Semester | | | | | | |
|--|--------------------------------|--|-----------------------|----------|----------|----------------|
| S.No | Course Code | Courses | Hours per week | | | Credits |
| | | | L | T | P | |
| 1 | PC | Machine Learning | 3 | 0 | 0 | 3 |
| 2 | PC | Big Data Analytics | 3 | 0 | 0 | 3 |
| 3 | PC | Cryptography and Network Security | 3 | 0 | 0 | 3 |
| 4 | PE | Professional Elective-II 1.Mobile Computing 2.MEAN Stack Development 3. Design Patterns 4.Scripting Languages | 3 | 0 | 0 | 3 |
| 5 | Open Elective/ Job Oriented | Open Elective-II Open Electives offered by other departments | 3 | 0 | 0 | 3 |
| 6 | PC | Big Data Analytics lab | 0 | 0 | 3 | 1.5 |
| 7 | PC | Machine Learning using Python Lab | 0 | 0 | 3 | 1.5 |
| 8 | PC | Cryptography and Network Security Lab | 0 | 0 | 3 | 1.5 |
| 9 | SO | Skill Oriented Course - IV 1.Data Science: Natural Language Processing OR 2.Video Analytics | 0 | 0 | 4 | 2 |
| 10 | MC3201 | Employability skills-II | 2 | 0 | 0 | 0 |
| Total credits | | | | | | 21.5 |
| Industrial/Research Internship(Mandatory) 2 Months during summer vacation | | | | | | |
| 11 | Minor | Data Structures and Algorithms ^s | 3 | 0 | 2 | 3+1 |
| 12 | Honors | Any course from the Pool, as per the opted track | 4 | 0 | 0 | 4 |
| Minor course through SWAYAM | | | - | - | - | 2 |

\$- Integrated Course



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| IV B. Tech –I Semester | | | | | | |
|------------------------------------|-----------------------------|---|----------------|---|---|-----------|
| S.No | Course Code | Course Title | Hours per week | | | Credits |
| | | | L | T | P | |
| 1 | PE | Professional Elective-III 1.Cloud Computing 2. Artificial Neural Networks 3. Internet of Things (IoT) 4.Cyber Security & Forensics | 3 | 0 | 0 | 3 |
| 2 | PE | Professional Elective-IV 1. Deep Learning Techniques 2. Social Networks Analysis 3. Advanced Databases 4.MOOCs-NPTEL/SWAYAM | 3 | 0 | 0 | 3 |
| 3 | PE | Professional Elective-V 1.Block-Chain Technologies 2.M-Commerce 3.Ethical Hacking 4.MOOCs-NPTEL/SWAYAM | 3 | 0 | 0 | 3 |
| 4 | Open Elective /Job Oriented | Open Elective-III Open Electives offered by other departments | 2 | 0 | 2 | 3 |
| 5 | Open Elective /Job Oriented | Open Elective-IV Open Electives offered by other departments | 2 | 0 | 2 | 3 |
| 6 | HS | Universal Human Values 2: Understanding Harmony | 3 | 0 | 0 | 3 |
| 7 | SO | PYTHON: Deep Learning OR Secure Coding Techniques OR APSSDC offered Courses | 0 | 0 | 4 | 2 |
| 8 | PR | Industrial/Research Internship 2 months (Mandatory) after third year (to be evaluated during VII semester) | 0 | 0 | 0 | 3 |
| Total credits | | | | | | 23 |
| 11 | Minor | Software Engineering ^{\$} / any other from PART-B (For Minor) | 3 | 0 | 2 | 3+1 |
| 12 | Honors | Any course from the Pool, as per the opted track | 4 | 0 | 0 | 4 |
| Minor course through SWAYAM | | | - | - | - | 2 |

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| IV B. Tech –II Semester | | | | | | |
|--------------------------------|--------------------|--|-----------------------|----------|----------|----------------|
| S.No | Course Code | Course Title | Hours per week | | | Credits |
| | | | L | T | P | C |
| 1 | Project | Major Project Work, Seminar Internship | - | - | - | 12 |
| Total credits | | | | | | 12 |

Note:

1. **For integrated courses:** Theory and laboratory exams will be conducted separately, and the student concern will get credits if successfully completes both theory and laboratory. Only external exam will be conducted for Laboratory component. Credit based weightage shall be considered while awarding the grade.
2. **For MOOC courses:** Based on the students interest, student can register and complete a 12 week course one year in advance, by prior information to the concern.



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SUGGESTED COURSES FOR HONORS PROGRAM

| | |
|--|---|
| <p>POOL1- AI & ML</p> <ol style="list-style-type: none"> 1. Mathematics for Machine Learning 2. Text Mining and Time Series Analysis 3. Natural Language Processing 4. Reinforcement Learning | <p>POOL2- Systems Engineering</p> <ol style="list-style-type: none"> 1. Internet of Things 2. Data Communications and Information Coding Theory 3. Service Oriented Architectures 4. Design of Secure Protocols 5. Network Coding |
| <p>POOL3- Information Security</p> <ol style="list-style-type: none"> 1. Principles of Cyber Security 2. Computational Number Theory 3. Cryptanalysis 4. Elliptic Curve Cryptography 5. Introduction to Quantum Computing and Quantum Cryptography 6. Public Key Infrastructure and Trust Management 7. Information Security Analysis and Audit 8. Cloud and IoT Security 9. Web Security 10. Block Chain Architecture Design and Use Cases | <p>POOL4 – Data Science</p> <ol style="list-style-type: none"> 1. Data Visualization 2. Statistical Foundations for Data Science 3. Mining Massive Data Sets 4. Medical Image Data Processing |



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SUGGESTED COURSES FOR MINOR ENGINEERING IN IT

Note:

1. Any **THREE** courses (*Any FOUR courses in case of MOOCS*) need to be studied from PART-A.
2. Any **ONE** course (*If it is in Regular Mode*) need to be studied from PART-B.
3. **TWO**, NPTEL courses of **EIGHT** week duration covering a total of 4 credits (offered by the department of CSE/IT only), Student can register at any time after the completion of II B.Tech. I Sem.
4. Students can pursue suggested MOOC Courses via NPTEL from II B.Tech II Sem and onwards, by prior information to the concern.
5. If sufficient numbers of students are not opted, as per the guidelines, dept can suggest students to pursue under MOOCS. In this case, department/students can select course such that there will not be any duplication.

Eligibility for Minor in IT:

| PART A | | | | | | |
|---|--------------------------------|--------------|----------------|--|---|---|
| Regular Mode | | | | MOOCS* | | |
| S.No | Subject | L-T-P | Credits | Course available in NPTEL | NPTEL Link | Credits |
| 1 | Operating Systems | 3-0-2 | 4 | Operating Systems | https://onlinecourses.swayam2.ac.in/cec21_cs20/preview | As recommended by the NPTEL (Dept need to verify the credits and suggest) |
| 2 | Data Structures and Algorithms | 3-0-2 | 4 | Data Structure and algorithms using Java | https://nptel.ac.in/courses/106105225 | |
| 3 | Software Engineering | 3-0-2 | 4 | Software Engineering | https://onlinecourses.swayam2.ac.in/cec21_cs21/preview | |
| 4 | Computer Networks | 3-0-2 | 4 | Computer Networks | https://onlinecourses.swayam2.ac.in/cec22_cs05/preview | |
| 5 | Database Management Systems | 3-0-2 | 4 | Data Base Management System | https://onlinecourses.nptel.ac.in/noc22_cs51/preview | |
| * If sufficient number of students are not available to offer, can pursue under MOOCS | | | | | | |



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| PART B | | | | | | |
|---------------|---|-------|---------|---|---|---|
| S.No | Subject | L-T-P | Credits | Course available in NPTEL | NPTEL Link | Credits |
| 1 | Object Oriented Programming through C++ | 3-0-2 | 4 | Programming in C++ (Two Credits) | https://onlinecourses.nptel.ac.in/noc21_cs02/preview | As recommended by the NPTEL (Dept need to verify the credits and suggest) |
| 2 | Data Analytics using Python | 3-0-2 | 4 | Data Analytics with Python | https://nptel.ac.in/courses/106107220 | |
| 3 | Artificial Intelligence | 4-0-0 | 4 | Artificial Intelligence: Knowledge Representation And Reasoning | https://nptel.ac.in/courses/106106140 | |
| OR | | | | An Introduction to Artificial Intelligence | https://onlinecourses.nptel.ac.in/noc22_cs56/preview | |
| 4 | Unix and Shell Programming | 3-0-2 | 4 | | | |
| 5 | Cloud Computing | 4-0-0 | 4 | Cloud computing | https://onlinecourses.nptel.ac.in/noc22_cs20/preview | |
| OR | | | | Cloud Computing and Distributed Systems (TWO Credits) | https://onlinecourses.nptel.ac.in/noc21_cs15/preview | |

* If sufficient number of students are not available to offer, can pursue under MOOCS



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|------------------------------|--|---|---|---|---|
| I Year - I Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| COMMUNICATIVE ENGLISH | | | | | |

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from learning about the language to using the language. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

Course Objectives:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes:

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 1:

Lesson-1: A Drawer full of happiness from “**Infotech English**”, Maruthi Publications

Lesson-2: Deliverance by Premchand from “**The Individual Society**”, Pearson Publications. (Non-detailed)

Listening: Listening to short audio texts and identifying the topic. Listening to prose, prose and conversation.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self introductions and introducing others.

Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information.



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Reading for Writing: Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

Vocabulary: Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.

Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences.

Pronunciation: Vowels, Consonants, Plural markers and their realizations

Unit 2:

Lesson-1: Nehru's letter to his daughter Indira on her birthday from "Infotech English", Maruthi Publications

Lesson-2: Bosom Friend by Hira Bansode from "The Individual Society", Pearson Publications.(Non-detailed)

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications)

Grammar: Use of articles and zero article; prepositions.

Pronunciation: Past tense markers, word stress-di-syllabic words

Unit 3:

Lesson-1: Stephen Hawking-Positivity 'Benchmark' from "Infotech English", Maruthi Publications

Lesson-2: Shakespeare's Sister by Virginia Woolf from "The Individual Society", Pearson Publications.(Non-detailed)

Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV's.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

Grammar: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Pronunciation: word stress-poly-syllabic words.



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Unit 4:

Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography from “Infotech English”, Maruthi Publications

Lesson-2: Telephone Conversation-Wole Soyinka from “The Individual Society”, Pearson Publications.(Non-detailed)

Listening: Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

Reading for Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. Writing SOP, writing for media.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.

Grammar: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Pronunciation: Contrastive Stress

Unit 5:

Lesson-1: Stay Hungry-Stay foolish from “Infotech English”, Maruthi Publications

Lesson-2: Still I Rise by Maya Angelou from “The Individual Society”, Pearson Publications.(Non-detailed)

Listening: Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving.

Reading: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

Reading for Writing: Writing academic proposals- writing research articles: format and style.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Pronunciation: Stress in compound words

Text Books:

1. “Infotech English”, Maruthi Publications. (Detailed)
2. “The Individual Society”, Pearson Publications.(Non-detailed)

Prescribed text book for Laboratory for Semesters-I & II:

1. “Infotech English”, Maruthi Publications. (with Compact Disc)

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.



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|---|--|---|---|---|---|
| I Year - I Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| MATHEMATICS-I (Calculus And Differential Equations) | | | | | |

Course Objectives:

- To familiarize a variety of well-known sequences and series, with a developing intuition about the behaviour of new ones.
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- utilize mean value theorems to real life problems (L3)
- solve the differential equations related to various engineering fields (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- apply double integration techniques in evaluating areas bounded by region (L3)
- learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3-dimensional coordinate systems(L5)

UNIT – I: Sequences, Series and Mean value theorems: (10hrs)

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test – Cauchy's root test – Alternate series– Leibnitz's rule.

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders, Problems and applications on the above theorem.

UNIT – II: Differential equations of first order and first degree: (10hrs)

Linear differential equations– Bernoulli's equations –Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling– Law of natural growth and decay– Orthogonal trajectories– Electrical circuits.

UNIT – III: Linear differential equations of higher order: (10hrs)

Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in x^n , $e^{ax}V(x)$ and $x^nV(x)$ – Method of Variation of parameters, Cauchy and Legendre's linear equations.

Applications: LCR circuit, Simple Harmonic motion.

UNIT – IV: Partial differentiation: (10hrs) Introduction –

Homogeneous function – Euler's theorem– Total derivative– Chain rule– Jacobian – Functional dependence –Taylor's and MacLaurin's series expansion of functions of two variables.

Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method.



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UNIT – V: Multiple integrals:

(8 hrs)

Double and Triple integrals – Change of order of integration in double integrals – Change of variables to polar, cylindrical and spherical coordinates.

Applications: Finding Areas and Volumes.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. Joel Hass, Christopher Heil and Maurice D. Weir, Thomas calculus, 14th Edition, Pearson.
3. Lawrence Turyrn, Advanced Engineering Mathematics, CRC Press, 2013.
4. Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.



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| | | | | | |
|------------------------|--|---|---|---|---|
| I Year - I Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| APPLIED PHYSICS | | | | | |

Course Objectives:

1. Bridging the gap between the physics in school at 10+2 level and UG level engineering courses.
2. To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications
3. Understand the mechanism of emission of light, utilization of lasers as coherent light sources for low and high energy applications, study of propagation of light through optical fibers and their implications in optical communications.
4. Enlightenment of the concepts of Quantum Mechanics and to provide fundamentals of deBroglie matter waves, quantum mechanical wave equation and its application, the importance of free electron theory for metals and band theory for crystalline solids. Metals-Semiconductors-Insulators concepts utilization of transport phenomenon of charge carriers in semiconductors.
5. To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
6. To Understand the physics of Semiconductors and their working mechanism. To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications.

Course Outcomes:

1. Explain the need of coherent sources and the conditions for sustained interference (L2). Identify the applications of interference in engineering (L3). Analyze the differences between interference and diffraction with applications (L4). Illustrate the concept of polarization of light and its applications (L2). Classify ordinary refracted light and extraordinary refracted rays by their states of polarization (L2)
2. Explain various types of emission of radiation (L2). Identify the role of laser in engineering applications (L3). Describe the construction and working principles of various types of lasers (L1). Explain the working principle of optical fibers (L2). Classify optical fibers based on refractive index profile and mode of propagation (L2). Identify the applications of optical fibers in medical, communication and other fields (L2). Apply the fiber optic concepts in various fields (L3).
3. Describe the dual nature of matter (L1). Explain the significance of wave function (L2). Identify the role of Schrodinger's time independent wave equation in studying particle in one-dimensional infinite potential well (L3). Identify the role of classical and quantum free electron theory in the study of electrical conductivity (L3). Classify the energy bands of solids (L2).
4. Explain the concept of dielectric constant and polarization in dielectric materials (L2). Summarize various types of polarization of dielectrics (L2). Interpret Lorentz field and Clausius-Mosotti relation in dielectrics (L2). Classify the magnetic materials based on susceptibility and their temperature dependence (L2). Explain the applications of dielectric and magnetic materials (L2). Apply the concept of magnetism to magnetic devices (L3)
5. Outline the properties of charge carriers in semiconductors (L2). Identify the type of semiconductor using Hall effect (L2). Identify applications of semiconductors in electronic devices (L2). Classify superconductors based on Meissner's effect (L2). Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2).



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Unit-I: Wave Optics

12hrs

Interference: Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton’s Rings- Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction due to single slit, double slit - N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating(Qualitative).

Polarization: Introduction-Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol’s Prism -Half wave and Quarter wave plates.

Unit Outcomes:

The students will be able to

- Explain the need of coherent sources and the conditions for sustained interference (L2)
- Identify engineering applications of interference (L3)
- Analyze the differences between interference and diffraction with applications (L4)
- Illustrate the concept of polarization of light and its applications (L2)
- Classify ordinary polarized light and extraordinary polarized light (L2)

Unit-II: Lasers and Fiber optics

8hrs

Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein’s coefficients – Population inversion – Lasing action - Pumping mechanisms – Ruby laser – He-Ne laser - Applications of lasers.

Fiber optics: Introduction –Principle of optical fiber- Acceptance Angle - Numerical Aperture - Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers - Applications.

Unit Outcomes:

The students will be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

Unit III: Quantum Mechanics, Free Electron Theory and Band theory

10hrs

Quantum Mechanics: Dual nature of matter – Heisenberg’s Uncertainty Principle – Significance and properties of wave function – Schrodinger’s time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory– Equation for electrical conductivity based on quantum free electron theory- Fermi-Dirac distribution- Density of states (3D) - Fermi energy.

Band theory of Solids: Bloch’s Theorem (Qualitative) - Kronig - Penney model (Qualitative)- E vs K diagram - v vs K diagram - effective mass of electron – Classification of crystalline solids– concept of hole.



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Unit Outcomes:

The students will be able to

- Explain the concept of dual nature of matter (L2)
- Understand the significance of wave function (L2)
- Interpret the concepts of classical and quantum free electron theories (L2)
- Explain the importance of K-P model
- Classify the materials based on band theory (L2)
- Apply the concept of effective mass of electron (L3)

Unit-IV: Dielectric and Magnetic Materials

8hrs

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field- Clausius-Mossotti equation- Piezoelectricity.

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Origin of permanent magnetic moment - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials- Eddy currents- Engineering applications.

Unit Outcomes: The students will be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Claussius- Mosotti relation in dielectrics(L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)
- Apply the concept of magnetism to magnetic data storage devices (L3)

Unit – V: Semiconductors and Superconductors

10hrs

Semiconductors: Introduction- Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – extrinsic semiconductors – density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation- Hall effect – Hall coefficient –Applications of Hall effect.

Superconductors: Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory (Qualitative) – Josephson effects (AC and DC) – SQUIDs – High T_c superconductors – Applications of superconductors.

Unit Outcomes:

The students will be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)
- Classify superconductors based on Meissner's effect (L2)
- Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2)



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Text Books:

1. M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy” A Text book of Engineering Physics”- S.Chand Publications, 11th Edition 2019.
2. Engineering Physics” by D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).
3. Applied Physics by P.K.Palanisamy SciTech publications.

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley & Sons
2. Engineering Physics by M.R.Srinivasan, New Age international publishers (2009).
3. Shatendra Sharma, Jyotsna Sharma, “Engineering Physics”, Pearson Education, 2018
4. Engineering Physics - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
5. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill
6. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning



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| I Year - I Semester | L | T | P | C |
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| PROGRAMMING FOR PROBLEM SOLVING USING C | | | | |

Course Objectives:

The objectives of Programming for Problem Solving Using C are

- To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
- To gain knowledge of the operators, selection, control statements and repetition in C
- To learn about the design concepts of arrays, strings, enumerated structure and union types and their usage.
- To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
- To assimilate about File I/O and significance of functions

Course Outcomes:

Upon the completion of the course the student will learn

- To write algorithms and to draw flowcharts for solving problems
- To convert flowcharts/algorithms to C Programs, compile and debug programs
- To use different operators, data types and write programs that use two-way/ multi-way selection
- To select the best loop construct for a given problem
- To design and implement programs to analyze the different pointer applications
- To decompose a problem into functions and to develop modular reusable code
- To apply File I/O operations

UNIT I

Introduction to Computers: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers

Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.

Structure of a C Program: Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

UNIT II

Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.

Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions.

Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples.

UNIT III

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages

Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code

Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application.



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UNIT IV

Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value

Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application.

Processor Commands: Processor Commands.

UNIT V

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions

Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

Text Books:

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F. Gilberg, CENGAGE.
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, 2e, Pearson.

Reference Books:

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD.



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| COMPUTER ENGINEERING WORKSHOP | | | | | |

Course Objectives:

Skills and knowledge provided by this subject are the following:

- **PC Hardware:** Identification of basic peripherals, Assembling a PC, Installation of system software like MS Windows, device drivers, etc. Troubleshooting of PC Hardware and Software issues.
- **Internet & World Wide Web:** Different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet, web browsers, email, newsgroups and discussion forums. Awareness of cyber hygiene (protecting the personal computer from getting infected with the viruses), worms and other cyber attacks.
- **Productivity Tools:** Understanding and practical approach of professional word documents, excel spread sheets, power point presentations and personal web sites using the Microsoft suite office tools.

Course Outcomes:

By the end of the course student will be able to

- Identify, assemble and update the components of a computer
- Configure, evaluate and select hardware platforms for the implementation and execution of computer applications, services and systems
- Make use of tools for converting pdf to word and vice versa
- Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spreadsheets, HTML, LaTeX

List of Exercises:

Note: Faculty to consolidate the workshop manuals using the textbook and references

Task 1: Identification of the peripherals of a computer - Prepare a report containing the block diagram of the computer along with the configuration of each component and its functionality. Describe about various I/O Devices and its usage.

Task 2: Practicing disassembling and assembling components of a PC

Task 3: Installation of Device Drivers, MS Windows, Linux Operating systems and Disk Partitioning, dual boating with Windows and Linux

Task 4: Introduction to Memory and Storage Devices, I/O Port, Assemblers, Compilers, Interpreters, Linkers and Loaders.

Task 5: Demonstration of Hardware and Software Troubleshooting

Task 6: Demonstrating Importance of Networking, Transmission Media, Networking Devices- Gateway, Routers, Hub, Bridge, NIC, Bluetooth Technology, Wireless Technology, Modem, DSL, and Dialup Connection.



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Task 7: Surfing the Web using Web Browsers, Awareness of various threats on the Internet and its solutions, Search engines and usage of various search engines, Need of anti-virus, Installation of anti-virus, configuring personal firewall and windows update.

(Students should get connected to their Local Area Network and access the Internet. In the process they should configure the TCP/IP setting and demonstrate how to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers)

Productivity Tools:

Task 8: Basic HTML tags, Introduction to HTML5 and its tags, Introduction to CSS3 and its properties. Preparation of a simple website/ homepage,

Assignment: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list.

Features to be covered:- Layouts, Inserting text objects, Editing text objects, Inserting Tables, Working with menu objects, Inserting pages, Hyper linking, Renaming, deleting, modifying pages, etc.,

Task 9: Demonstration and Practice of various features of Microsoft Word

Assignment: 1. Create a project certificate.

2. Creating a news letter

Features to be covered:-Formatting Fonts, Paragraphs, Text effects, Spacing, Borders and Colors, Header and Footer, Date and Time option, tables, Images, Bullets and Numbering, Table of Content, Newspaper columns, Drawing toolbar and Word Art and Mail Merge in word etc.,

Task 10: Demonstration and Practice of various features Microsoft Excel

Assignment: 1. Creating a scheduler

2. Calculating GPA

3. Calculating Total, average of marks in various subjects and ranks of students based on marks

Features to be covered:- Format Cells, Summation, auto fill, Formatting Text, Cell Referencing, Formulae in excel, Charts, Renaming and Inserting worksheets, etc.,

Task 11: Demonstration and Practice of various features Microsoft Power Point

Features to be covered:- Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks Tables and Charts, Master Layouts, Types of views, Inserting – Background, textures, Design Templates, etc.,

Task 12: Demonstration and Practice of various features LaTeX – document preparation, presentation (Features covered in Task 9 and Task 11 need to be explored in LaTeX)

Task 13: Tools for converting word to pdf and pdf to word

Task 14: Internet of Things (IoT): IoT fundamentals, applications, protocols, communication models, architecture, IoT devices

Reference Books:

1. Computer Fundamentals, Anita Goel, Pearson India Education, 2017
2. PC Hardware Trouble Shooting Made Easy, TMH
3. Introduction to Information Technology, ITL Education Solutions Limited, 2nd Edition, Perason, 2020
4. Upgrading and Repairing PCs, 18th Edition, Scott Mueller, QUE, Pearson, 2008
5. LaTeX Companion – Leslie Lamport, PHI/Pearson



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6. Introducing HTML5, Bruce Lawson, Remy Sharp, 2nd Edition, Pearson, 2012
7. Teach yourself HTML in 24 hours, By Techmedia
8. HTML 5 and CSS 3.0 to the Real World by Alexis Goldstein, Sitepoint publication.
9. Internet of Things, Technologies, Applications, Challenges and Solutions, B K Tripathy, J Anuradha, CRC Press
10. Comdex Information Technology Course Tool Kit, Vikas Gupta, Wiley Dreamtech.
11. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme, CISCO Press, Pearson Education.
12. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N. B. Venkateswarlu, S. Chand Publishers



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| I Year - I Semester | | L | T | P | C |
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| ENGLISH COMMUNICATION SKILLS LABORATORY | | | | | |

UNIT I:

Vowels, Consonants, Pronunciation, Phonetic Transcription, Common Errors in Pronunciation,

UNIT II:

Word stress-di-syllabic words, poly-syllabic words, weak and strong forms, contrastive stress
 (Homographs)

UNIT III: Stress in compound words, rhythm, intonation, accent neutralization.

UNIT IV: Listening to short audio texts and identifying the context and specific pieces of information to answer a series of questions in speaking.

UNIT V: Newspapers reading; Understanding and identifying key terms and structures useful for writing reports.

Text Book:

1. “Infotech English”, Maruthi Publications.

Reference Books:

1. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
2. English Pronunciation in use- Mark Hancock, Cambridge University Press.
3. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
4. English Pronunciation in use- Mark Hewings, Cambridge University Press.
5. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
6. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.



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| I Year - I Semester | | L | T | P | C |
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| APPLIED PHYSICS LAB | | | | | |

(Any 10 of the following listed experiments)

List of Applied Physics Experiments

1. Determination of thickness of thin object by wedge method.
2. Determination of radius of curvature of a given plano convex lens by Newton's rings.
3. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
4. Determination of dispersive power of the prism.
5. Determination of dielectric constant using charging and discharging method.
6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
7. Determination of numerical aperture and acceptance angle of an optical fiber.
8. Determination of wavelength of Laser light using diffraction grating.
9. Estimation of Planck's constant using photoelectric effect.
10. Determination of the resistivity of semiconductor by four probe method.
11. To determine the energy gap of a semiconductor using p-n junction diode.
12. Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method
13. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect .
14. Measurement of resistance of a semiconductor with varying temperature.
15. Resistivity of a Superconductor using four probe method & Meissner effect.

References:

1. S. Balasubramanian, M.N. Srinivasan "A Text Book of Practical Physics"- S Chand Publishers, 2017.



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| I Year - I Semester | | L | T | P | C |
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| PROGRAMMING FOR PROBLEM SOLVING USING C LAB | | | | | |

Course Objectives:

- Apply the principles of C language in problem solving.
- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers & functions.
- To review the file operations, preprocessor commands.

Course Outcomes:

By the end of the Lab, the student

- Gains Knowledge on various concepts of a C language.
- Able to draw flowcharts and write algorithms.
- Able design and development of C problem solving skills.
- Able to design and develop modular programming skills.
- Able to trace and debug a program

Exercise 1:

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

Exercise 2:

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum.
 $1 + 1/2 + 1/3 + 1/4 + 1/5 \dots 1/n$ terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.



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Exercise 6:

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7:

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

Exercise 9:

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11:

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12:

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13:

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc() function.

Exercise 14:

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc() function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15:

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

Exercise 16:

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk.



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| I Year - II Semester | | L | T | P | C |
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| MATHEMATICS-II (Linear Algebra And Numerical Methods) | | | | | |

Course Objectives:

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)
- evaluate the approximate roots of polynomial and transcendental equations by different algorithms (L5)
- apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
- apply numerical integral techniques to different Engineering problems (L3)
- apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3)

UNIT – I: Solving systems of linear equations, Eigen values and Eigen vectors: (10hrs)

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss Elimination method – Eigenvalues and Eigen vectors and properties (article-2.14 in text book-1).

Unit – II: Cayley–Hamilton theorem and Quadratic forms: (10hrs)

Cayley-Hamilton theorem (without proof) – Applications – Finding the inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation. Singular values of a matrix, singular value decomposition (text book-3).

UNIT – III: Iterative methods: (8 hrs)

Introduction– Bisection method–Secant method – Method of false position– Iteration method – Newton-Raphson method (One variable and simultaneous Equations) – Jacobi and Gauss-Seidel methods for solving system of equations numerically.

UNIT – IV: Interpolation: (10 hrs)

Introduction– Errors in polynomial interpolation – Finite differences– Forward differences– Backward differences –Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula– Newton's divide difference formula.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA****KAKINADA – 533 003, Andhra Pradesh, India****DEPARTMENT OF INFORMATION TECHNOLOGY****UNIT – V: Numerical differentiation and integration, Solution of ordinary differential equations with initial conditions: (10 hrs)**

Numerical differentiation using interpolating polynomial – Trapezoidal rule– Simpson's $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method –Runge-Kutta method (second and fourth order).

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
3. David Poole, Linear Algebra- A modern introduction, 4th Edition, Cengage.

Reference Books:

1. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
2. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
3. Lawrence Turyn, Advanced Engineering Mathematics, CRC Press.



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| I Year - II Semester | | L | T | P | C |
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| APPLIED CHEMISTRY | | | | | |

Course Objectives

- Importance of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- Outline the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
- Explain the preparation of semiconductors and nanomaterials, engineering applications of nanomaterials, superconductors and liquid crystals.
- Recall the increase in demand for power and hence alternative sources of power are studied due to depleting sources of fossil fuels. Advanced instrumental techniques are introduced.
- Outline the basics of computational chemistry and molecular switches

UNIT I: POLYMER TECHNOLOGY

8 hrs

Polymerisation:- Introduction, methods of polymerization (emulsion and suspension), mechanical properties.

Plastics: Compounding, fabrication (compression, injection, blown film and extrusion), preparation, properties and applications (PVC, polycarbonates and Bakelite), mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste (waste to wealth).

Elastomers:- Introduction, preparation, properties and applications (Buna S, thiokol and polyurethanes).

Composite materials: Fiber reinforced plastics, conducting polymers, biodegradable polymers, biopolymers, biomedical polymers.

Course Outcomes: At the end of this unit, the students will be able to

- Analyze the different types of composite plastic materials and interpret the mechanism of conduction in conducting polymers.

UNIT II: ELECTROCHEMICAL CELLS AND CORROSION

10 hrs

Single electrode potential, electrochemical series and uses of series, standard hydrogen electrode, calomel electrode, construction of glass electrode, batteries (Dry cell, Li ion battery and zinc air cells), fuel cells (H₂-O₂, CH₃OH-O₂, phosphoric acid and molten carbonate).

Corrosion:- Definition, theories of corrosion (chemical and electrochemical), galvanic corrosion, differential aeration corrosion, stress corrosion, galvanic series, factors influencing rate of corrosion, corrosion control (proper designing and cathodic protection), Protective coatings (surface preparation, cathodic coatings, anodic coatings, electroplating and electroless plating [nickel]), Paints (constituents, functions and special paints).

Course Outcomes: At the end of this unit, the students will be able to

- Utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion.

UNIT III: MATERIAL CHEMISTRY

10 hrs

Part I : Non-elemental semiconducting materials:- Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion, ion implantation) - Semiconductor devices (p-n junction diode as rectifier, junction transistor).

Insulators & magnetic materials: electrical insulators-ferro and ferri magnetism-Hall effect and its applications.



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Part II: Nano materials:- Introduction, sol-gel method, characterization by (Brunauer Emmet Teller [BET]), (scanning electron microscopy [SEM]) and (transmission electron microscopy [TEM]), applications of graphene and fullerenes, carbon nanotubes (types, preparation and applications)

Liquid crystals:- Introduction-types-applications.

Super conductors:-Type –I, Type II-characteristics and applications

Course Outcomes: At the end of this unit, the students will be able to

- Synthesize nanomaterials for modern advances of engineering technology.
- Summarize the preparation of semiconductors; analyze the applications of liquid crystals and superconductors.

UNIT IV: SPECTROSCOPIC TECHNIQUES & NON-CONVENTIONAL ENERGY SOURCES

10 hrs

Part A: SPECTROSCOPIC TECHNIQUES

Electromagnetic spectrum-UV (laws of absorption, instrumentation, theory of electronic spectroscopy, Frank-condon principle, chromophores and auxochromes, intensity shifts, applications), FT-IR [instrumentation and differentiation of sp, sp², sp³ and IR stretching of functional groups (alcohols, carbonyls, amines) applications], magnetic resonance imaging and CT scan (procedure & applications).

Part B: NON-CONVENTIONAL ENERGY SOURCES

Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, hydropower, geothermal power, tidal and wave power, ocean thermal energy conversion.

Course Outcomes: At the end of this unit, the students will be able to

- Analyze the principles of different analytical instruments and their applications.
- Design models for energy by different natural sources.

UNIT V: ADVANCED CONCEPTS/TOPICS IN CHEMISTRY

8 hrs

Computational chemistry: Introduction to computational chemistry, molecular modelling and docking studies

Molecular switches: characteristics of molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor

Course Outcomes: At the end of this unit, the students will be able to

- Obtain the knowledge of computational chemistry and molecular machines

Text Books:

1. P.C. Jain and M. Jain “Engineering Chemistry”, 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, “Engineering Chemistry”, Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, “A Textbook of Engineering Chemistry”, S.Chand & Co, (2010).
4. Shashi Chawla, “Engineering Chemistry”, Dhanpat Rai Publishing Co. (Latest edition).

Reference Books:

1. K. Sessa Maheshwaramma and Mridula Chugh, “Engineering Chemistry”, Pearson India Edn.
2. O.G. Palana, “Engineering Chemistry”, Tata McGraw Hill Education Private Limited, (2009).
3. CNR Rao and JM Honig (Eds) “Preparation and characterization of materials” Academic press, New York (latest edition)
4. B. S. Murthy, P. Shankar and others, “Textbook of Nanoscience and Nanotechnology”, University press (latest edition)



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| I Year - II Semester | | L | T | P | C |
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| COMPUTER ORGANIZATION | | | | | |

The purpose of the course is to introduce principles of computer organization and the basic architectural concepts. It provides an in depth understanding of basic organization, design, programming of a simple digital computer, computer arithmetic, instruction set design, micro programmed control unit, pipelining and vector processing, memory organization and I/O systems.

Course Outcomes:

By the end of the course the student will be able to

- Demonstrate and understanding of the design of the functional units of a digital computer system.
- Relate Postulates of Boolean algebra and minimize combinational functions
- Recognize and manipulate representations of numbers stored in digital computers
- Build the logic families and realization of logic gates.
- Design and analyze combinational and sequential circuits
- Recall the internal organization of computers, CPU, memory unit and Input/Outputs and the relations between its main components
- Solve elementary problems by assembly language programming

UNITI:

Digital Computers and Data Representation: Introduction ,Numbering Systems, Decimal to Binary Conversion, Binary Coded Decimal Numbers, Weighted Codes, Self-Complementing Codes, Cyclic Codes, Error Detecting Codes, Error Correcting Codes, Hamming Code for Error Correction, Alphanumeric Codes, ASCII Code

Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.

Boolean Algebra and Logical gates:

Boolean Algebra :Theorems and properties, Boolean functions, canonical and standard forms , minimization of Boolean functions using algebraic identities; Karnaugh map representation and minimization using two and three variable Maps ;Logical gates ,universal gates and Two-level realizations using gates : AND-OR, OR-AND, NAND-NAND and NOR-NOR structures

UNITII:

Digital logic circuits: Combinatorial Circuits: Introduction, Combinatorial Circuit Design Procedure, Implementation using universal gates, Multi-bit adder, Multiplexers, Demultiplexers, Decoders

Sequential Switching Circuits: Latches and Flip-Flops, Ripple counters using T flip-flops; Synchronous counters: Shift Registers; Ring counters



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UNITIII:

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Booth multiplication algorithm, Division Algorithms, Floating – point Arithmetic operations.

Register Transfer language and microinstructions :Bus memory transfer, arithmetic and logical micro-operations, shift and rotate micro-operations

Basic Computer Organization and Design: Stored program concept, computer Registers, common bus system, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input–Output configuration and program Interrupt.

UNITIV:

Microprogrammed Control: Control memory, Addresssequencing, microprogram example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control: conditional Flags and Branching

UNITV:

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

TextBooks:

1. Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson Education.
2. Computer System Architecture, 3rd ed., M. Morris Mano, PHI

Reference Books:

1. Digital Logic and Computer Organization, Rajaraman, Radhakrishnan, PHI, 2006
2. Computer Organization, 5th ed., Hamacher, Vranesic and Zaky, TMH, 2002
3. Computer Organization & Architecture : Designing for Performance, 7th ed., William Stallings, PHI, 2006



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| I Year – II Semester | | L | T | P | C |
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| PYTHON PROGRAMMING | | | | | |

Course Objectives:

The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & functions
- To be familiarized with general coding techniques and object-oriented programming

Course Outcomes:

- Develop essential programming skills in computer programming concepts like data types, containers
- Apply the basics of programming in the Python language
- Solve coding tasks related conditional execution, loops
- Solve coding tasks related to the fundamental notions and techniques used in object-oriented programming

UNIT I

Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

UNIT II

Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop

Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.

UNIT III

List and Dictionaries: Lists, Defining Simple Functions, Dictionaries

Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program's Namespace, Higher Order Function.

Modules: Modules, Standard Modules, Packages.



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UNIT IV

File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using OOPS support

Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism

UNIT V

Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.

Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources.

Programming: Introduction to Programming Concepts with Scratch.

Text Books

- 1) Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
- 2) Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference Books:

- 1) Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
- 2) Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

e-Resources:

https://www.tutorialspoint.com/python3/python_tutorial.pdf



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| I Year – II Semester | | L | T | P | C |
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| DATA STRUCTURES | | | | | |

Course Objectives:

The objective of the course is to

- Introduce the fundamental concept of data structures and abstract data types
- Emphasize the importance of data structures in developing and implementing efficient algorithms
- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms

Course Outcomes:

After completing this course a student will be able to:

- Summarize the properties, interfaces, and behaviors of basic abstract data types
- Discuss the computational efficiency of the principal algorithms for sorting & searching
- Use arrays, records, linked structures, stacks, queues, trees, and Graphs in writing programs
- Demonstrate different methods for traversing trees

UNIT I

Data Structures - Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity.

Searching - Linear search, Binary search, Fibonacci search.

Sorting- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.

UNIT II

Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal ,Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation ,Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion.

UNIT III

Queues: Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues-Circular Queues, Deques, Priority Queues, Multiple Queues.

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.



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UNIT IV

Trees: Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals, Applications-Expression Trees, Heap Sort, Balanced Binary Trees- AVL Trees, Insertion, Deletion and Rotations.

UNIT V

Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prim's & Kruskal's Algorithm, Dijkstra's shortest path, Transitive closure, Warshall's Algorithm.

Text Books:

- 1) Data Structures Using C. 2nd Edition. Reema Thareja, Oxford.
- 2) Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.

Reference Books:

- 1) Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
- 2) Data Structures: A PseudoCode Approach, 2/e, Richard F. Gilberg, Behrouz A. Forouzan, Cengage.
- 3) Data Structures with C, Seymour Lipschutz TMH

e-Resources:

- 1) <http://algs4.cs.princeton.edu/home/>
- 2) https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf



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| I Year - II Semester | | L | T | P | C |
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| APPLIED CHEMISTRY LAB | | | | | |

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of Mn^{+2} using standard oxalic acid solution.
4. Determination of ferrous iron using standard $\text{K}_2\text{Cr}_2\text{O}_7$ solution.
5. Determination of Cu^{+2} using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of Fe^{+3} by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
9. Determination of iso-electric point of amino acids using pH-metry method/conductometric method.
10. Determination of the concentration of strong acid vs strong base (by conductometric method).
11. Determination of strong acid vs strong base (by potentiometric method).
12. Determination of Mg^{+2} present in an antacid.
13. Determination of CaCO_3 present in an egg shell.
14. Estimation of Vitamin C.
15. Determination of phosphoric content in soft drinks.
16. Adsorption of acetic acid by charcoal.
17. Preparation of nylon-6, 6 and Bakelite (demonstration only).

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Outcomes: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.



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| I Year - II Semester | | L | T | P | C |
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| PYTHON PROGRAMMING LAB | | | | | |

Course Objectives:

The Objectives of Python Programming are

- *To learn about Python programming language syntax, semantics, and the runtime environment*
- *To be familiarized with universal computer programming concepts like data types, containers*
- *To be familiarized with general computer programming concepts like conditional execution, loops & functions*
- *To be familiarized with general coding techniques and object-oriented programming*

Course Outcomes:

- Develop essential programming skills in computer programming concepts like data types, containers
- Apply the basics of programming in the Python language
- Solve coding tasks related conditional execution, loops
- Solve coding tasks related to the fundamental notions and techniques used in object-oriented programming

List of Experiments:

- 1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
- 2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
- 3) Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
- 4) Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
- 5) Use a *for* loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.


```
*
**
***
****
```
- 6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
- 7) Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and *Not close* otherwise.
- 8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
- 9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not,



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the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde* and *ABCDE* the program should print out *AaBbCcDdEe*.

- 10) Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.
- 11) In algebraic expressions, the symbol for multiplication is often left out, as in $3x+4y$ or $3(x+5)$. Computers prefer those expressions to include the multiplication symbol, like $3*x+4*y$ or $3*(x+5)$. Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.
- 12) Write a program that generates a list of 20 random numbers between 1 and 100.
 - (a) Print the list.
 - (b) Print the average of the elements in the list.
 - (c) Print the largest and smallest values in the list.
 - (d) Print the second largest and second smallest entries in the list
 - (e) Print how many even numbers are in the list.
- 13) Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.
- 14) Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in $[1,0,1,1,0,0,0,0,1,0,0]$ is 4.
- 15) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list $[1,1,2,3,4,3,0,0]$ would become $[1,2,3,4,0]$.
- 16) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, it is much shorter with lists and it is also easier to add new conversions if you use lists.
- 17) Write a function called *sum_digits* that is given an integer num and returns the sum of the digits of num.
- 18) Write a function called *first_diff* that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.
- 19) Write a function called *number_of_factors* that takes an integer and returns how many factors the number has.
- 20) Write a function called *is_sorted* that is given a list and returns True if the list is sorted and False otherwise.
- 21) Write a function called *root* that is given a number x and an integer n and returns $x^{1/n}$. In the function definition, set the default value of n to 2.
- 22) Write a function called *primes* that is given a number n and returns a list of the first n primes. Let the default value of n be 100.
- 23) Write a function called *merge* that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
 - (a) Do this using the sort method.
 - (b) Do this without using the sort method.
- 24) Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.



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- 25) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
- 26) Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file called *ftemps.txt*.
- 27) Write a class called Product. The class should have fields called name, amount, and price, holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price* that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase* that receives the number of items to be bought and decreases amount by that much.
- 28) Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes* that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours* that returns a string of hours, minutes, and seconds formatted analogously to the previous method.
- 29) Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, `c = Converter(9,'inches')`. The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call `c.feet()` and should get 0.75 as the result.
- 30) Write a Python class to implement `pow(x, n)`.
- 31) Write a Python class to reverse a string word by word.
- 32) Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.
- 33) Write a program to demonstrate Try/except/else.
- 34) Write a program to demonstrate try/finally and with/as.



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| I Year – II Semester | | L | T | P | C |
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| DATA STRUCTURES LAB | | | | | |

Course Objectives:

The objective of this lab is to demonstrate the different data structures implementation.

Course Outcomes:

By the end of this lab the student is able to

- Use basic data structures such as arrays and linked list.
- Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
- Use various searching and sorting algorithms.

List of Experiments:

Exercise -1 (Searching)

- a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list.
- b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.

Exercise -2 (Sorting-I)

- a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order
- b) Write C program that implement Quick sort, to sort a given list of integers in ascending order
- c) Write C program that implement Insertion sort, to sort a given list of integers in ascending order

Exercise -3(Sorting-II)

- a) Write C program that implement radix sort, to sort a given list of integers in ascending order
- b) Write C program that implement merge sort, to sort a given list of integers in ascending order

Exercise -4(Singly Linked List)

- a) Write a C program that uses functions to create a singly linked list
- b) Write a C program that uses functions to perform insertion operation on a singly linked list
- c) Write a C program that uses functions to perform deletion operation on a singly linked list
- d) Write a C program to reverse elements of a single linked list.

Exercise -5(Queue)

- a) Write C program that implement Queue (its operations) using arrays.
- b) Write C program that implement Queue (its operations) using linked lists



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Exercise -6(Stack)

- a) Write C program that implement stack (its operations) using arrays
- b) Write C program that implement stack (its operations) using Linked list
- c) Write a C program that uses Stack operations to evaluate postfix expression

Exercise -7(Binary Tree)

- d) Write a recursive C program for traversing a binary tree in preorder, inorder and postorder.

Exercise -8(Binary Search Tree)

- a) Write a C program to Create a BST
- b) Write a C program to insert a node into a BST.
- c) Write a C program to delete a node from a BST.



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| I Year – II Semester | | L | T | P | C |
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| ENVIRONMENT SCIENCE | | | | | |

Course Objectives:

The objectives of the course are to impart:

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

UNIT I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information technology in environment and human health.

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT II

Natural Resources: Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT III

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.



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UNIT IV

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being.

Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT V

Social Issues and the Environment: Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act - Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.

The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:

- 1) Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
- 2) Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
- 3) Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

Reference Books:

- 1) Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
- 2) A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
- 3) Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
- 4) Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014



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| II Year -I Semester | | L | T | P | C |
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| MATHEMATICS - III | | | | | |

Course Objectives:

- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes:

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

- Interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- Estimate the work done against a field, circulation and flux using vector calculus (L5)
- Apply the Laplace transform for solving differential equations (L3)
- Find or compute the Fourier series of periodic signals (L3)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- Identify solution methods for partial differential equations that model physical processes (L3)

UNIT I: Vector calculus: (10 hrs)

Vector Differentiation: Gradient – Directional derivative – Divergence – Curl – Scalar Potential.

Vector Integration: Line integral – Work done – Area – Surface and volume integrals –

Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).

UNIT II: Laplace Transforms: (10 hrs)

Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT III: Fourier series and Fourier Transforms: (10hrs)

Fourier Series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties – inverse transforms – Finite Fourier transforms.

UNIT IV: PDE of first order: (8 hrs)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.



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UNIT V: Second order PDE and Applications: (10hrs)

Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS term of the type e^{ax+by} , $\sin(ax + by)$, $\cos(ax + by)$, $x^m y^n$.

Applications of PDE: Method of separation of Variables – Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

Text Books:

- 1) B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
- 2) B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

- 1) Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
- 2) Dean. G. Duffy, Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
- 3) Peter O' Neil, Advanced Engineering Mathematics, Cengage.
- 4) Srimantha Pal, S C Bhunia, Engineering Mathematics, Oxford University Press.



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| II Year – I Semester | | L | T | P | C |
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| OBJECT ORIENTED PROGRAMMING THROUGH C++ | | | | | |

Course Objectives:

- Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
- Understand dynamic memory management techniques using pointers, constructors, destructors
- Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
- Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
- Demonstrate the use of various OOPs concepts with the help of programs

Course Outcomes:

By the end of the course, the student

- Classify object oriented programming and procedural programming
- Apply C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling
- Build C++ classes using appropriate encapsulation and design principles
- Apply object oriented or non-object oriented techniques to solve bigger computing problems

UNIT I

Introduction to C++: Difference between C and C++, Evolution of C++, The Object Oriented Technology, Disadvantage of Conventional Programming, Key Concepts of Object Oriented Programming, Advantage of OOP, Object Oriented Language.

UNIT II

Classes and Objects & Constructors and Destructor: Classes in C++, Declaring Objects, Access Specifiers and their Scope, Defining Member Function, Overloading Member Function, Nested class, Constructors and Destructors, Introduction, Constructors and Destructor, Characteristics of Constructor and Destructor, Application with Constructor, Constructor with Arguments parameterized Constructor, Destructors, Anonymous Objects.

UNIT III

Operator Overloading and Type Conversion & Inheritance: The Keyword Operator, Overloading Unary Operator, Operator Return Type, Overloading Assignment Operator (=), Rules for Overloading Operators, Inheritance, Reusability, Types of Inheritance, Virtual Base Classes- Object as a Class Member, Abstract Classes, Advantages of Inheritance, Disadvantages of Inheritance.



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UNIT IV

Pointers & Binding Polymorphisms and Virtual Functions: Pointer, Features of Pointers, Pointer Declaration, Pointer to Class, Pointer Object, The this Pointer, Pointer to Derived Classes and Base Class, Binding Polymorphisms and Virtual Functions, Introduction, Binding in C++, Virtual Functions, Rules for Virtual Function, Virtual Destructor.

UNIT V

Generic Programming with Templates & Exception Handling: Definition of class Templates, Normal Function Templates, Over Loading of Template Function, Bubble Sort Using Function Templates, Difference between Templates and Macros, Linked Lists with Templates, Exception Handling, Principles of Exception Handling, The Keywords try throw and catch, Multiple Catch Statements, Specifying Exceptions.

Overview of Standard Template Library, STL Programming Model, Containers, Sequence Containers, Associative Containers, Algorithms, Iterators, Vectors, Lists, Maps.

Text Books:

- 1) A First Book of C++, Gary Bronson, Cengage Learning.
- 2) The Complete Reference C++, Herbert Schildt, TMH.

Reference Books:

- 1) Object Oriented Programming C++, Joyce Farrell, Cengage.
- 2) C++ Programming: from problem analysis to program design, DS Malik, Cengage Learning
- 3) Programming in C++, Ashok N Kamthane, Pearson 2nd Edition

e- Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105151/>
- 2) <https://github.com/topics/object-oriented-programming>



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| II Year – I Semester | | L | T | P | C |
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| OPERATING SYSTEMS | | | | | |

Course Objectives:

The objectives of this course is to

- Introduce to the internal operation of modern operating systems
- Define, explain, processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems
- Understand File Systems in Operating System like UNIX/Linux and Windows
- Understand Input Output Management and use of Device Driver and Secondary Storage (Disk) Mechanism
- Analyze Security and Protection Mechanism in Operating System

Course Outcomes:

After learning, the course the students should be able to:

- Describe various generations of Operating System and functions of Operating System
- Describe the concept of program, process and thread and analyze various CPU Scheduling Algorithms and compare their performance
- Solve Inter Process Communication problems using Mathematical Equations by various methods
- Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement Techniques
- Outline File Systems in Operating System like UNIX/Linux and Windows

UNIT I

Operating Systems Overview: Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems.
 System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.

UNIT II

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems.

Multithreaded Programming: Multithreading models, Thread libraries, Threading issues.

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling.

Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

UNIT III

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation.

Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation.



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UNIT IV

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention.

File Systems: Files, Directories, File system implementation, management and optimization.

Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

UNIT V

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.

System Security: Introduction, Program threats, System and network threats, Cryptography for security, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer security classification.

Case Studies: Linux, Microsoft Windows.

Text Books:

- 1) Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013.
- 2) Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Interprocess Communication and File systems.)

Reference Books:

- 1) Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.
- 2) Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
- 3) Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105214/>



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| II Year – I Semester | | L | T | P | C |
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| DATABASE MANAGEMENT SYSTEMS | | | | | |

Course Objectives:

- To introduce about database management systems
- To give a good formal foundation on the relational model of data and usage of Relational Algebra
- To introduce the concepts of basic SQL as a universal Database language
- To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- To provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes:

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

- Describe a relational database and object-oriented database
- Create, maintain and manipulate a relational database using SQL
- Describe ER model and normalization for database design
- Examine issues in data storage and query processing and can formulate appropriate solutions
- Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage

UNIT I

Introduction: Database system, Characteristics (Database Vs File System), Database Users(Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

UNIT II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

UNIT III

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF).



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UNIT V

Transaction Concept: Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Indexing Techniques: B+ Trees: Search, Insert, Delete algorithms, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes , Index data Structures, Hash Based Indexing: Tree base Indexing ,Comparison of File Organizations, Indexes and Performance Tuning

Text Books:

- 1) Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
- 2) Database System Concepts,5/e, Silberschatz, Korth, TMH

Reference Books:

- 1) Introduction to Database Systems, 8/e C J Date, PEA.
- 2) Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
- 3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105175/>
<https://www.geeksforgeeks.org/introduction-to-nosql/>



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| II Year – I Semester | | L | T | P | C |
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| DISCRETE MATHEMATICS AND GRAPH THEORY | | | | | |

Course Objectives:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science

Course Outcomes:

At the end of the course student will be able to

- Demonstrate skills in solving mathematical problems
- Comprehend mathematical principles and logic
- Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software
- Manipulate and analyze data numerically and/or graphically using appropriate Software

UNIT I

Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT II

Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties, Algebraic Structures: Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism.

UNIT III

Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler's Theorems

UNIT IV

Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations



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UNIT-V

Graph Theory: Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees

Text Books:

- 1) Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
- 2) Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
- 3) Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

Reference Books:

- 1) Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
- 2) Discrete Mathematical Structures, Bernard Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
- 3) Discrete Mathematics, S. K. Chakraborty and B.K. Sarkar, Oxford, 2011.
- 4) Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.



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| II Year – I Semester | | L | T | P | C |
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| OBJECT ORIENTED PROGRAMMING THROUGH C++ LAB | | | | | |

Course Objectives:

The objective of this lab is to

- Demonstrate procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
- Understand dynamic memory management techniques using pointers, constructors, destructors, etc
- Demonstrate the concept of function overloading, operator overloading, virtual functions and polymorphism, inheritance.

Course Outcomes:

By the end of this lab the student is able to

- Apply the various OOPs concepts with the help of programs.
-

Exercise -1 (Classes Objects)

Create a Distance class with:

- feet and inches as data members
 - member function to input distance
 - member function to output distance
 - member function to add two distance objects
1. Write a main function to create objects of DISTANCE class. Input two distances and output the sum.
 2. Write a C++ Program to illustrate the use of Constructors and Destructors (use the above program.)
 3. Write a program for illustrating function overloading in adding the distance between objects (use the above problem)

Exercise – 2 (Access)

Write a program for illustrating Access Specifiers public, private, protected

1. Write a program implementing Friend Function
2. Write a program to illustrate this pointer
3. Write a Program to illustrate pointer to a class

Exercise -3 (Operator Overloading)

1. Write a program to Overload Unary, and Binary Operators as Member Function, and Non Member Function.
 1. Unary operator as member function
 2. Binary operator as non member function
2. Write a c ++ program to implement the overloading assignment = operator



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Exercise -4 (Inheritance)

1. Write C++ Programs and incorporating various forms of Inheritance
 - i) Single Inheritance
 - ii) Hierarchical Inheritance
 - iii) Multiple Inheritances
 - iv) Multi-level inheritance
 - v) Hybrid inheritance
2. Also illustrate the order of execution of constructors and destructors in inheritance

Exercise -5(Templates, Exception Handling)

1. a) Write a C++ Program to illustrate template class
2. b) Write a Program to illustrate member function templates
3. c) Write a Program for Exception Handling Divide by zero
4. d) Write a Program to rethrow an Exception

Exercise -6

1. Write a C++ program illustrating user defined string processing functions using pointers (string length, string copy, string concatenation)
2. Write a C++ program illustrating Virtual classes & virtual functions.
3. Write C++ program that implement Bubble sort, to sort a given list of integers in ascending order



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| II Year – I Semester | | L | T | P | C |
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| OPERATING SYSTEM LAB | | | | | |

Course Objectives:

- To understand the design aspects of operating system
- To study the process management concepts & Techniques
- To study the storage management concepts
- To familiarize students with the Linux environment
- To learn the fundamentals of shell scripting/programming

Course Outcomes:

- To use Unix utilities and perform basic shell control of the utilities
 - To use the Unix file system and file access control
 - To use of an operating system to develop software
 - Students will be able to use Linux environment efficiently
 - Solve problems using bash for shell scripting
- 1) a) Study of Unix/Linux general purpose utility command list: man, who, cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.
 b) Study of vi editor
 c) Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system
 d) Study of Unix/Linux file system (tree structure)
 e) Study of .bashrc, /etc/bashrc and Environment variables.
 - 2) Write a C program that makes a copy of a file using standard I/O, and system calls
 - 3) Write a C program to emulate the UNIX ls -l command.
 - 4) Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls -l | sort
 - 5) Simulate the following CPU scheduling algorithms:
 (a) Round Robin (b) SJF (c) FCFS (d) Priority
 - 6) Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit (), System calls
 - 7) Simulate the following:
 a) Multiprogramming with a fixed number of tasks (MFT)
 b) Multiprogramming with a variable number of tasks (MVT)
 - 8) Simulate Bankers Algorithm for Dead Lock Avoidance
 - 9) Simulate Bankers Algorithm for Dead Lock Prevention.
 - 10) Simulate the following page replacement algorithms:
 a) FIFO b) LRU c) LFU
 - 11) Simulate the following File allocation strategies
 (a) Sequenced (b) Indexed (c) Linked



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- 12) Write a C program that illustrates two processes communicating using shared memory
- 13) Write a C program to simulate producer and consumer problem using semaphores
- 14) Write C program to create a thread using pthreads library and let it run its function.
- 15) Write a C program to illustrate concurrent execution of threads using pthreads library.



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| II Year – I Semester | | L | T | P | C |
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| DATABASE MANAGEMENT SYSTEMS LAB | | | | | |

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

Course Outcomes:

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

- Utilize SQL to execute queries for creating database and performing data manipulation operations
- Examine integrity constraints to build efficient databases
- Apply Queries using Advanced Concepts of SQL
- Build PL/SQL programs including stored procedures, functions, cursors and triggers

List of Exercises:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
 - i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
 - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.



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9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexing techniques.

Text Books/Suggested Reading:

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



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|---------------------------------|---------------------------------|----------|----------|----------|----------|
| II Year - I Semester | Skill Oriented Course- I | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| ANIMATIONS- 2D ANIMATION | | | | | |

Course Objectives:

This Course will enable students to learn various aspects of animation using a variety of 2-D software and to implement advance principles of traditional animation in Adobe animate to create high quality animation for production

Course Outcomes:

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

- learn various tools of digital 2-D animation.
- understand production pipeline to create 2-D animation.
- analyze special effects in animation to bring interest and awe in the scenes and backgrounds.
- apply the tools to create 2D animation for films and videos.

Perform Experiments related to the following concepts:

2D GRAPHIC DESIGN

Adobe Photoshop:

1. Create your visiting card
2. Create Title for any forthcoming film
3. Digital Matte Paint
4. Convert Black and White to Color
5. Convert Day mode to Night mode
6. Design Image manipulation
7. Smooth skin and remove blemishes & scars
8. Create a 3D pop-out effect
9. Create Textures
10. Timeline Animation

Adobe Illustrator:

1. Advertisement
2. Digital Illustrations
3. Brochure
4. Packet Design(Toothpaste packet, Soap cover, any Food product)
5. Dangers for display
6. Menu cards
7. Calendar Design
8. Tracing image
9. Vehicle Design
10. Festival



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Adobe Indesign:

1. Magazine A4 Size
2. Newspaper layout design & advertisements – Fine arts
3. Special Supplement
4. Different categories of Books
5. Info-graphics
6. Caricatures

Corel DRAW:

1. Create a paper ad for advertising of any commercial agency
2. Package Design
3. Corporate ID
4. Exhibition Layout
5. Oblers

2D ANIMATION

1. Creating Web Banners in Adobe Flash
2. Creating a Logo Animation in Adobe Flash
3. Creating Frame by Frame animation
4. Draw Cartoon Animation using reference.
5. Create Lip Sink to Characters
6. Using filters & Special effects
7. Create a scene by using Mask layers animation

E-Learning Lab:

8. Student Application form
9. Video Controlling
10. Audio Controlling
11. Start Drag and Stop Drag Actions
12. Interactive Keyboard Controls using Flash Action Script.
13. Interactive Flash Game.
14. Creating Character Animation in After Effects



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| II Year - I Semester | Skill Oriented Course- I | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| DISTRIBUTED TECHNOLOGIES-SQLITE | | | | | |

Course Objectives:

This Course will enable students to learn about SQLite Database and applying CRUD operations

Course Outcomes:

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

- learn about SQLite which is a relational database that is present in android and helps the users by storing important information.
- Perform various operations on server less database SQLite
- implement a small, fast, self-contained, high-reliability, full-featured using SQL database engine.

Perform Experiments related to the following concepts:

1. SQLite Installation
2. DOT(.) Commands
3. Attach, Detach Databases
4. Data types
5. Constraint
6. Create, Alter, Drop Index
7. SELECT statement
8. Operators
9. Aggregate functions
10. Core Functions
11. JOINS
12. Triggers



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| II Year - I Semester | | L | T | P | C |
| | | 2 | 0 | 0 | 0 |
| CONSTITUTION OF INDIA | | | | | |

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative

Course Outcomes:

At the end of the course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
 1. Know the sources, features and principles of Indian Constitution.
 2. Learn about Union Government, State government and its administration.
 3. Get acquainted with Local administration and Pachayati Raj.
 4. Be aware of basic concepts and developments of Human Rights.
 5. Gain knowledge on roles and functioning of Election Commission

UNIT I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Learning outcomes: After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

UNIT II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

Learning outcomes: After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court



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UNIT III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Learning outcomes: After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat

UNIT IV

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation
 Pachayati Raj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning outcomes:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Evaluate Zilla Panchayat block level organisation

UNIT V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Learning outcomes: After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

References:

- 1) Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt. Ltd.
- 2) Subash Kashyap, Indian Constitution, National Book Trust
- 3) J.A. Siwach, Dynamics of Indian Government & Politics
- 4) D.C. Gupta, Indian Government and Politics
- 5) H.M. Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
- 6) J.C. Johari, Indian Government and Politics Hans
- 7) J. Raj Indian Government and Politics
- 8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
- 9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012



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e-Resources:

- 1) nptel.ac.in/courses/109104074/8
- 2) nptel.ac.in/courses/109104045/
- 3) nptel.ac.in/courses/101104065/
- 4) www.hss.iitb.ac.in/en/lecture-details
- 5) www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution



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| II Year – II Semester | | L | T | P | C |
| | | 2 | 0 | 2 | 3 |
| STATISTICS WITH R | | | | | |

COURSE OBJECTIVES:

After taking the course, students will be able to

- Use R for statistical programming, computation, graphics, and modeling,
- Write functions and use R in an efficient way,
- Fit some basic types of statistical models
- Use R in their own research,
- Be able to expand their knowledge of R on their own.

COURSE OUTCOMES:

At the end of this course, students will be able to:

- List motivation for learning a programming language
- Access online resources for R and import new function packages into the R workspace
- Import, review, manipulate and summarize data-sets in R
- Explore data-sets to create testable hypotheses and identify appropriate statistical tests
- Perform appropriate statistical tests using R , Create and edit visualizations with R

UNIT-I:

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II:

R Programming Structures, Control Statements, Loops, - Looping Over Nonvector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Example: A Binary Search Tree.

UNIT-III:

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files,

UNIT-IV:

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.



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15) The sales of a company for each year are shown in the table below.

| | | | | | |
|--------------------|------|------|------|------|------|
| x (year) | 2015 | 2016 | 2017 | 2018 | 2019 |
| y (sales in lakhs) | 12 | 19 | 29 | 37 | 45 |

a) Find the least square regression line $y = a x + b$.

b) Use the least squares regression line as a model to estimate the sales of the company in 2021.

16) Find the least square regression line for the following set of data $\{(-1, 0), (0, 2), (1, 4), (2, 5)\}$ Plot the given points and the regression line in the same rectangular system of axes



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| II Year – II Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| PRINCIPLES OF SOFTWARE ENGINEERING | | | | | |

Course Objectives:

This course is designed to:

- Give exposure to phases of Software Development, common process models including Waterfall, and the Unified Process, and hands-on experience with elements of the agile process
- Give exposure to a variety of Software Engineering practices such as requirements analysis and specification, code analysis, code debugging, testing, traceability, and version control
- Give exposure to Software Design techniques

Course Outcomes:

Students taking this subject will gain software engineering skills in the following areas:

- Transform an Object-Oriented Design into high quality, executable code
- Skills to design, implement, and execute test cases at the Unit and Integration level
- Compare conventional and agile software methods

UNIT I

The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths, How It All Starts. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.

UNIT II

Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge , Core Principles, Principles That Guide Each Framework Activity, Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

UNIT III

Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling, Requirements Modeling Strategies, Flow-Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modelling, Requirements Modeling for WebApps.

UNIT IV

Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow, What Is a Component?, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for WebApps, Designing Traditional Components, Component-Based Development.



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UNIT V

The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Interface Design, Design Evaluation, Elements of Software Quality Assurance, SQA Tasks, Goals & Metrics, Statistical SQA, Software Reliability, A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing

Text Books:

- 1) Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
- 2) Software Engineering, Ian Sommerville, Ninth Edition, Pearson.

Reference Books:

- 1) Software Engineering, A Precise Approach, PankajJalote, Wiley India, 2010.
- 2) Software Engineering, Ugrasen Suman, Cengage.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105182/>



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| II Year – II Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| AUTOMATA THEORY AND COMPILER DESIGN | | | | | |

Course Objectives:

- To learn fundamentals of Regular and Context Free Grammars and Languages
- To understand the relation between Contexts free Languages, PDA and TM
- To study the various phases in the design of a compiler
- To understand the design of top-down and bottom-up parsers
- To understand syntax directed translation schemes
- To learn to develop algorithms to generate code for a target machine

Course Outcomes:

At the end of the course, the students will be able to:

- Ability to design, develop, and implement a compiler for any language
- Able to use LEX and YACC tools for developing a scanner and a parser
- Able to design and implement LL and LR parsers
- Able to design algorithms to perform code optimization in order to improve the performance of a program in terms of space and time complexity
- Ability to design algorithms to generate machine code

UNIT-I

Formal Language and Regular Expressions : Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools.

UNIT-II

Context Free grammars and parsing : Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing

Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.

UNIT-III

Semantics: Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT-IV

Run time storage : Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation.

Code optimization : Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

UNIT-V

Code generation : Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.



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| II Year – II Semester | | L | T | P | C |
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| JAVA PROGRAMMING | | | | | |

Course Objectives:

The learning objectives of this course are:

- To identify Java language components and how they work together in applications
- To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- To understand how to design applications with threads in Java
- To understand how to use Java APIs for program development

Course Outcomes:

By the end of the course, the student will be

- Able to realize the concept of Object Oriented Programming & Java Programming Constructs
- Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages, Enumeration and various keywords
- Apply the concept of exception handling and Input/ Output operations
- Able to design the applications of Java & Java applet
- Able to Analyze & Design the concept of Event Handling and Abstract Window Toolkit

UNIT I

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?., Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.



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UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by

Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods for Modifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New



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Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface, Creating JDBC Application, JDBC Batch Processing, JDBC Transaction Management

Text Books:

- 1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
- 2) The complete Reference Java, 8th edition, Herbert Schildt, TMH.

References Books:

- 1) Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
- 2) Murach's Java Programming, Joel Murach

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105191/>
- 2) https://www.w3schools.com/java/java_data_types.asp



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| II Year – II Semester | | L | T | P | C |
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| MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTANCY | | | | | |

Course Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals

Course Outcomes:

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making

UNIT I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics – Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

UNIT II

Theories of Production and Cost Analyses: Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

UNIT III

Introduction to Markets, Theories of the Firm & Pricing Policies: Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson’s models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock



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Company – State/Public Enterprises and their forms.

UNIT IV

Introduction to Accounting & Financing Analysis: Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

UNIT V

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Text Books:

- 1) A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

Reference Books:

- 1) Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd.
- 2) JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
- 3) N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd.
- 4) Maheswari S.N, An Introduction to Accountancy, Vikas Publishing House Pvt Ltd
- 5) I.M Pandey, Financial Management, Vikas Publishing House Pvt Ltd
- 6) V. Maheswari, Managerial Economics, S. Chand & Company Ltd.



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DEPARTMENT OF INFORMATION TECHNOLOGY

| | | | | | |
|--|--|----------|----------|----------|----------|
| II Year –I I Semester | | L | T | P | C |
| | | 0 | 1 | 2 | 2 |
| UNIFIED MODELING LANGUAGE (UML) LAB | | | | | |

Course Objectives:

- To know the practical issues of the different object oriented analysis and design concepts
- Inculcate the art of object oriented software analysis and design
- Apply forward and reverse engineering of a software system
- Carry out the analysis and design of a system in an object oriented way

Course Outcomes:

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

- Know the syntax of different UML diagrams
- Create use case documents that capture requirements for a software system
- Create class diagrams that model both the domain model and design model of a software system
- Create interaction diagrams that model the dynamic aspects of a software system
- Write code that builds a software system
- Develop simple applications

Note: For performing the experiments consider any case study (ATM/ Banking/ Library/Hospital management systems)

Experiment 1:

Familiarization with Rational Rose or Umbrella environment

Experiment 2:

- a) Identify and analyze events
- b) Identify Use cases
- c) Develop event table

Experiment 3:

- a) Identify & analyze domain classes
- b) Represent use cases and a domain class diagram using Rational Rose
- c) Develop CRUD matrix to represent relationships between use cases and problem domain classes

Experiment 4:

- a) Develop Use case diagrams
- b) Develop elaborate Use case descriptions & scenarios
- c) Develop prototypes (without functionality)

Experiment 5:

- a) Develop system sequence diagrams and high-level sequence diagrams for each use case
- b) Identify MVC classes / objects for each use case
- c) Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three-layer objects



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Experiment 6:

- a) Develop detailed design class model (use GRASP patterns for responsibility assignment)
- b) Develop three-layer package diagrams for each case study

Experiment 7:

- a) Develop Use case Packages
- b) Develop component diagrams
- c) Identify relationships between use cases and represent them
- d) Refine domain class model by showing all the associations among classes

Experiment 8:

Develop sample diagrams for other UML diagrams - state chart diagrams, activity diagrams and deployment diagrams



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| II Year –I I Semester | | L | T | P | C |
| | | 0 | 0 | 2 | 1 |
| FOSS LAB | | | | | |

Course Objectives:

This Course will enable students to

- provide introduction to UNIX operating system and its File System.
- develop the ability to formulate Regular Expressions and use them for Pattern Matching.
- gain an understanding of important aspects related to the Shell and the Process.
- provide a comprehensive introduction to Shell Programming, Services and Utilities.

Course Outcomes:

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

- Demonstrate UNIX commands for file handling and process control
- Construct regular expressions for pattern matching and apply them to various filters for a specific task.
- Analyze a given problem and apply requisite facets of shell programming in order to devise a shell script to solve the problem

Programs:

1. Session-1

- a) Log into the system
- b) Use vi editor to create a file called myfile.txt which contains some text.
- c) correct typing errors during creation.
- d) Save the file
- e) logout of the system

Session-2

- a) Log into the system
- b) open the file created in session 1
- c) Add some text
- d) Change some text
- e) Delete some text
- f) Save the Changes
- g) Logout of the system

2.a) Log into the system

b) Use the cat command to create a file containing the following data. Call it mytable use tabs to separate the fields.

```
1425 Ravi 15.65
4320 Ramu 26.27
6830 Sita 36.15
1450 Raju 21.86
```

c) Use the cat command to display the file, mytable

d) Use the vi command to correct any errors in the file, mytable.



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- e) Use the sort command to sort the file my table according to the first field. Call the sorted file my table (same name)
- f) Print the file my table
- g) Use the cut and paste commands to swap fields 2 and 3 of my table. Call it my table (same name)
- h) Print the new file, mytable
- i) Logout of the system.

3.A)

- a) Login to the system
- b) Use the appropriate command to determine your login shell
- c) Use the /etc/passwd file to verify the result of step b.
- d) Use the who command and redirect the result to a file called myfile1. Use the more command to see the contents of myfile1.
- e) Use the date and who commands in sequence (in one line) such that the output of date will display on the screen and the output of who will be redirected to a file called myfile2. Use the more command to check the contents of myfile2.

B) Write a sed command that deletes the first character in each line in a file.

- b) Write a sed command that deletes the character before the last character in each line in a file.
- c) Write a sed command that swaps the first and second words in each line in a file.

- 4. a) Pipe your /etc/passwd file to awk, and print out the home directory of each user.
- b) Develop an interactive grep script that asks for a word and a file name and then tells how many lines contain that word.
- c) Repeat
- d) Part using awk

5. a) Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else

- b) Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.
- c) Write a shell script that determines the period for which a specified user is working on the system.

- 6. a) Write a shell script that accepts a file name starting and ending line numbers as arguments and displays all the lines between the given line numbers.
- b) Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.

7. a) Write a shell script that computes the gross salary of a employee according to the following rules:

- i) If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic.
- ii) If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic



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The basic salary is entered interactively through the key board.

b) Write a shell script that accepts two integers as its arguments and computes the value of first number raised to the power of the second number.

8. a) Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, have the program ask the user for the necessary information, such as the file name, new name and so on.

b) Write shell script that takes a login name as command – line argument and reports when that person logs in

c) Write a shell script which receives two file names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.

9. a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.

b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.

c) Write a shell script to perform the following string operations:

i) To extract a sub-string from a given string.

ii) To find the length of a given string.

10. Write a C program that takes one or more file or directory names as command line input and reports the following information on the file:

i) File type ii) Number of links iii) Read, write and execute permissions

iv) Time of last access

(Note : Use stat/fstat system calls)

11. Write C programs that simulate the following unix commands:

a) mv b) cp (Use system calls)

12. Write a C program that simulates ls Command (Use system calls / directory API)

13. Write a shell script to accept the name of the file from standard input and perform the following tests on it a) File executable b) File readable c) File writable d) Both readable & writable

14. Write an awk program to print sum, avg of students marks list

15. Write an awk program which will find maximum word and its length in the given input File



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| II Year – II Semester | | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |
| JAVA PROGRAMMING LAB | | | | | |

Course Objectives:

The aim of this lab is to

- Practice programming in the Java
- Gain knowledge of object-oriented paradigm in the Java programming language
- Learn use of Java in a variety of technologies and on different platforms

Course Outcomes:

By the end of the course student will be able to write java program for

- Evaluate default value of all primitive data type, Operations, Expressions, Control-flow, Strings
- Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism
- Construct Threads, Event Handling, implement packages, developing applets

Exercise - 1 (Basics)

- a) Write a JAVA program to display default value of all primitive data type of JAVA
- b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.
- c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.

Exercise - 2 (Operations, Expressions, Control-flow, Strings)

- a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
- c) Write a JAVA program to sort for an element in a given list of elements using merge sort.
- d) Write a JAVA program using StringBuffer to delete, remove character.

Exercise - 3 (Class, Objects)

- a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
- b) Write a JAVA program to implement constructor.

Exercise - 4 (Methods)

- a) Write a JAVA program to implement constructor overloading.
- b) Write a JAVA program implement method overloading.

Exercise - 5 (Inheritance)

- a) Write a JAVA program to implement Single Inheritance
- b) Write a JAVA program to implement multi level Inheritance
- c) Write a java program for abstract class to find areas of different shapes

Exercise - 6 (Inheritance - Continued)

- a) Write a JAVA program give example for “super” keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?



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Exercise - 7 (Exception)

- a) Write a JAVA program that describes exception handling mechanism
- b) Write a JAVA program Illustrating Multiple catch clauses

Exercise – 8 (Runtime Polymorphism)

- a) Write a JAVA program that implements Runtime polymorphism
- b) Write a Case study on run time polymorphism, inheritance that implements in above problem

Exercise – 9 (User defined Exception)

- a) Write a JAVA program for creation of Illustrating throw
- b) Write a JAVA program for creation of Illustrating finally
- c) Write a JAVA program for creation of Java Built-in Exceptions
- d) Write a JAVA program for creation of User Defined Exception

Exercise – 10 (Threads)

- a) Write a JAVA program that creates threads by extending Thread class .First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds ,(Repeat the same by implementing Runnable)
- b) Write a program illustrating **isAlive** and **join ()**
- c) Write a Program illustrating Daemon Threads.

Exercise - 11 (Threads continuity)

- a) Write a JAVA program Producer Consumer Problem
- b) Write a case study on thread Synchronization after solving the above producer consumer problem

Exercise – 12 (Packages)

- a) Write a JAVA program illustrate class path
- b) Write a case study on including in class path in your os environment of your package.
- c) Write a JAVA program that import and use the defined your package in the previous Problem

Exercise - 13 (Applet)

- a) Write a JAVA program to paint like paint brush in applet.
- b) Write a JAVA program to display analog clock using Applet.
- c) Write a JAVA program to create different shapes and fill colors using Applet.

Exercise - 14 (Event Handling)

- a) Write a JAVA program that display the x and y position of the cursor movement using Mouse.
- b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet.



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| II Year - II Semester | Skill Oriented Course- II | L | T | P | C |
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| ANIMATIONS- INTRODUCTION TO 3D | | | | | |

Course Objectives:

This Course will enable students to

- To know about 3D software interface.
- To know about different type of 3d modeling like polygon, nerves modeling, curve based modeling, Patch modeling,
- To understand the basic blocking of 3D Inorganic and organic modeling, high poly modeling, unwrapping texturing.

Course Outcomes:

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

- To understand different styles and treatment of content in 3d model creation
- To analyze the importance of cognitive 3d designing.
- To apply tools to create effective 3D modelling texturing and lighting

1. Create any Model some objects such as chairs, tables, fruits, utensils
2. Create any Model instruments, tools
3. Create any Model of Cars or Bike,
4. Create any model of the male or female character.
5. Create any Model of any animal.
6. Create any Model of any birds, fishes, and worms.
7. Apply basic material and shader types & Procedurals textures.
8. Unwrap the models of objects and characters using various projection maps.
9. Apply texture on various objects and characters.
10. Create a natural outdoor or indoor scene.
11. Create Opacity, Smoothness, Secularity, and color maps, Transparency, Reflection
12. Bump & Displacement Maps
13. Render a frame and video of indoor and outdoor scenes.
14. Render a video of indoor scenes.
15. Render a photorealistic output of an interior scene.
16. Advance lighting using mental ray render.
17. Animate day and night scene of a street with the help of lighting.



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| II Year - II Semester | Skill Oriented Course- II | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| DISTRIBUTED TECHNOLOGIES-MONGODB | | | | | |

Course Objectives:

This Course will enable students to

- master the leading document-oriented NoSQL database, MongoDB Architecture, CRUD, Schema
- Design, Data Modelling and Indexing using real-life case studies
- Learn how to design Schema using Advanced Queries

Course Outcomes:

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

- Install, configure and setup the drivers to use MongoDB with your programming language of choice
- Gain an in-depth understanding of main features of MongoDB and their use cases
- Retrieve data in the database using advanced querying
- to build new types of applications for mobile, cloud, e-commerce and social technologies

Perform Experiments related to the following concepts:

1. MongoDB on Windows
2. MongoShell
3. Databases, Documents
4. Collections
5. MongoDB Connections
6. Query and Projection
7. Operators
8. Aggregation Pipeline Operators
9. Database Commands
10. Shell Methods



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UNIT IV:

The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.

Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, NAT-, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6- Internet control protocols- ICMP-ARP-DHCP

UNIT V:

The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services-TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.

Application Layer — World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System: Name Space, DNS in Internet ,- Resolution-Caching- Resource Records- DNS messages- Registrars-security of DNS Name Servers, SNMP.

Text Books:

1. Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.

References Books:

1. Data Communications and Networks- Achut S Godbole, AtulKahate
2. Computer Networks, Mayank Dave, CENGAGE



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| III Year – I Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| DESIGN AND ANALYSIS OF ALGORITHMS | | | | | |

Course Objectives:

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

- Ability to understand, analyze and denote time complexities of algorithms
- To introduce the different algorithmic approaches for problem solving through numerous example problems
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
- To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

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

- Analyze the performance of a given algorithm, denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms
- List and describe various algorithmic approaches and Solve problems using divide and conquer & greedy Method
- Synthesize efficient algorithms dynamic programming approaches to solve in common engineering design situations.
- Organize important algorithmic design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches
- Demonstrate NP- Completeness theory ,lower bound theory and String Matching

UNIT I:

Introduction: Algorithm Definition, Algorithm Specification, performance Analysis, Performance measurement, asymptotic notation, Randomized Algorithms.

UNIT II:

Divide and Conquer: General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort.

The Greedy Method: The general Method, knapsack problem, minimum-cost spanning Trees, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT III:

Dynamic Programming: The general method, multistage graphs, All pairs-shortest paths, optimal Binary search trees, 0/1 knapsack, The traveling salesperson problem.

UNIT IV:

Backtracking: The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles, knapsack problem.

UNIT V:

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.



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Text Books:

1. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, 2nd Edition, Universities Press.
2. Introduction to Algorithms Thomas H. Cormen, PHI Learning
3. Harsh Bhasin, “Algorithms Design & Analysis”, Oxford University Press.

Reference Books:

1. Horowitz E. Sahani S: “Fundamentals of Computer Algorithms”, 2nd Edition, Galgotia Publications,2008.
2. S. Sridhar, “Design and Analysis of Algorithms”, Oxford University Press.



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| III Year – I Semester | L | T | P | C |
| | 3 | 0 | 0 | 3 |
| DATA MINING TECHNIQUES | | | | |

Course Objectives:

The main objective of the course is to

- Introduce basic concepts and techniques of data warehousing and data mining
- Examine the types of the data to be mined and apply pre-processing methods on raw data
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

Course Outcomes:

By the end of the course student will be able to

- Illustrate the importance of Data Warehousing, Data Mining and its functionalities and Design schema for real time data warehousing applications.
- Demonstrate on various Data Preprocessing Techniques viz. data cleaning, data integration, data transformation and data reduction and Process raw data to make it suitable for various data mining algorithms.
- Choose appropriate classification technique to perform classification, model building and evaluation.
- Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent itemsets generation.
- Identify and apply various clustering algorithm (with open source tools), interpret, evaluate and report the result.

UNIT I:

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic concepts, Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Introduction: Why and What is data mining, What kinds of data need to be mined and patterns can be mined, Which technologies are used, Which kinds of applications are targeted.

UNIT II:

Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT III:

Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction.

UNIT IV:

Association Analysis: Problem Definition, Frequent Item set Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm.

UNIT V:

Cluster Analysis: Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means,



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Text Books:

1. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
3. Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
4. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
http://onlinecourses.nptel.ac.in/noc18_cs14/preview
5. (NPTEL course by Prof.PabitraMitra)
http://onlinecourses.nptel.ac.in/noc17_mg24/preview
6. (NPTEL course by Dr. NandanSudarshanam& Dr. BalaramanRavindran)
http://www.saedsayad.com/data_mining_map.htm



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| III Year – I Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| DevOps (Job Oriented Course) | | | | | |

Course Objectives:

- Introduces the basic concepts of Information System.
- To understand The Management Control Framework and The Application Control Framework.

Course Outcomes: At the end of the course, student will be able to

- Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility.
- Describe DevOps & DevSecOps methodologies and their key concepts
- Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
- Set up complete private infrastructure using version control systems and CI/CD tools
- Acquire the knowledge of maturity model, Maturity Assessment

UNIT I: Phases of Software Development Life Cycle, Values and principles of agile software development.

UNIT II: Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

UNIT III: DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

UNIT IV: CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices

UNIT V: Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment

Text Books:

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.
2. What is Devops? Infrastructure as code, 1st Edition, Mike Loukides ,O'Reilly publications, 2012.

Reference Books:

1. Building a DevOps Culture, 1st Edition, Mandi Walls, O'Reilly publications, 2013.



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| III Year – I Semester | | L | T | P | C |
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| ARTIFICIAL INTELLIGENCE (Professional Elective –I) | | | | | |

Course Objectives: The student will be able to

- Know the methodology of Problem solving
- Implement basic AI algorithms
- Design and carry out an empirical evolution of different algorithms on a problem formalization

Course Outcomes (COs): At the end of the course, student will be able to

- Understand the fundamental concepts in Artificial Intelligence
- Analyze the applications of search strategies and problem reductions
- Apply the mathematical logic concepts.
- Develop the Knowledge representations in Artificial Intelligence.
- Explain the Fuzzy logic systems.

UNIT I:

Introduction to artificial intelligence: Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI.

UNIT II:

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem

Search Strategies: exhaustive searches, heuristic search techniques, iterative-deepening A*, constraint satisfaction

UNIT III:

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, predicate logic

UNIT IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure.

UNIT V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.

Text Books:

1. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach , 2nd ed, Stuart Russel, Peter Norvig, PEA
3. Artificial Intelligence, Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH
4. Introduction to Artificial Intelligence, Patterson, PHI



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Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5th ed, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier



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| III Year – I Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| AGILE SOFTWARE PROCESS (Professional Elective –I) | | | | | |

Course Objectives:

Students shall be able to

- Comprehend an iterative, incremental development process leads to faster delivery of more useful software.
- Apply the principles and practices of extreme programming.
- Analyze the essence of agile development methods.
- Develop prototyping in the software process.

Course Outcomes:

After going through this course the student will be able to:

- Comprehend the common characteristics of an agile development process.
- Identify and contrast state of the practice agile methodologies.
- Analyze and contrast agile software development process models and plan driven process models.
- Determine software project characteristics that would be suitable for an agile process

UNIT I:

The Agile Movement - A Five Minute Primer, What is Agile Development, The Agile Methodologies Agile Values, Agile Practices, Agile Principles Agile Characteristics-The Characteristics of an Agile Project, The Development Team Project Management, The Customer, Processes and Tools The Contract, What Projects Can Benefit from Agile Development.

UNIT II:

The Agile Methodologies: Common Themes, Methodology Descriptions, Extreme Programming, Scrum, Feature Driven Development, The Crystal Methodologies, Adaptive Software Development, Dynamic Systems Development Method, Lean Software Development, Starting Monday: Investigate Further Selecting an Approach that Fits: Choosing between an Agile or Traditional Approach, Selecting the Right Agile Approach

UNIT III:

Going Agile: Is the Team Ready? Announcing the Team's Intention to Go Agile, Encountering, Addressing and Overcoming Resistance, Start with the Bare Minimum, Altering the Project Environment, Iteration Zero, Discontinue a Process Once its Served its Purpose, False Agile, Practitioners and Projects, Starting Monday: Measuring The Team's Progress.

UNIT IV:

Agile Practices: Getting Started, Agile Practices Explained, Selecting the Next Practice, Rejecting a Practice, Adopt Practices before Tools Learn Programming Practices in Pairs, Agile Practices in this Book Agile Practices Explained, Why these Practices were Chosen

UNIT V:

Testing :An Agile Approach to Testing, The Good Enough Approach Testing as the Best Defense, Sharing a Code Base with another Project Team, Sharing Common Components with another Project Team, Depending upon Code or Components Produced by Another Project Team



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Text Books:

1. Agile Software Development with Scrum, Ken Schawber, Mike Beedle, Pearson, 2015. ISBN-13: 9780132074896.
2. Integrating Agile Development In The Real World (Charles River Media Programming), Peter Schuh, , 2004, Cengage Learning, ISBN-13: 9781584503644

Reference Books:

1. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin, Janet Gregory, Publisher: Addison Wesley
2. Agile Software Development, Principles, Patterns and Practices, Alistair Cockburn, Pearson Education, 2015. ISBN-13: 9780321482754
3. Agile Software Development: The Cooperative Game, By Alistair Cockburn Publisher: Addison Wesley



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| III Year – I Semester | | L | T | P | C |
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| DISTRIBUTED SYSTEMS (Professional Elective –I) | | | | | |

Course Objectives:

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems
- To learn distributed mutual exclusion and deadlock detection algorithms
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems
- To learn the characteristics of peer-to-peer and distributed shared memory systems

Course Outcomes:

At the end of the course, the students will be able to:

- Elucidate the foundations and issues of distributed systems
- Illustrate the various synchronization issues and global state for distributed systems
- Illustrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Describe the agreement protocols and fault tolerance mechanisms in distributed systems
- Describe the features of peer-to-peer and distributed shared memory systems

UNIT I:

Distributed Systems: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges.

A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process communications.

Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.

UNIT II:

Message Ordering & Snapshots: Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels.

UNIT III:

Distributed Mutex & Deadlock: Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport's algorithm, Ricart-Agrawala algorithm, Maekawa's algorithm, Suzuki-Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Models of deadlocks, Knapp's classification, Algorithms for the single resource model, the AND model and the OR model.

UNIT IV:

Recovery & Consensus: Check pointing and rollback recovery: Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Coordinated check pointing algorithm, Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure, free system, Agreement in synchronous systems with failures.



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UNIT V:

Peer-to-peer computing and overlay graphs: Introduction, Data indexing and overlays, Chord –Content addressable networks, Tapestry.

Distributed shared memory: Abstraction and advantages, Memory consistency models, Sharedmemory Mutual Exclusion.

Text Books:

1. Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and TimKindberg, Fifth Edition, Pearson Education, 2012.
2. Distributed computing: Principles, algorithms, and systems, Ajay Kshemkalyani and Mukesh Singhal, Cambridge University Press, 2011.

Reference Books:

1. Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall ofIndia, 2007.
2. Advanced concepts in operating systems. Mukesh Singhal and Niranjana G. Shivaratri, McGraw-Hill, 1994.
3. Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M., Pearson Education, 2007.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/106/106106168/>



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| III Year – I Semester | | L | T | P | C |
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| ADVANCED UNIX PROGRAMMING (Professional Elective –I) | | | | | |

Course Objectives:

Understanding the shell commands, shell programming, system calls of files and processes, signals, inter-process communication concepts and programming, TCP and UDP.

Course Outcomes: After finishing this course student will be able to:

- Gain good knowledge on Unix commands and awareness of shell programming
- Know about different system calls for files and directories
- Ability to know the working of processes and signals
- Application of client server program for IPC
- Knowledge about socket programming

UNIT I:

Introduction, Architecture of unix, Responsibilities of shell, unix file system, vi editor. **Unix commands:** Some Basic Commands, file utilities, process utilities, text processing utilities, network utilities, disk utilities, backup utilities , Security by file permissions.

UNIT II:

Shell Programming: shell variables, The Export command, The Profile File a Script Run During starting, The First Shell Script, The read command, Positional Parameters, The \$? Variable , Knowing the exit Status- More about the Set Command, The Exit command, Branching Control Structures, Loop Control Structures, The Continue and Break Statement- The Expr Command, Performing Integer Arithmetic- Real Arithmetic in Shell Programs- The here Document(<<), The Sleep Command, Debugging Scripts, The Script command, The Eval command, The Exec Command, Sample programs. **Files** - Introduction, file descriptors, open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking- fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, links-soft and hard links-symlink, link, unlink.

UNIT III:

Directories-Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions. **Process Control:** process identifiers, fork function, vfork function, exit function, wait and waitpid functions, exec functions, user identification. **Signals:** signal handling using signal function, kill and raise, alarm, pause, abort and sleep functions.

UNIT IV:

IPC: introduction, pipes, FIFO's, client –server examples for pipes and FIFO's **message queues:** message queue structure in kernel, system calls of message queue, client-server example for message queue. **Semaphores:** definition, system calls of semaphores, semaphores structure in kernel, file locking using semaphores

UNIT V:

Shared memory-system calls of shared memory, semaphore structure in kernel, client server example. **Sockets:** Introduction, overview, elementary socket system calls, TCP Echo program, UDP Echo program



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| III Year – I Semester | | L | T | P | C |
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| DATA MINING TECHNIQUES WITH R LAB | | | | | |

Course Objectives:

- To understand the mathematical basics quickly and covers each and every condition of data mining in order to prepare for real-world problems.
- The various classes of algorithms will be covered to give a foundation to further apply knowledge to dive deeper into the different flavors of algorithms.
- Students should aware of packages and libraries of R and also familiar with functions used in R for visualization.
- To enable students to use R to conduct analytics on large real life datasets.
- To familiarize students with how various statistics like mean median etc. can be collected for data exploration in R.

Course Outcomes(COs): At the end of the course, student will be able to

- Extend the functionality of R by using add-on packages
- Extract data from files and other sources and perform various data manipulation tasks on them.
- Code statistical functions in R
- Use R Graphics and Tables to visualize results of various statistical operations on data
- Apply the knowledge of R gained to data Analytics for real life applications

List of Experiments:

1. Implement all basic R commands.
2. Interact data through .csv files (Import from and export to .csv files).
3. Get and Clean data using swirl exercises.(Use 'swirl' package, library and install that topic from swirl).
4. Visualize all Statistical measures (Mean, Mode, Median, Range, Inter Quartile Range etc., using Histograms, Boxplots and Scatter Plots).
5. Create a data frame with the following structure.

| EMP ID | EMP NAME | SALARY | START DATE |
|--------|----------|--------|------------|
| 1 | Satish | 5000 | 01-11-2013 |
| 2 | Vani | 7500 | 05-06-2011 |
| 3 | Ramesh | 10000 | 21-09-1999 |
| 4 | Praveen | 9500 | 13-09-2005 |
| 5 | Pallavi | 4500 | 23-10-2000 |

- a. Extract two column names using column name.
 - b. Extract the first two rows and then all columns.
 - c. Extract 3rd and 5th row with 2nd and 4th column.
6. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into
 - i. 0 to 1 range with min-max normalization.
 - ii. a value around 0 with z-score normalization.
 7. Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind' function.
 8. Write R program to implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best R² and plot the original values in 'green' and predicted values in 'red'.



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9. Write R Programs to implement k-means clustering.
10. Write R Programs to implement k-medoids clustering.
11. Write R Programs to implement density based clustering on iris dataset.
12. Write a R Program to implement decision trees using 'readingSkills' dataset.
13. Implement decision trees using 'iris' dataset using package party and 'rpart'.
14. Use a Corpus() function to create a data corpus then Build a term Matrix and Reveal word frequencies.

Reference Books:

1. www.tutorialspoint.com/r
2. www.r-tutor.com
3. R and Data Mining: Examples and Case Studies, 1st ed, Yanchang Zhao, Springer, 2012.
4. <https://towardsdatascience.com/>



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| III Year – I Semester | | L | T | P | C |
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| COMPUTER NETWORKS LAB | | | | | |

Course Objectives:

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

Course Outcomes:

By the end of the course student will be able to

- Know how reliable data communication is achieved through data link layer.
- Suggest appropriate routing algorithm for the network.
- Provide internet connection to the system and its installation.
- Work on various network management tools

List of Experiments:

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer framing methods such as
 - i) Character stuffing ii) bit stuffing.
3. Write a Program to implement data link layer framing method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Goback N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.
11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Write a Program to implement Broadcast tree by taking subnet of hosts.
13. Wireshark
 - i. Packet Capture Using Wire shark
 - ii. Starting Wire shark
 - iii. Viewing Captured Traffic
 - iv. Analysis and Statistics & Filters.
14. How to run Nmap scan
15. Operating System Detection using Nmap
16. Do the following using NS2 Simulator
 - i. NS2 Simulator-Introduction
 - ii. Simulate to Find the Number of Packets Dropped
 - iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
 - iv. Simulate to Find the Number of Packets Dropped due to Congestion
 - v. Simulate to Compare Data Rate& Throughput.



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| III Year – I Semester | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| ANIMATION COURSE: ANIMATION DESIGN (Skill Oriented Course) | | | | | |

Course Objectives:

The main objective of this course is to understand 2-D and 3-D animation using Adobe package

Course Outcomes:

At the end of the Course, Student will be able to:

- learn various tools of digital 2-D animation
- understand production pipeline to create 2-D animation.
- apply the tools to create 2D animation for films and videos
- understand different styles and treatment of content in 3D model creation
- apply tools to create effective 3D modelling texturing and lighting

List of Experiments:

1. Adobe Photoshop:
 - a. Create your visiting card
 - b. Create Title for any forthcoming film
2. Draw Cartoon Animation using reference
3. Creating Frame by Frame animation
4. Create a scene by using Mask layers animation
5. Adobe Illustrator:

Packet Design(Toothpaste packet, Soap cover, any Food product)
6. Create any model of the male or female character
7. Create any Model of Cars or Bike
8. Create any Model of any animal.
9. Create any Model of any birds, fishes, and worms.
10. Create and Convert 2D objects into 3D objects
11. Create an animated 3D titling with sound
12. Create any Model some objects such as chairs, tables, fruits, utensils

List of Augmented Experiments: (Weeks 13 – Week 16)

(Any two of the following experiments can be performed)

1. Animate day and night scene of a street with the help of lighting
2. Create a human character using Character studio and animate the same
3. Create a natural outdoor or indoor scene.
4. Apply texture on various objects and characters

Reference Books:

1. Flash MX 2004, Thyagarajan Anbumani, TMH.
2. Brian Underdahl, The Complete Reference – Macromedia Flash Mx2004, 2nd edition – TMH.

Web Links:

1. https://onlinecourses.swayam2.ac.in/cec21_cs07/preview
2. https://onlinecourses.swayam2.ac.in/ugc19_cs09/preview
3. https://onlinecourses.swayam2.ac.in/ntr20_ed15/preview
4. https://youtube.com/playlist?list=PLfFk8y2fd3FjeE_CrFASNvDLBp3yF1Hwi



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| III Year – I Semester | | L | T | P | C |
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| CONTINUOUS INTEGRATION AND CONTINUOUS DELIVERY USING DevOps (Skill Oriented Course) | | | | | |

Course Outcomes:

At the end of the Course, Student will be able to:

- Understand the why, what and how of DevOps adoption
- Attain literacy on Devops
- Align capabilities required in the team
- Create an automated CICD pipeline using a stack of tools

List of Exercises:

Note: There are online courses indicated in the reference links section. Learners need to go through the contents in order to perform the given exercises

Exercise 1:

Reference course name : [Software engineering and Agile software development](#)

Get an understanding of the stages in software development lifecycle, the process models, values and principles of agility and the need for agile software development. This will enable you to work in projects following an agile approach to software development.

Solve the questions [given in the reference course name](#) to gauge your understanding of the topic

Exercise 2:

Reference course name: [Development & Testing with Agile: Extreme Programming](#)

Get a working knowledge of using extreme automation through XP programming practices of test first development, refactoring and automating test case writing.

Solve the questions in the “Take test” module [given in the reference course name](#) to gauge your understanding of the topic

Exercise 3:

Module name : DevOps adoption in projects

It is important to comprehend the need to automate the software development lifecycle stages through DevOps. Gain an understanding of the capabilities required to implement DevOps, continuous integration and continuous delivery practices.

Solve the questions given in Quiz1, Quiz2, Quiz 3

Exercise 4:

Module name :Implementation of CICD with Java and open source stack

Configure the web application and Version control using Git using Git commands and version control operations.

Exercise 5:

Module Name: Implementation of CICD with Java and open source stack

Configure a static code analyzer which will perform static analysis of the web application code and identify the coding practices that are not appropriate. Configure the profiles and dashboard of the static code analysis tool.



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Exercise 6:

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| Module Name: Implementation of CICD with Java and open source stack |
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|---|
| Write a build script to build the application using a build automation tool like Maven. Create a folder structure that will run the build script and invoke the various software development build stages. This script should invoke the static analysis tool and unit test cases and deploy the application to a web application server like Tomcat. |
|---|

Exercise 7:

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| Module Name: Implementation of CICD with Java and open source stack |
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| Configure the Jenkins tool with the required paths, path variables, users and pipeline views. |
|---|

Exercise 8:

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|---|
| Module name: Implementation of CICD with Java and open source stack |
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| |
|---|
| Configure the Jenkins pipeline to call the build script jobs and configure to run it whenever there is a change made to an application in the version control system. Make a change to the background color of the landing page of the web application and check if the configured pipeline runs. |
|---|

Exercise 9:

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| Module name: Implementation of CICD with Java and open source stack |
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| Create a pipeline view of the Jenkins pipeline used in Exercise 8. Configure it with user defined messages. |
|---|

Exercise 10 :

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| Module name: Implementation of CICD with Java and open source stack |
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| In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for static analysis of code. |
|--|

Exercise 11:

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| Module name :Implementation of CICD with Java and open source stack |
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| In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for static unit testing. |
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Exercise 12:

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|------------------------------------|
| Module name :Course end assessment |
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| In the configured Jenkins pipeline created in Exercise 8 and 9, implement quality gates for code coverage. |
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Reference Books:

1. Learning Continuous Integration with Jenkins: A beginner's guide to implementing Continuous Integration and Continuous Delivery using Jenkins - Nikhil Pathania ,Packt publication
[\[https://www.amazon.in/Learning-Continuous-Integration-Jenkins-Pathania/dp/1785284835\]](https://www.amazon.in/Learning-Continuous-Integration-Jenkins-Pathania/dp/1785284835)
2. Jenkins 2 – Up and Running: Evolve Your Deployment Pipeline for Next Generation Automation - Brent Laster, O'Reilly publication
[\[https://www.amazon.in/Jenkins-2-Running-Brent-Laster/dp/1491979593\]](https://www.amazon.in/Jenkins-2-Running-Brent-Laster/dp/1491979593)



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| III Year – I Semester | | L | T | P | C |
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| EMPLOYABILITY SKILLS-I | | | | | |

Course Objectives:

The main objective of this course is to assist students in developing employability skills and personal qualities related to gaining and sustaining employment.

Course Outcomes: The end of the course student will be able to

- Understand the corporate etiquette.
- Make presentations effectively with appropriate body language
- Be composed with positive attitude
- Understand the core competencies to succeed in professional and personal life

UNIT I:

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT II:

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT III:

Standard Operation Methods: Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

Verbal Ability: Synonyms, Antonyms, One Word Substitutes-Correction of Sentences-Analogies, Spotting Errors, Sentence Completion, Course of Action -Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work

UNIT IV:

Job-Oriented Skills –I: Group Discussion, Mock Group Discussions

UNIT V:

Job-Oriented Skills –II: Resume Preparation, Interview Skills, Mock Interviews

Text Books and Reference Books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
3. R.S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand & Company Ltd., 2018.
4. Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

e-resources:

1. www.Indiabix.com
2. www.freshersworld.com



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| III Year – I Semester | Minor Course | L | T | P | C |
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| COMPUTER NETWORKS | | | | | |

Course Objectives:

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

Course Outcomes:

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

- Demonstrate different network models for networking links OSI, TCP/IP, B-ISDN, N-BISDN and get knowledge about various communication techniques, methods and protocol standards.
- Discuss different transmission media and different switching networks.
- Analyze data link layer services, functions and protocols like HDLC and PPP.
- Compare and Classify medium access control protocols like ALOHA, CSMA, CSMA/CD, CSMA/CA, Polling, Token passing, FDMA, TDMA, CDMA protocols
- Suggest appropriate routing algorithm for the network.
- Determine application layer services and client server protocols working with the client server paradigms like WWW, HTTP, FTP, e-mail and SNMP etc.

UNIT I:

Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP, Lack of OSI models success, Internet History.

Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and unguided media: Wireless-Radio waves, microwaves, infrared.

UNIT II:

Data link layer: Design issues, **Framing:** fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols:** simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.

Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field, point to point protocol (PPP): framing transition phase, multiplexing, multi link PPP.

UNIT III:

Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).

UNIT IV:

The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-



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General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.

UNIT V:

The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services-TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.

List of Experiments:

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer farming methods such as
 - i) Character stuffing ii) bit stuffing.
3. Write a Program to implement data link layer farming method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Goback N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.

Text Books:

1. Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.

References Books:

1. Data Communications and Networks- Achut S Godbole, AtulKahate
2. Computer Networks, Mayank Dave, CENGAGE



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| III Year – II Semester | | L | T | P | C |
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| MACHINE LEARNING | | | | | |

Course Objectives:

- Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

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

- Explain the fundamental usage of the concept Machine Learning system
- Demonstrate on various regression Technique
- Analyze the Ensemble Learning Methods
- Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
- Discuss the Neural Network Models and Fundamentals concepts of Deep Learning

Unit I:

Introduction- Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning.

Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.

Unit II:

Supervised Learning(Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, **Linear Models:** Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, **Binary Classification:** Multiclass/Structured outputs, MNIST, Ranking.

Unit III:

Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.

Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.

Unit IV:

Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures.

Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.

Unit V:

Neural Networks and Deep Learning: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.



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Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
2. Data Science and Machine Learning Mathematical and Statistical Methods, Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman, 25th November 2020

Reference Books:

1. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.



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| III Year – II Semester | | L | T | P | C |
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| BIG DATA ANALYTICS | | | | | |

Course Objectives:

- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyze the big data using intelligent techniques
- To introduce programming tools PIG & HIVE in Hadoop ecosystem

Course Outcomes:

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

- Illustrate big data challenges in different domains including social media, transportation, finance and medicine
- Use various techniques for mining data stream
- Design and develop Hadoop
- Identify the characteristics of datasets and compare the trivial data and big data for various applications
- Explore the various search methods and visualization techniques

UNIT I:

Introduction: Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

UNIT II:

Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions.

UNIT III:

Introduction to Hadoop: Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

UNIT IV:

Frameworks and Applications: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper.

UNIT V:

Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application



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Text Books:

1. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, Fourth Edition, 2015.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012

Reference Books:

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
2. Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, “Harness the Power of Big Data: The IBM Big Data Platform”, Tata McGraw Hill Publications, 2012.
3. Arshdeep Bahga and Vijay Madisetti, “Big Data Science & Analytics: A Hands On Approach “, VPT, 2016.
4. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons, 2014.

Software Links:

1. Hadoop: <http://hadoop.apache.org/>
2. Hive: <https://cwiki.apache.org/confluence/display/Hive/Home>
3. Piglatin: <http://pig.apache.org/docs/r0.7.0/tutorial.html>



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| III Year – II Semester | | L | T | P | C |
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| CRYPTOGRAPHY AND NETWORK SECURITY | | | | | |

Course Objectives:

The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

Course Outcomes : At the end of the course, student will be able to

- Explain different security threats and countermeasures and foundation course of cryptography mathematics.
- Classify the basic principles of symmetric key algorithms and operations of some symmetric key algorithms and asymmetric key cryptography
- Revise the basic principles of Public key algorithms and Working operations of some Asymmetric key algorithms such as RSA, ECC and some more
- Design applications of hash algorithms, digital signatures and key management techniques
- Determine the knowledge of Application layer, Transport layer and Network layer security Protocols such as PGP, S/MIME, SSL,TSL, and IPsec .

UNIT I:

Basic Principles : Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography.

UNIT II:

Symmetric Encryption: Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

UNIT III:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography

UNIT IV:

Data Integrity, Digital Signature Schemes & Key Management : Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management.

UNIT V:

Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :** Security at the Network Layer: IPSec, System Security

Text Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson,2006
3. Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016

Reference Books:

1. Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018



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| III Year – II Semester | L | T | P | C |
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| MOBILE COMPUTING (Professional Elective-II) | | | | |

Course Objectives:

- To understand the fundamentals of mobile communication
- To understand the architecture of various Wireless Communication Networks
- To understand the significance of different layers in mobile system Course Contents

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

- Develop a strong grounding in the fundamentals of mobile Networks
- Apply knowledge in MAC, Network, and Transport Layer protocols of Wireless Network
- Comprehend, design, and develop a lightweight network stack
- Analyze the Mobile Network Layer system working
- Explain about the WAP Model

UNIT I:

Introduction to Wireless Networks: Applications, History, Simplified Reference Model, Wireless transmission, Frequencies, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular Systems: Frequency Management and Channel Assignment, types of hand-off and their characteristics.

UNIT II:

MAC – Motivation, SDMA, FDMA, TDMA, CDMA, Telecommunication Systems, GSM: Architecture Location tracking and call setup, Mobility management, Handover, Security, GSM, SMS, International roaming for GSM, call recording functions, subscriber and service data management, DECT, TETRA, UMTS, IMT-2000.

UNIT III:

Wireless LAN: Infrared vs. Radio transmission, Infrastructure, Adhoc Network, IEEE 802.11WLAN Standards, Architecture, Services, HIPERLAN, Bluetooth Architecture & protocols.

UNIT IV:

Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol, Mobile Transport Layer, Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/Fast recovery, Transmission/Time-out freezing, Selective retransmission, Transaction Oriented TCP.

UNIT V:

Support for Mobility: Wireless Application Protocol: Architecture, Wireless Datagram Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Wireless Session Protocol, Wireless Application Environment, Wireless Markup Language, WML Scripts, Wireless Telephone Application.

Text Books:

1. Jochen Schiller, “Mobile Communication”, Second Edition, Pearson Education, 2008.

Reference Books:

1. William Stallings, “Wireless Communications and Networks”, Second Edition, Pearson Education, 2004.
2. C. Siva Ram Murthy, B. S. Manoj, “Adhoc Wireless Networks: Architectures and Protocols”, Second Edition, Pearson Education, 2008.



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| MEAN STACK DEVELOPMENT (Professional Elective II) | | | | | |

Course Outcomes:

At the end of the Course, Student will be able to:

- Build static web pages using HTML 5 elements.
- Apply JavaScript to embed programming interface for web pages and also to perform Client side validations.
- Build a basic web server using Node.js, work with Node Package Manager (NPM) and recognize the need for Express.js.
- Develop JavaScript applications using typescript and work with document database using MongoDB.
- Utilize Angular JS to design dynamic and responsive web pages.

UNIT-I:

HTML 5: Introduction to Web, Overview of Web Technologies, HTML - Introduction, HTML - Need, Case-insensitivity, Platform-independency, DOCTYPE Declaration, Types of Elements, HTML Elements - Attributes, Metadata Element, Sectioning Elements, Paragraph Element, Division and Span Elements, List Element, Link Element, Character Entities, HTML5 Global Attributes, Creating Table Elements, Table Elements : Colspan/ Rowspan Attributes, border, cellspacing and cellpadding attributes, Creating Form Elements, Input Elements - Attributes, Color and Date Pickers, Select and Datalist Elements, Editing Elements, Media, Iframe, Why HTML Security, HTML Injection, Clickjacking, HTML5 Attributes & Events Vulnerabilities, Local Storage Vulnerabilities, HTML5 - Cross-browser support, Best Practices For HTML Web Pages.

UNIT-II:

JavaScript: Why we need JavaScript, What is JavaScript, Environment Setup, Working with Identifiers, Type of Identifiers, Primitive and Non Primitive Data Types, Operators and Types of Operators, Types of Statements, Non - Conditional Statements, Types of Conditional Statements, If and Switch Statements, Types of Loops, Types of Functions, Declaring and Invoking Function, Arrow Function, Function Parameters, Nested Function, Built-in Functions, Variable Scope in Functions, Working With Classes, Creating and Inheriting Classes, In-built Events and Handlers, Working with Objects, Types of Objects, Creating Objects, Combining and cloning Objects using Spread operator, Destructuring Objects, Browser and Document Object Model, Creating Arrays, Destructuring Arrays, Accessing Arrays, Array Methods, Introduction to Asynchronous Programming, Callbacks, Promises, Async and Await, Executing Network Requests using Fetch API, Creating and consuming Modules.

UNIT-III:

Node.js: Why and What Node.js, How to use Node.js, Create a web server in Node.js, Node Package Manager, Modular programming in Node.js, Restarting Node Application, File Operations.

Express.js: Express Development Environment, Defining a route, Handling Routes, Route and Query Parameters, How Middleware works, Chaining of Middlewares, Types of Middlewares, Connecting to MongoDB with Mongoose, Validation Types and Defaults, Models, CRUD Operations, API Development, Why Session management, Cookies, Sessions, Why and What Security, Helmet Middleware, Using a Template Engine Middleware, Stylus CSS Preprocessor.



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UNIT-IV:

Typescript: Installing TypeScript, Basics of TypeScript, Function, Parameter Types and Return Types, Arrow Function, Function Types, Optional and Default Parameters, Rest Parameter, Creating an Interface, Duck Typing, Function Types, Extending Interfaces, Classes, Constructor, Access Modifiers, Properties and Methods, Creating and using Namespaces, Creating and using Modules, Module Formats and Loaders, Module Vs Namespace, What is Generics, What are Type Parameters, Generic Functions, Generic Constraints.

MongoDB: Introduction Module Overview, Document Database Overview, Understanding JSON, MongoDB Structure and Architecture, MongoDB Remote Management, Installing MongoDB on the local computer (Mac or Windows), Introduction to MongoDB Cloud, Create MongoDB Atlas Cluster, GUI tools Overview, Install and Configure MongoDB Compass, Introduction to the MongoDB Shell, MongoDB Shell JavaScript Engine, MongoDB Shell JavaScript Syntax, Introduction to the MongoDB Data Types, Introduction to the CRUD Operations on documents, Create and Delete Databases and Collections, Introduction to MongoDB Queries.

UNIT-V:

What is Angular, Features of Angular, Angular Application Setup, Components and Modules, Executing Angular Application, Elements of Template, Change Detection, Structural Directives - ngIf, ngFor, ngSwitch, Custom Structural Directive, Attribute Directives - ngStyle, ngClass, Custom Attribute Directive, Property Binding, Attribute Binding, Style and Event Binding, Built in Pipes, Passing Parameters to Pipes, Nested Components Basics, Passing data from Container Component to Child Component, Passing data from Child Component to ContainerComponent, Shadow DOM, Component Life Cycle, Template Driven Forms, Model Driven Forms or Reactive Forms, Custom Validators in Reactive Forms, Custom Validators in Template Driven forms, Dependency Injection, Services Basics, RxJS Observables, Server Communication using HttpClient, Communicating with different backend services using Angular HttpClient, Routing Basics, Router Links, Route Guards, Asynchronous Routing, Nested Routes.

Text Books:

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson.
2. Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly.
3. Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.
4. MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow, O'Reilly.

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech.
2. An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda SKatila, Cengage Learning.

Web Links:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview (HTML5)
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview (Javascript)
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overview (Node.js & Express.js)



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4. https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview
(Typescript)
5. https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overview
(Angular JS)
6. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_shared/overview
(MongoDB)



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| III Year – II Semester | | L | T | P | C |
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| DESIGN PATTERNS (Professional Elective II) | | | | | |

Course Objectives:

- Demonstration of patterns related to object oriented design.
- Describe the design patterns that are common in software applications
- Analyze a software development problem and express it
- Design a module structure to solve a problem, and evaluate alternatives
- Implement a module so that it executes efficiently and correctly

Course Outcomes:

- Construct a design consisting of a collection of modules
- Examine well-known design patterns (such as Iterator, Observer, Factory and Visitor)
- Distinguish between different categories of design patterns
- Ability to understand and apply common design patterns to incremental /iterative development
- Identify appropriate patterns for design of given problem
- Design the software using Pattern Oriented Architectures

UNIT I:

Introduction: Design Pattern, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation.

UNIT II:

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

UNIT III:

Structural Pattern: Adapter, Bridge, Composite, Decorator, façade, Flyweight, Proxy.

UNIT IV:

Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer.

UNIT V:

Behavioral Patterns: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

What to Expect from Design Patterns, a Brief History, the Pattern Community an Invitation, a Parting Thought.

Text Books:

1. “Design Patterns”, Erich Gamma, Pearson Education.



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Reference Books:

1. “Head First Design patterns”, Eric Freeman & Elisabeth Freeman, O’REILLY, 2007.
2. “Design Patterns in Java”, Steven John Metsker & William C. Wake, Pearson education, 2006
3. “J2EE Patterns”, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
4. “Design Patterns in C#”, Steven John metsker, Pearson education, 2004.
5. “Pattern Oriented Software Architecture”, F.Buschmann & others, John Wiley & Sons.

e-Resources:

1. <https://www.javatpoint.com/design-patterns-in-java>
2. https://www.tutorialspoint.com/design_pattern/design_pattern_overview.htm



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| SCRIPTING LANGUAGES (Professional Elective II) | | | | | |

Course Objectives:

From the course the student will

- Understand the concepts of scripting languages for developing web based projects
- Illustrates object oriented concepts like PHP, PYTHON, PERL
- Create database connections using PHP and build the website for the world
- Demonstrate IP address for connecting the web servers
- Analyze the internet ware application, security issues and frame works for application

Course Outcomes:

After the completion of the course, student will be able to do the following

- Ability to understand the differences between scripting languages
- Create PHP authentication Methodology for security issues
- Identify PHP encryption functions and Mcrypt Package
- Explain syntax and variables in TCL
- Able to gain some fluency programming in Ruby, JavaScript, Perl, Python, and related languages
- Master an understanding of python especially the object oriented concepts

UNIT I:

Introduction to PERL and Scripting: Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT II:

Advanced PERL: Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

PHP Basics: PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT III:

Advanced PHP Programming: PHP and Web Forms, Files, PHP Authentication and Methodologies- Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World.

UNIT IV:

TCL: TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures , strings , patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding , Perl-Tk.



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UNIT V:

Python: Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling. Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

Text Books:

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
3. Beginning PHP and MySQL, 3rd Edition, Jason Gilmore, Apress Publications (Dream tech).

References Books:

1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education. Programming Python, M.Lutz, SPD.
2. PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.
3. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
4. PHP and MySQL by Example, E.Quigley, Prentice Hall (Pearson).
5. Perl Power, J.P.Flynt, Cengage Learning.



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| BIG DATA ANALYTICS LAB | | | | | |

Software Requirements :

1. **Hadoop** : <https://hadoop.apache.org/release/2.7.6.html>
2. **Java** : <https://www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html>
3. **Eclipse** : <https://www.eclipse.org/downloads/>

List of Experiments:

Experiment 1: Week 1, 2:

1. Implement the following Data structures in Java
 - a) Linked Lists b) Stacks c) Queues d) Set e) Map

Experiment 2: Week 3:

2. (i) Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed
 (ii) Use web based tools to monitor your Hadoop setup.

Experiment 3: Week 4:

3. Implement the following file management tasks in Hadoop:
 - Adding files and directories
 - Retrieving files
 - Deleting files

Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

Experiment 4: Week 5:

4. Run a basic Word Count MapReduce program to understand MapReduce Paradigm.

Experiment 5: Week 6:

5. Write a map reduce program that mines weather data.
 Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.

Experiment 6: Week 7:

6. Use MapReduce to find the shortest path between two people in a social graph.

Hint: Use an adjacency list to model a graph, and for each node store the distance from the original node, as well as a back pointer to the original node. Use the mappers to propagate the distance to the original node, and the reducer to restore the state of the graph. Iterate until the target node has been reached.

Experiment 7: Week 8:

7. Implement Friends-of-friends algorithm in MapReduce.

Hint: Two MapReduce jobs are required to calculate the FoFs for each user in a social network. The first job calculates the common friends for each user, and the second job sorts the common friends by the number of connections to your friends.



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Experiment 8: Week 9:

8. Implement an iterative PageRank graph algorithm in MapReduce.

Hint: PageRank can be implemented by iterating a MapReduce job until the graph has converged. The mappers are responsible for propagating node PageRank values to their adjacent nodes, and the reducers are responsible for calculating new PageRank values for each node, and for re-creating the original graph with the updated PageRank values.

Experiment 9: Week 10:

9. Perform an efficient semi-join in MapReduce.

Hint: Perform a semi-join by having the mappers load a Bloom filter from the Distributed Cache, and then filter results from the actual MapReduce data source by performing membership queries against the Bloom filter to determine which data source records should be emitted to the reducers.

Experiment 10: Week 11:

10. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

Experiment 12: Week 12:

11. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes



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| III Year – II Semester | | L | T | P | C |
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| MACHINE LEARNING USING PYTHON LAB | | | | | |

Course Objectives:

This course will enable students to learn and understand different Data sets in implementing the machine learning algorithms.

Course Outcomes (Cos): At the end of the course, student will be able to

- Implement procedures for the machine learning algorithms
- Design and Develop Python programs for various Learning algorithms
- Apply appropriate data sets to the Machine Learning algorithms
- Develop Machine Learning algorithms to solve real world problems

Requirements: Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.

Experiment-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.

Experiment-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.

Experiment-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.

Experiment-4:

Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier

Experiment-5: Develop a program for Bias, Variance, Remove duplicates , Cross Validation

Experiment-6: Write a program to implement Categorical Encoding, One-hot Encoding

Experiment-7:

Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment-8:

Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

Experiment-9: Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Experiment-10:

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



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recall for your data set.

Experiment-11: Apply EM algorithm to cluster a Heart Disease Data Set. 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.

Experiment-12: Exploratory Data Analysis for Classification using Pandas or Matplotlib.

Experiment-13:

Write a Python 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

Experiment-14:

Write a program to Implement Support Vector Machines and Principle Component Analysis

Experiment-15:

Write a program to Implement Principle Component Analysis



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| III Year – II Semester | | L | T | P | C |
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| CRYPTOGRAPHY AND NETWORK SECURITY LAB | | | | | |

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To understand and implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

Course Outcomes: At the end of the course, student will be able to

- Apply the knowledge of symmetric cryptography to implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher
- Demonstrate the different algorithms like DES, BlowFish, and Rijndael, encrypt the text “Hello world” using Blowfish Algorithm.
- Analyze and implement public key algorithms like RSA, Diffie-Hellman Key Exchange mechanism, the message digest of a text using the SHA-1 algorithm

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
 - a) Ceaser Cipher
 - b) Substitution Cipher
 - c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text “Hello world” using BlowFish. Create your own key using Java key tool.
8. Write a Java program to implement RSA Algorithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.



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| III Year – II Semester | | L | T | P | C |
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| DATA SCIENCE: NATURAL LANGUAGE PROCESSING (Skill Oriented Course) | | | | | |

Course Outcomes:

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

- Explore natural language processing (NLP) libraries in Python
- Learn various techniques for implementing NLP including parsing & text processing
- Understand how to use NLP for text feature engineering

Python Libraries: nltk, re, word2vec

List of Experiments :

1. Demonstrate Noise Removal for any textual data and remove regular expression pattern such as hash tag from textual data.
2. Perform lemmatization and stemming using python library nltk.
3. Demonstrate object standardization such as replace social media slangs from a text.
4. Perform part of speech tagging on any textual data.
5. Implement topic modeling using Latent Dirichlet Allocation (LDA) in python.
6. Demonstrate Term Frequency – Inverse Document Frequency (TF – IDF) using python
7. Demonstrate word embeddings using word2vec.
8. Implement Text classification using naïve bayes classifier and text blob library.
9. Apply support vector machine for text classification.
10. Convert text to vectors (using term frequency) and apply cosine similarity to provide closeness among two text.
11. Case study 1: Identify the sentiment of tweets
 In this problem, you are provided with tweet data to predict sentiment on electronic products of netizens.
12. Case study 2: Detect hate speech in tweets.
 The objective of this task is to detect hate speech in tweets. For the sake of simplicity, we say a tweet contains hate speech if it has a racist or sexist sentiment associated with it. So, the task is to classify racist or sexist tweets from other tweets.

Web References:

1. <https://www.analyticsvidhya.com/blog/2017/01/ultimate-guide-to-understand-implement-natural-language-processing-codes-in-python/>
2. https://datahack.analyticsvidhya.com/contest/linguipedia-codefest-natural-language-processing-1/?utm_source=ultimate-guide-to-understand-implement-natural-language-processing-codes-in-python&utm_medium=blog
3. <https://www.analyticsvidhya.com/blog/2018/07/hands-on-sentiment-analysis-dataset-python/>



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| VIDEO ANALYTICS (Skill Oriented Course) | | | | | |

Course Outcomes:

At the end of the Course, Student will be able to:

- Illustrate the principles and techniques of digital image
- Demonstrate the image recognition and motion recognition
- Discuss the fundamentals of digital video processing
- Illustrate the motion estimation, segmentation and modeling
- Analyze video processing in applications

List of Experiments:

Note: Implement the following applications using MATLAB/Open CV/Python

1. Image enhancement application
2. Object/image recognition applications based on digital image transforms.
3. Image analysis systems for object recognition.
4. Content Based Image Retrieval
5. Image compression, Image Fusion
6. Image Steganography, Watermarking
7. Video Enhancement and Noise Reduction
8. Motion Estimation and Segmentation,
9. Motion Tracking
10. Multi-target/Multi-camera tracking
11. Action Recognition

List of Augmented Experiments: (Weeks 13 – Week 16)

(Any two of the following experiments can be performed)

1. Implement Optical character recognition,
2. Implement Image Captioning and Visual Question Answering.
3. Implement Gesture Recognition.
4. Implement Smart Surveillance and Tracking

Reference Books:

1. "Practical Image and Video Processing Using MATLAB", Oge Marques, Wiley-IEEE Press, 2011.
2. "Image Engineering: Processing, Analysis and Understanding", Yu Jin Zhang, Tsinghua University Press, 2009.
3. "Object Detection and Recognition in Digital Images: Theory and Practice", Boguslaw Cyganek, Wiley 2013.



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| III Year – II Semester | | L | T | P | C |
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| EMPLOYABILITY SKILLS-II | | | | | |

Course Objectives:

The main objective of this course is to assist students in developing employability skills and personal qualities related to gaining and sustaining employment.

Course Outcomes: After completion of this course

- Solve various Basic Mathematics problems by following different methods
- Follow strategies in minimizing time consumption in problem solving Apply shortcut methods to solve problems
- Confidently solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.
- Analyze, summarize and present information in quantitative forms including table, graphs and formulas

UNIT I:

Numerical ability I: Number system, HCF & LCM, Average, Simplification, Problems on numbers

Numerical ability II: Ratio & Proportion, Partnership, Percentages, Profit & Loss

UNIT II:

Arithmetical ability I: Problems on ages, Time & Work, Pipes & Cistern, Chain Rule.

Arithmetical ability II: Time & Distance, Problems on boats & Steams, Problems on Trains

UNIT III:

Arithmetical ability III: Allegation, Simple interest and compound interest, Races & Games of skills, Calendar and Clock,

Logical ability: Permutations and Combination and Probability.

UNIT IV:

Mensuration: Geometry, Areas, Volumes

UNIT V:

Data interpretation: Tabulation, Bar graphs, Pie charts, line graphs

Text Books And Reference Books:

1. R. S. Aggarwal “Quantitative Aptitude”, Revised ed., S Chand publication, 2017 ISBN:8121924987

E- resources:

1. https://blog.feedspot.com/aptitude_youtube_channels/
2. https://www.tutorialspoint.com/quantitative_apititude/
3. <https://www.careerbless.com/aptitude/qa/home.php>



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| III Year – II Semester | Minor Course | L | T | P | C |
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| DATA STRUCTURES AND ALGORITHMS | | | | | |

Course Objectives:

The objective of the course is to

- Introduce the fundamental concept of data structures and abstract data types
- Emphasize the importance of data structures in developing and implementing efficient algorithms
- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Demonstrate the different data structures implementation

Course Outcomes:

After completing this course a student will be able to:

- Use basic data structures such as arrays and linked list.
- Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
- Use various searching and sorting algorithms.

UNIT I:

Data Structures - Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity.

Searching - Linear search, Binary search, Fibonacci search.

Sorting- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.

UNIT II:

Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal, Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation, Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion.

UNIT III:

Queues: Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues- Circular Queues, Deques, Priority Queues, Multiple Queues.

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.

UNIT IV:

Trees: Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals,



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UNIT V:

Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prim's & Kruskal's Algorithm, Dijkstra's shortest path

Exercise -1 (Searching)

- a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list.
- b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.

Exercise -2 (Sorting-I)

- a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order
- b) Write C program that implement Quick sort, to sort a given list of integers in ascending order
- c) Write C program that implement Insertion sort, to sort a given list of integers in ascending order

Exercise -3 (Sorting-II)

- a) Write C program that implement radix sort, to sort a given list of integers in ascending order
- b) Write C program that implement merge sort, to sort a given list of integers in ascending order

Exercise -4 (Singly Linked List)

- a) Write a C program that uses functions to create a singly linked list
- b) Write a C program that uses functions to perform insertion, deletion operations on a singly linked list
- c) Write a C program to reverse elements of a single linked list.

Exercise -5 (Queue)

- a) Write C program that implement Queue (its operations) using arrays.
- b) Write C program that implement Queue (its operations) using linked lists

Exercise -6 (Stack)

- a) Write C program that implement stack (its operations) using arrays
- b) Write C program that implement stack (its operations) using Linked list
- c) Write a C program that uses Stack operations to evaluate postfix expression

Exercise -7 (Binary Tree)

Write a recursive C program for traversing a binary tree in preorder, inorder and postorder.

Exercise -8 (Binary Search Tree)

- a) Write a C program to Create a BST
- b) Write a C program to insert a node into and delete a node from a BST.

Text Books:

- 1) Data Structures Using C. 2nd Edition. Reema Thareja, Oxford.
- 2) Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.

Reference Books:

- 1) Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
- 2) Data Structures: A PseudoCode Approach, 2/e, Richard F. Gilberg, Behrouz A. Forouzon, Cengage.
- 3) Data Structures with C, Seymour Lipschutz TMH



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e-Resources:

- 1) <http://algs4.cs.princeton.edu/home/>
- 2) https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf



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| IV Year – I Semester | | L | T | P | C |
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| CLOUD COMPUTING (Professional Elective-III) | | | | | |

Course Objectives:

- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

Course Outcomes: At the end of the course, student will be able to

- Illustrate the key dimensions of the challenge of Cloud Computing
- Classify the Levels of Virtualization and mechanism of tools.
- Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.
- Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud
- Assess control storage systems and cloud security, the risks involved its impact and develop cloud application

UNIT I:

Systems Modeling, Clustering and Virtualization: Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, , Performance, Security and Energy Efficiency

UNIT II:

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT III:

Cloud Platform Architecture: Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure

UNIT IV:

Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.

UNIT V:

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system.

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.



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Reference Books:

1. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madiseti, University Press
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
3. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH



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| IV Year – I Semester | | L | T | P | C |
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| ARTIFICIAL NEURAL NETWORKS (Professional Elective-III) | | | | | |

Course Objectives: The main objective of the course is to

- Introduce the foundations of Artificial Neural Networks.
- Acquire the knowledge on Soft Computing Concepts.
- learn various types of Genetic algorithms and its applications.
- gain knowledge to apply optimization strategies.

Course Outcomes: At the end of the course, student will be able to

- Understand the concepts of Artificial intelligence and soft computing techniques
- Analyze the concepts of Neural Networks and select the Learning Networks in modeling real world systems.
- Implement the concepts of Fuzzy reasoning and concepts of Genetic algorithm and its applications to soft computing.
- Classify Biologically inspired algorithm such as neural networks, genetic algorithms, ant colony optimization, and bee colony optimization.
- Design hybrid system incorporating neural network, genetic algorithms, fuzzy systems.

UNIT I:

Soft Computing and Artificial Intelligence: Introduction of Soft Computing, Soft Computing vs. Hard Computing, Various Types of Soft Computing Techniques, Applications of Soft Computing, AI Search Algorithm, Predicate Calculus, Rules of Inference, Semantic Networks, Frames, Objects, Hybrid Models.

UNIT II:

Artificial Neural Networks and Paradigms: Introduction to Neuron Model, Neural Network Architecture, Learning Rules, Perceptrons, Single Layer Perceptrons, Multilayer Perceptrons, Back propagation Networks, Kohonen's self organizing networks, Hopfield network, Applications of NN.

UNIT III:

Fuzzy Logic: Introduction, Fuzzy sets and Fuzzy reasoning, Basic functions on fuzzy sets, relations, rule based models and linguistic variables, fuzzy controls, Fuzzy decision making, applications of fuzzy logic.

UNIT IV:

Genetic Algorithms and Swarm Optimizations: Introduction, Genetic Algorithm, Fitness Computations, Cross Over, Mutation, Evolutionary Programming, Classifier Systems, Genetic Programming Parse Trees, Variants of GA, Applications, Ant Colony Optimization, Particle Swarm Optimization, Artificial Bee Colony Optimization.

UNIT V:

Hybrid Systems: Neuro fuzzy hybrid systems, Adaptive neuro fuzzy inference systems, Fuzzy backpropagation network, Genetic neuro hybrid system, Genetic algorithm based backpropagation network, Genetic-fuzzy hybrid systems.

Text Books:

1. Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition.
2. S. Rajasekaran & G. A. Vijayalakshmi Pai “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications”, PHI,2003.



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| IV Year – I Semester | | L | T | P | C |
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| INTERNET OF THINGS (IoT) (Professional Elective-III) | | | | | |

Course Objectives:

From the course the student will learn

- the application areas of IOT
- the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- building blocks of Internet of Things and characteristics

Course Outcomes:

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

- Review Internet of Things (IoT).
- Demonstrate various business models relevant to IoT.
- Construct designs for web connectivity
- Organize sources of data acquisition related to IoT, integrate to enterprise systems.
- Describe IoT with Cloud technologies.

UNIT I:

The Internet of Things- An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, Examples OF IoTs, Design Principles For Connected Devices, Internet connectivity, **Application Layer Protocols-** HTTP, HTTPS, FTP

UNIT II:

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.

UNIT III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/Services/Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015



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Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things, CunoPfister , Oreilly



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| IV Year – I Semester | | L | T | P | C |
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| CYBER SECURITY & FORENSICS (Professional Elective-III) | | | | | |

Course Objectives:

The aim of the course is to

- identify security risks and take preventive steps
- understand the forensics fundamentals
- understand the evidence capturing process
- understand the preservation of digital evidence

Course Outcomes: At the end of the course, student will be able to

- Explain the Cybercrime Fundamentals
- Describe the types of attacks on networks
- Analyze various tools available for Cybercrime Investigation
- Explain the Computer Forensics and Investigation Fundamentals and tools
- Analyze the legal perspectives of Cybercrime

UNIT I:

Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

UNIT II:

Tools and Methods : Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

UNIT III:

Cyber Crime Investigation: Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

UNIT IV:

Computer Forensics and Investigations: Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

UNIT V:

Cyber Crime Legal Perspectives: Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario.



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Text Books:

1. Sunit Belapure Nina Godbole “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, WILEY, 2011.
2. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.

Reference Books:

1. Michael T. Simpson, Kent Backman and James E. Corley, “Hands on Ethical Hacking and Network Defence”, Cengage, 2019.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Alfred Basta, Nadine Basta, Mary Brown and Ravinder Kumar “Cyber Security and Cyber Laws”, Cengage, 2018.

E-Resources:

1. CERT-In Guidelines- <http://www.cert-in.org.in/>
2. <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks> [Online Course]
3. <https://computersecurity.stanford.edu/free-online-videos> [Free Online Videos]
4. Nikolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, <https://ocw.mit.edu> License: Creative Commons BY-NC-SA.



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| IV Year – I Semester | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| DEEP LEARNING TECHNIQUES (Professional Elective-IV) | | | | | |

Course Objectives: At the end of the course, the students will be expected to:

- Learn deep learning methods for working with sequential data,
- Learn deep recurrent and memory networks,
- Learn deep Turing machines,
- Apply such deep learning mechanisms to various learning problems.
- Know the open issues in deep learning, and have a grasp of the current research directions.

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

- Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning.
- Discuss the Neural Network training, various random models.
- Explain the Techniques of Keras, TensorFlow, Theano and CNTK
- Classify the Concepts of CNN and RNN
- Implement Interactive Applications of Deep Learning.

UNIT I:

Fundamentals of Deep Learning: Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines, **Fundamentals of Machine Learning:** Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Underfitting. [**Text Book 2**]

UNIT II: Introducing Deep Learning: Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks. [**Text Book3**]

UNIT III: Neural Networks: Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews: Binary Classification, Classifying newswires: Multiclass Classification. [**Text Book 2**]

UNIT IV:

Convolutional Neural Networks: Nerual Network and Representation Learning, Convolutional Layers, Multichannel Convolution Operation, **Recurrent Neural Networks:** Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch. [**Text Book 3**]

UNIT V:

Interactive Applications of Deep Learning: Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning. [**Text Book 1**]

Deep Learning Research: Autoencoders, Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks. [**Text Book 1**]



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Text Books:

1. Deep Learning- Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016
2. Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
4. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

Reference Books:

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.

Web Link:

1. Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview



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| IV Year – I Semester | | L | T | P | C |
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| SOCIAL NETWORK ANALYSIS (Professional Elective-IV) | | | | | |

Course Objectives:

- Formalize different types of entities and relationships as nodes and edges and represent this information as relational data
- Plan and execute network analytical computations
- Use advanced network analysis software to generate visualizations and perform empirical investigations of network data
- Interpret and synthesize the meaning of the results with respect to a question, goal, or task
- Collect network data in different ways and from different sources while adhering to legal standards and ethics standards

Course Outcomes:

After completing the course student should:

- Know basic notation and terminology used in network science
- Be able to visualize, summarize and compare networks
- Illustrate basic principles behind network analysis algorithms
- Develop practical skills of network analysis in R programming language
- Be capable of analyzing real work networks

UNIT I:

Social Network Analysis: Preliminaries and definitions, Erdos Number Project, Centrality measures, Balance and Homophily.

UNIT II:

Random graph models: Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions.

UNIT III:

Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.

UNIT IV:

Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The Erdos Renyi Model, Clustering Models.

UNIT V:

Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

Text Books:

1. S. Wasserman and K. Faust. “Social Network Analysis: Methods and Applications”, Cambridge University Press.
2. D. Easley and J. Kleinberg, “Networks, Crowds and Markets: Reasoning about a highly connected world” , Cambridge University Press, 1st edition,2010



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Reference Books:

1. Maarten van Steen. “Graph Theory and Complex Networks. An Introduction”, 2010.
2. Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. “Social Media Mining: An Introduction”. Cambridge University Press 2014.
3. Maksim Tsvetovat and Alexander Kouznetsov. “Social Network Analysis for Startups”. O’Reilly Media, 2011.

e-Resources:

- 1) <https://www.classcentral.com/course/edx-social-network-analysis-sna-9134>
- 2) <https://www.coursera.org/learn/social-network-analysis>



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| IV Year – I Semester | | L | T | P | C |
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| ADVANCED DATABASES (Professional Elective-IV) | | | | | |

Course Objectives:

- This Subject deals with dealing data in the real world, maintaining data without any redundancy, several techniques involved in DBMS to recover the problems caused due to redundancy, storing data for quick insertion, manipulation and deletion operations in order to retrieve data from the database.
- This subject provides an introduction to multidisciplinary field of data mining, the general data features, techniques for data preprocessing, general implementation of data warehouses and OLAP, the relationship between data warehousing and other generalization methods
- The concepts of data clustering includes a different methods of clustering such as k-means, k-medoids, db scan algorithm, role of data mining in web mining.

Course Outcomes:

After the completion of the course, student will be able to

- Analyze on normalization techniques.
- Elaborate on concurrency control techniques and query optimization.
- Summarize the concepts of data mining, data warehousing and data preprocessing strategies.
- Apply data mining algorithms.
- Assess various classification & cluster techniques.

UNIT I:

Introduction: Concepts and Definitions, Relational models, Data Modeling and Query Languages, Database Objects. **Normalization Techniques:** Functional Dependency, 1NF, 2NF, 3NF, BCNF; Multi valued Dependency; Loss-less Join and Dependency Preservation.

UNIT II:

Transaction Processing: Consistency, Atomicity, Isolation and Durability, Serializable Schedule, Recoverable Schedule, Concurrency Control, Time-stamp based protocols, Isolation Levels, Online Analytical Processing, **Database performance Tuning and Query optimization:** Query Tree, Cost of Query, Join, Selection and Projection Implementation Algorithms and Optimization Database Security: Access Control, MAC, RBAC, Authorization, SQL Injection Attacks.

UNIT III:

Data Mining: stages and techniques, knowledge representation methods, data mining approaches (OLAP, DBMS, Statistics and ML). **Data warehousing:** data warehouse and DBMS, multidimensional data model, OLAP operations. **Data processing:** cleaning, transformation, reduction, filters and discretization with weka.

UNIT IV:

Knowledge representation: background knowledge, representing input data and output knowledge, visualization techniques and experiments with weka. **Data mining algorithms:** association rules, mining weather data, generating item sets and rules efficiently, correlation analysis.

UNIT V:

Classification & Clustering: 1R algorithm, decision trees, covering rules, task prediction, statistical classification, Bayesian network, instance based methods, linear models, Cluster/2, Cobweb, k-means, Hierarchical methods. **Mining real data:** preprocessing data from a real medical domain, data mining



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techniques to create a comprehensive and accurate model of data. **Advanced topics:** text mining, text classification, web mining, data mining software.

Text Books:

1. Fundamentals of Database Systems, RamezElmasri, Shamkant B. Navathe, Addison-Wesley, 6th edition-
2. Data Mining: Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufmann C.J. Date, Database Systems, Pearson, 3rd edition-

Reference Books:

1. Principles of Distributed Database Systems, Prentice Hall, P. Valduriez, M. TamerOzsu 3rd edition-2000
2. Database systems: Design, implementation and Management, C.M. Coronel, S. Morris, P. Rob, Boston: Cengage Learning, 9th edition-2011



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| IV Year – I Semester | | L | T | P | C |
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| BLOCK-CHAIN TECHNOLOGIES (Professional Elective-V) | | | | | |

Course Objectives:

To understand block chain technology and Cryptocurrency works

Course Outcomes:

After the completion of the course, student will be able to

- Demonstrate the block chain basics, Crypto currency
- To compare and contrast the use of different private vs. public block chain and use cases
- Design an innovative Bit coin Block chain and scripts, Block chain Science on varies coins
- Classify Permission Block chain and use cases – Hyper ledger, Corda
- Make Use of Block-chain in E-Governance, Land Registration, Medical Information Systems and others

UNIT I:

Introduction: Introduction, basic ideas behind block chain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required, Block chain or distributed trust, Currency, Cryptocurrency, How a Cryptocurrency works, Financial services, Bitcoin prediction markets.

UNIT II:

Hashing, public key cryptosystems, private vs public block chain and use cases, Hash Puzzles, Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment

UNIT III:

Introduction to Bitcoin : Bitcoin Block chain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc Downside of Bit coin mining, Block chain Science: Grid coin, Folding coin, Block chain Genomics, Bit coin MOOCs.

UNIT IV:

Ethereum continued, IOTA, The real need for mining, consensus, Byzantine Generals Problem, and Consensus as a distributed coordination problem, Coming to private or permissioned block chains, Introduction to Hyper ledger, Currency, Token, Campus coin, Coin drop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency

UNIT V:

Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations, Uses of Block chain in E-Governance, Land Registration, Medical Information Systems.

Text Books:

1. Blockchain Blue print for Economy by Melanie Swan

Reference Books:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition, by Daniel Drescher



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| IV Year – I Semester | | L | T | P | C |
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| M-COMMERCE (Professional Elective-V) | | | | | |

Course Objectives:

The objective of the course is to provide the students with the Mobile Commerce concepts, environment and customer value and Business applications of Mobile Commerce.

Course Outcomes:

After the completion of the course, student will be able to

- Define mobile commerce and its framework, growth benefits and limitations
- Determine the information distribution for mobile networks in multimedia content
- Describe the method how to publish mobile networks and mobile payment models in multimedia
- get acquaintance with wireless communications technology with reference to WWAN, Cellular systems 2G, 2.5G, 3G, 4G, 5G and WLAN, and WMAN technology
- learn M-COMMERCE applications in various areas like advertising, payment, ticketing, product location, entertainment and shopping

UNIT I:

Electronic Commerce: Traditional commerce and E-commerce, Internet and WWW, Role of WWW, Value Chains, Strategic Business and Industry Value Chains, Role of E-commerce. Packet Switched Networks, TCP/IP Protocol Script, Internet Utility Programmes – SGML, HTML and XML, Web Client and Servers, Web Client/Server Architecture, Intranet and Extranets, Web Based Tools for E-commerce, Security.

UNIT II:

Mobile Commerce: Introduction, Infrastructure of M-Commerce, Types Of Mobile Commerce Services, Technologies of Wireless Business, Benefits and Limitations, Support, Mobile Marketing & Advertisement, Non- Internet Applications in M-Commerce, Wireless/Wired Commerce Comparisons.

UNIT III:

Mobile Commerce Technology : A Framework For The Study Of Mobile Commerce, NTT Docomo's I-Mode, Wireless Devices For Mobile Commerce, Towards a Classification Framework for Mobile Location Based Services, Wireless Personal and Local Area Networks, The Impact of Technology Advances on Strategy Formulation in Mobile Communications Networks.

UNIT IV:

Mobile Commerce Theory and Applications : The Ecology of Mobile Commerce, The Wireless Application Protocol, Mobile Business Services, Mobile Portal, Factors Influencing the Adoption of Mobile Gaming Services, Mobile Data Technologies and Small Business Adoption and Diffusion, E-commerce in The Automotive Industry, Location- Based Services: Criteria For Adoption and Solution Deployment, The Role of Mobile Advertising in Building a Brand, M-commerce Business Models

UNIT V:

Business- To- Business Mobile E- Commerce : Enterprise Enablement, Email and Messaging, Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare), Field Sales Support (Content Access, Inventory), Asset Tracking and Maintenance/Management, Remote IT Support, Customer Retention (B2C Services, Financial, Special Deals), Warehouse Automation, Security.



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Text Books:

1. E.Brian Mennecke, J.Troy Strader, “Mobile Commerce: Technology, Theory and Applications”, Idea Group Inc., IRM press, 2003.
2. Ravi Kalakota, B.Andrew Whinston, “Frontiers of Electronic Commerce”, Pearson Education, 2003.

Reference Books:

1. P. J. Louis, “M-Commerce Crash Course”, McGraw- Hill Companies February 2001.
2. Paul May, “Mobile Commerce: Opportunities, Applications, and Technologies Of Wireless Business” Cambridge University Press March 2001.



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| IV Year – I Semester | | L | T | P | C |
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| ETHICAL HACKING (Professional Elective-V) | | | | | |

Course Objectives:

- The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing the security.
- The course includes-Impacts of Hacking; Types of Hackers; Information Security Models, Information Security Program, Business Perspective, Planning a Controlled Attack
- Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration)

Course Outcomes: At the end of the course, student will be able to

- Explain the concepts related to hacking, ports and protocols, pen testing and virtualization
- Determine the applicable footprinting techniques and scanning methods
- Explain the process of system hacking and Explain the concepts Trojans, backdoors, worms and virus and it's countermeasures
- Demonstrate systematic understanding of the concepts of Sniffing and Social Engineering and it's attacks
- Determine the applicable methods of cryptography, steganography and Vulnerability Assessment

UNIT I:

Introduction to Hacking: Hacking, Types and phases of hacking, **Introduction to Ports & Protocols:** Ports, Protocols, Primary Network Types, **Virtualization & Introduction to Kali Linux:** Virtualization, Virtualization software, supported platforms, **Introduction to Penetration Testing:** Penetration test, Categories and Types of Penetration tests, Structure of Penetration Test Report.

UNIT II:

Footprinting: Footprinting, Types, Using ping and ns Lookup commands in Windows command line, **Scanning:** Scanning, Basics of Scanning, Basic Techniques of Scanning, Enumerating DNS using dns enum, Performing flag scan using hping3.

UNIT III:

Hacking into System: System Hacking, Password Cracking, Default password databases, Manual and Automated Password Cracking, Process of System Hacking, Using Keyloggers, **Trojans & Backdoors:** Trojans, Working of Trojan, Infection Techniques, Attack, Lifecycle and Classification of Virus, Worms, Virus Construction Kit.

UNIT IV:

Sniffing, Packet Analysis & Session Hijacking: Sniffing, Packet Analysis, Types of Sniffing, Active and Passive Sniffing Techniques, Session Hijacking, **Social Engineering:** Social Engineering, Process, Identity Theft, Human and Computer Based Social Engineering Techniques, Phishing Process, Types of Phishing Attacks, Social Engineering Toolkit (SET)

UNIT V:

Cryptography: Cryptography, Digital Signature, Hash Functions, **Steganography:** Steganography Process, watermarking, Steganography Methods and Attacks, Steganography tools, **Vulnerability Assessment:** Vulnerability, The Open Web Application Security Project (OWASP), Prevention, Damn Vulnerable Web Application (DVWA), installation and testing of DVWA



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Text Books:

1. Hacking: Be a Hacker with Ethics, Harsh Bothra, Khanna Publications, 2019
2. Ethical Hacking and Penetration Testing Guide, Rafay Baloch, 2014

Reference Books:

1. Kali Linux Wireless Penetration Testing Beginner's Guide, Vivek Ramachandran, Cameron Buchanan, Packt Publishing, 2015
2. SQL Injection Attacks and Defense, 1st Edition, Justin Clarke-Salt, Syngress Publication
3. Mastering Modern Web Penetration Testing, Prakhar Prasad, Packt Publishing, October 2016



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| IV Year – I Semester | | L | T | P | C |
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| UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY | | | | | |

Human Values Courses

This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course named as “H-102 Universal Human Values 2: Understanding Harmony” is designed which may be covered in their III or IV semester. During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

Universal Human Values 2: Understanding Harmony

Course code: HSMC (H-102)

Credits: L-T-P-C 2-1-0-3 or 2L:1T:0P 3 credits

Pre-requisites: None. Universal Human Values 1 (desirable)

1. Objective:

The objective of the course is four fold:

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 the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

2. Course Topics:

The course has 28 lectures and 14 practice sessions in 5 modules:

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

2. Purpose and motivation for the course, recapitulation from Universal Human Values-I
3. Self-Exploration—what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration
4. Continuous Happiness and Prosperity- A look at basic Human Aspirations
5. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
6. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
7. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

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



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

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

8. 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
9. Understanding the meaning of Trust; Difference between intention and competence
10. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
11. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
12. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

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

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. 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.
26. Case studies of typical holistic technologies, management models and production systems
27. 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
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

3. READINGS:

3.1 Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010



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3.2 Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

4. MODE OF CONDUCT (L-T-P-C 2-1-0-3 or 2L:1T:0P 3 credits)

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

5. 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: 10 marks

Assessment by peers: 10 marks



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DEPARTMENT OF INFORMATION TECHNOLOGY

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|---|--|----------|----------|----------|----------|
| IV Year – I Semester | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| PYTHON: DEEP LEARNING (Skill Oriented Course) | | | | | |

Course Outcomes:

At the end of the Course, Student will be able to:

- Demonstrate the basic concepts fundamental learning techniques and layers.
- Discuss the Neural Network training, various random models.
- Apply various optimization algorithms to comprehend different activation functions to understand hyper parameter tuning
- Build a convolutional neural network, and understand its application to build a recurrent neural network, and understand its usage to comprehend auto encoders to briefly explain transfer learning

Pre-requisite knowledge :

- Exploratory data analysis: Collecting, importing, pre-processing, organizing, exploring, analyzing data and deriving insights from data
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012666909428129792728_shared/overview
- Data visualization using Python: Data visualization functions and plots
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126051913436938241455_shared/overview
- Regression analysis: Regression, types, linear, polynomial, multiple linear, Generalized linear regression models
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01320408013336576065_shared/overview
- Clustering using Python: Clustering, techniques, Assessment and evaluation
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130441799423426561190_shared/overview
- Machine learning using Python: Machine learning fundamentals, Regression, classification, clustering, introduction to artificial neural networks
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012600400790749184237_shared/overview
- Time series analysis : Patterns, decomposition models, smoothing time, forecasting data
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126051804744253441280_shared/overview

List of Exercises:

Note: There are online courses indicated in the reference links section. Learners need to go through the contents in order to perform the given exercises

Exercise 1:

Course name : .Build a Convolution Neural Network for Image Recognition.

Go through the modules of the course mentioned and answer the self-assessment questions given in the link below at the end of the course.

[Self Assessment - Deep Learning - Viewer Page | Infosys Springboard \(onwingspan.com\)](#)



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Exercise 2:

Module name : Understanding and Using ANN : Identifying age group of an actor

Exercise : Design Artificial Neural Networks for Identifying and Classifying an actor using Kaggle Dataset.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012776492416663552259_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course

Exercise 3:

Module name : Understanding and Using CNN : Image recognition

Exercise: Design a CNN for Image Recognition which includes hyper parameter tuning.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012785694443167744910_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course

Exercise 4:

Module name : Predicting Sequential Data

Exercise: Implement a Recurrence Neural Network for Predicting Sequential Data.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_01279144948849868822_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course

Exercise 5:

Module Name: Removing noise from the images

Exercise: Implement Multi-Layer Perceptron algorithm for Image denoising hyperparameter tuning.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012792058258817024272_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course

Exercise 6:

Module Name: Advanced Deep Learning Architectures

Exercise: Implement Object Detection Using YOLO.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013102923373297664873_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course

Exercise 7:

Module Name: Optimization of Training in Deep Learning

Exercise Name: Design a Deep learning Network for Robust Bi-Tempered Logistic Loss.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013107917226680320184_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course

Exercise 8:

Module name: Advanced CNN

Exercise: Build AlexNet using Advanced CNN.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013111844422541312984_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course



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Exercise 9:

| |
|---|
| Module name: Autoencoders Advanced |
| Exercise: Demonstration of Application of Autoencoders. |
| https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_0131164551289896962081_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course |

Exercise 10 :

| |
|---|
| Module name: Advanced GANs |
| Exercise: Demonstration of GAN. |
| https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_0131155456664289281901_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course |

Exercise 11:

| |
|---|
| Module name : Capstone project |
| Exercise : Complete the requirements given in capstone project |
| Description: In this capstone, learners will apply their deep learning knowledge and expertise to a real world challenge. |
| https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013119291805696000651_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course |

Exercise 12:

| |
|---|
| Module name : Capstone project |
| Exercise : Complete the requirements given in capstone project |
| https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013119291805696000651_shared?collectionId=lex_auth_01274814254931148859_shared&collectionType=Course |

Reference Books:

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.

Hardware and software configuration:

| Experimental Environment | Configuration Instructions | |
|--------------------------|----------------------------|--|
| | Hardware Environment | CPU |
| GPU | | Nvidia GTX 750, 4GB |
| Memory | | 8 GB |
| Software Environment | Operating System | Ubuntu 14.04, 64 bit |
| | Programming Environment | Tensorflow deep learning framework and Python language |



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Web Links: [Courses mapped to Infosys Springboard platform]

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012782105116811264219_shared/contents
[Introduction to Deep Learning]
2. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013119291805696000651_shared [Deep learning for Developers]



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| IV Year – I Semester | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| SECURE CODING TECHNIQUES (Skill Oriented Course) | | | | | |

Course Outcomes:

At the end of the Course, Student will be able to:

- Implement Network Configuration
- Install Programming APIs and Implement OWASP design principles while designing a web application
- Write Python script to implement web request
- Understand the importance of security in all phases of SDLC
- Write secure coding using some of the practices in C/C++/Java and Python programming languages

List of Experiments:

EXPERIMENT-1:

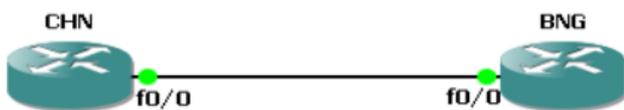
- 1.1 Identification of classes of IPv4 addresses
- 1.2 Classification of IPv4 Address into public and private
- 1.3 Create a Sub net
- 1.4 To determine Network ID, Broadcast ID, Usable Host

Web link:

https://infyspringboard.onwingspan.com/web/en/viewer/pdf/lex_auth_013239574635692032240_shared?collectionId=lex_auth_012683751296065536354_shared&collectionType=Course

EXPERIMENT-2:

- 2.1 Configure the given topology deducing from the outputs following it



- 2.2 Troubleshoot the below topology with below operations

- Configure the below topology
- Protect the privileged mode by assigning it a password
- Display 'Welcome to BENGALURU' and 'Welcome to MYSURU' as message of the day, while entering the consoles of respective DC's



Web link:

https://infyspringboard.onwingspan.com/web/en/viewer/pdf/lex_auth_013239574635692032240_shared?collectionId=lex_auth_012683751296065536354_shared&collectionType=Course

EXPERIMENT-3:

- 3.1 Explore cryptography, input and output sanitization, error handling, input validation, logging and auditing, and session and exception management.
- 3.2 Install Programming interfaces (APIs), including those that offer different types of functionality, such



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as Microsoft's Crypto API and Python's pycrypto, which both provide cryptographic functions.

3.3 Implement Concurrency, type safety, memory management, configuration parameter management, tokenizing, and sandboxing.

Web Link : <https://springboard.percipio.com/courses/57a7fcde-9829-4f12-a9af-cb14eacf673e/videos/6135b4f6-29dc-4d44-98c5-60fcbfa859d0?tab=overview>

EXPERIMENT-4:

4.1 Server-side and client-side code

4.2 scan a web app for vulnerabilities using OWASP ZAP and Burp Suite

4.3 explore secure coding using the OWASP ESAPI

Web Link : <https://springboard.percipio.com/courses/79fb661e-26b5-4ae5-a008-2cf7d4e63e3c/videos/ccaa5e65-ab27-4bd4-8416-cc262569e96c>

EXPERIMENT-5:

Defensive programming for C/C++ including inspections, testing, and input validation

Web Link: <https://springboard.percipio.com/courses/f44c02f9-1bcc-11e7-b15b-0242c0a80b07/videos/f44ced50-1bcc-11e7-b15b-0242c0a80b07>

EXPERIMENT-6:

6.1 Identify when to use Python, along with a working knowledge of how to write and run a Python script, are beneficial skills in secure coding

6.2 Create variables, containers including lists, dictionaries, and tuples, conditionals, loops, and functions in a Python script.

6.3 Imports and file reading and writing using a PowerShell script. Finally, you'll learn how to use a Python script to make a web request.

Web Link : <https://springboard.percipio.com/courses/be99adad-1f65-47a8-a4b5-6b5346072b8e/videos/71397986-c553-419f-a525-105965ca3158>

EXPERIMENT-7:

Consider the following code in C language:

```
int main() {
    mybufferOverflow();
}
void mybufferOverflow() {
char stringLine[10];
printf("Enter the text: ");
gets(stringLine);
printf("You have entered: ", stringLine);
return 0;
}
```

What is a buffer overflow attack that can happen on this code? Rewrite the code prevent buffer overflow.

EXPERIMENT-8:

Create a login page with user name and password which will connect to a database which will store the name and password. You can use Java and HTML code and database as per convenience. Simulate an SQL injection attack. Write embedded SQL code to avoid SQL injection attack. Document how this is taken care in the later versions of Java.



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EXPERIMENT-9:

Create a login page with user name and password which will connect to a database which will store the name and password. You can use Python as a base and database as per convenience. Simulate an SQL injection attack. Write the revised code in Python that will sanitize the inputs and help prevent an SQL injection attack.

EXPERIMENT-10 :

Read and understand the Heartbleed vulnerability. Identify the code in C++ that can simulate this vulnerability and also code to fix it. Document the secure coding practices to take care of this vulnerability and the reasons for it to happen.

EXPERIMENT-11:

Go to OWASP.org. Read about the top 10 vulnerabilities mentioned. Document the following:

- a. Name of the vulnerability
- b. Causes
- c. Mitigation

How will you prevent it in the programming language that you use, if applicable with example codes

EXPERIMENT-12:

Go to http://cwe.mitre.org/top25/archive/2021/2021_cwe_top25.html. Read about the top 10 vulnerabilities mentioned. Document the following:

- a. Name of the programming error
- b. Causes
- c. Mitigation
- d. How will you prevent it in the programming language that you use, if applicable with example codes

Web Link : http://cwe.mitre.org/top25/archive/2021/2021_cwe_top25.html

Web Links:

1. https://infyspringboard.onwingspan.com/web/en/viewer/pdf/lex_auth_013239574635692032240_share_d?collectionId=lex_auth_012683751296065536354_shared&collectionType=Course
2. <https://springboard.percipio.com/courses/57a7fcde-9829-4f12-a9af-cb14eac673e/videos/6135b4f6-29dc-4d44-98c5-60fcbfa859d0?tab=overview>
3. <https://springboard.percipio.com/courses/79fb661e-26b5-4ae5-a008-2cf7d4e63e3c/videos/ccaa5e65-ab27-4bd4-8416-cc262569e96c>
4. <https://springboard.percipio.com/courses/f44c02f9-1bcc-11e7-b15b-0242c0a80b07/videos/f44ced50-1bcc-11e7-b15b-0242c0a80b07>
5. <https://springboard.percipio.com/courses/be99adad-1f65-47a8-a4b5-6b5346072b8e/videos/71397986-c553-419f-a525-105965ca3158>
6. <https://www.techtarget.com/searchsecurity/definition/buffer-overflow#:~:text=A%20buffer%20overflow%20occurs%20when,adjacent%20to%20the%20destination%20buffer>
7. <https://www.journaldev.com/34028/sql-injection-in-java>
8. <https://realpython.com/prevent-python-sql-injection/>
9. <https://www.securecoding.com/blog/finding-and-fixing-c-vulnerabilities/>
10. <https://owasp.org/www-project-top-ten/>



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| IV Year – I Semester | Minor Course | L | T | P | C |
| | | 3 | 0 | 2 | 4 |
| SOFTWARE ENGINEERING | | | | | |

Course Objectives:

This course is designed to acquire the generic software development skill through various stages of software life cycle and also to ensure the quality of software through software development with various protocol based environment

Course Outcomes:

Students taking this subject will gain software engineering skills in the following areas:

- Ability to transform an Object-Oriented Design into high quality, executable code
- Skills to design, implement, and execute test cases at the Unit and Integration level
- Compare conventional and agile software methods
- Prepare SRS document, design document, test cases and software configuration management and risk management related document.
- Develop function oriented and object oriented software design using tools like rational rose.
- Use modern engineering tools necessary for software project management, estimations, time management and software reuse
- Generate test cases for software testing

UNIT I:

The Nature of Software, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.

UNIT II:

Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge, Core Principles, Principles That Guide Each Framework Activity, Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

UNIT III:

Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling, Requirements Modeling Strategies, Flow-Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modelling,.

UNIT IV:

Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow, Components, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for WebApps, Designing Traditional Components, Component- Based Development.



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UNIT V:

The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation, Elements of Software Quality Assurance, SQA Tasks, Goals & Metrics, Statistical SQA, Software Reliability, A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing.

List of Experiments:

- 1) Perform the following, for the following experiments:
 - i. Do the Requirement Analysis and Prepare SRS
 - ii. Draw E-R diagrams, DFD, CFD and structured charts for the project.
- 1) Course Registration System
- 2) Students Marks Analyzing System
- 3) Online Ticket Reservation System
- 4) Stock Maintenance
- 5) Draw the UML Diagrams for the problem 1,2, 3, 4.
- 6) Design the test cases for e-Commerce application (Flipcart, Amazon)
- 7) Design and Implement ATM system through UML Diagrams.

Text Books:

- 1) Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
- 2) Software Engineering, Ian Sommerville, Ninth Edition, Pearson.

Reference Books:

- 1) Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
- 2) Software Engineering, Ugrasen Suman, Cengage.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105182/>



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DEPARTMENT OF INFORMATION TECHNOLOGY

MINOR COURSES
PART B



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| PART B | Minor Course | L | T | P | C |
| | | 3 | 0 | 2 | 4 |
| OBJECT ORIENTED PROGRAMMING THROUGH C++ | | | | | |

Course Objectives:

- Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
- Understand dynamic memory management techniques using pointers, constructors, destructors
- Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
- Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
- Demonstrate the use of various OOPs concepts with the help of programs

Course Outcomes:

By the end of the course, the student

- Classify object oriented programming and procedural programming
- Apply C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling
- Build C++ classes using appropriate encapsulation and design principles
- Apply object oriented or non-object oriented techniques to solve bigger computing problems

UNIT I

Introduction to C++: Difference between C and C++, Evolution of C++, The Object Oriented Technology, Disadvantage of Conventional Programming, Key Concepts of Object Oriented Programming, Advantage of OOP, Object Oriented Language.

UNIT II

Classes and Objects & Constructors and Destructor: Classes in C++, Declaring Objects, Access Specifiers and their Scope, Defining Member Function, Overloading Member Function, Nested class, Constructors and Destructors, Introduction, Constructors and Destructor, Characteristics of Constructor and Destructor, Application with Constructor, Constructor with Arguments parameterized Constructor, Destructors, Anonymous Objects.

UNIT III

Operator Overloading and Type Conversion & Inheritance: The Keyword Operator, Overloading Unary Operator, Operator Return Type, Overloading Assignment Operator (=), Rules for Overloading Operators, Inheritance, Reusability, Types of Inheritance, Virtual Base Classes- Object as a Class Member, Abstract Classes, Advantages of Inheritance, Disadvantages of Inheritance.

UNIT IV

Pointers & Binding Polymorphisms and Virtual Functions: Pointer, Features of Pointers, Pointer Declaration, Pointer to Class, Pointer Object, The this Pointer, Pointer to Derived Classes and Base Class, Binding Polymorphisms and Virtual Functions, Introduction, Binding in C++, Virtual Functions, Rules for Virtual Function, Virtual Destructor.

UNIT V

Generic Programming with Templates & Exception Handling: Definition of class Templates, Normal Function Templates, Over Loading of Template Function, Bubble Sort Using Function Templates, Difference between Templates and Macros, Linked Lists with Templates, Exception Handling, Principles of Exception Handling, The Keywords try throw and catch, Multiple Catch Statements, Specifying Exceptions.



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Overview of Standard Template Library, STL Programming Model, Containers, Sequence Containers, Associative Containers, Algorithms, Iterators, Vectors, Lists, Maps.

List of Experiments:

Exercise -1 (Classes Objects)

Create a Distance class with:

- feet and inches as data members
- member function to input distance
- member function to output distance
- member function to add two distance objects

1. Write a main function to create objects of DISTANCE class. Input two distances and output the sum.
2. Write a C++ Program to illustrate the use of Constructors and Destructors (use the above program.)
3. Write a program for illustrating function overloading in adding the distance between objects (use the above problem)

Exercise – 2 (Access)

Write a program for illustrating Access Specifiers public, private, protected

1. Write a program implementing Friend Function
2. Write a program to illustrate this pointer
3. Write a Program to illustrate pointer to a class

Exercise -3 (Operator Overloading)

1. Write a program to Overload Unary, and Binary Operators as Member Function, and Non Member Function.
2. Write a c ++ program to implement overloading assignment = operator

Exercise -4 (Inheritance)

Write C++ Programs and incorporating various forms of Inheritance

- i) Single Inheritance
- ii) Hierarchical Inheritance
- iii) Multiple Inheritances
- iv) Multi-level inheritance
- v) Hybrid inheritance

Exercise -5(Templates, Exception Handling)

1. Write a C++ Program to illustrate template class
2. Write a Program for Exception Handling Divide by zero
3. Write a Program to rethrow an Exception

Exercise -6

1. Write a C++ program illustrating user defined string processing functions using pointers (string length, string copy, string concatenation)
2. Write a C++ program illustrating Virtual classes & virtual functions.
3. Write C++ program that implement Bubble sort, to sort a given list of integers in ascending order

Text Books:

- 1) A First Book of C++, Gary Bronson, Cengage Learning.
- 2) The Complete Reference C++, Herbert Schildt, TMH.



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Reference Books:

- 1) Object Oriented Programming C++, Joyce Farrell, Cengage.
- 2) C++ Programming: from problem analysis to program design, DS Malik, Cengage Learning
- 3) Programming in C++, Ashok N Kamthane, Pearson 2nd Edition

e- Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105151/>
- 2) <https://github.com/topics/object-oriented-programming>



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| PART B | Minor Course | L | T | P | C |
| | | 3 | 0 | 2 | 4 |
| DATA ANALYTICS USING PYTHON | | | | | |



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Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5th ed, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier



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| PART B | Minor Course | L | T | P | C |
| | | 3 | 0 | 2 | 4 |
| UNIX AND SHELL PROGRAMMING | | | | | |

Course Objectives:

Understanding the shell commands, shell programming, system calls of files and processes, signals, inter-process communication concepts and programming, TCP and UDP.

Course Outcomes: After finishing this course student will be able to:

- Gain good knowledge on Unix commands and awareness of shell programming
- Know about different system calls for files and directories
- Ability to know the working of processes and signals
- Application of client server program for IPC
- Knowledge about socket programming

UNIT-I:

Introduction, Architecture of unix, Responsibilities of shell, unix file system, vi editor. **Unix commands:** Some Basic Commands, file utilities, process utilities, text processing utilities, network utilities, disk utilities, backup utilities , Security by file permissions.

UNIT-II:

Shell Programming: shell variables, The Export command, The Profile File a Script Run During starting, The First Shell Script, The read command, Positional Parameters, The \$? Variable , Knowing the exit Status- More about the Set Command, The Exit command, Branching Control Structures, Loop Control Structures, The Continue and Break Statement- The Expr Command, Performing Integer Arithmetic- Real Arithmetic in Shell Programs- The here Document(<<), The Sleep Command, Debugging Scripts, The Script command, The Eval command, The Exec Command, Sample programs.

UNIT-III:

Files - Introduction, file descriptors, open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking- fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, links-soft and hard links-symlink, link, unlink.

UNIT IV:

Directories-Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions.

UNIT V:

Process Control: process identifiers, fork function, vfork function, exit function, wait and waitpid functions, exec functions, user identification. **Signals:** signal handling using signal function, kill and raise, alarm, pause, abort and sleep functions.

List of Experiments:

- 1)a) Study of Unix/Linux general purpose utility command list: man,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.
- b) Study of vi editor
- c) Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system
- d) Study of Unix/Linux file system (tree structure)
- e)Study of .bashrc, /etc/bashrc and Environment variables.



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- 2) Write a C program that makes a copy of a file using standard I/O, and system calls
- 3) Write a C program to emulate the UNIX `ls -l` command.
- 4) Write a C program that illustrates how to execute two commands concurrently with a command pipe.
Ex: - `ls -l | sort`
- 5) Implementation of `fork ()`, `wait ()`, `exec()` and `exit ()`, System calls

Text Books:

1. Unix the ultimate guide, 3rd edition, Sumitabha Das, TMH.
2. Advanced programming in the Unix environment by W. Richard Stevens.
3. Unix network programming by W. Richard Stevens.

Reference Books:

1. Introduction to Unix and shell programming, Venkateshmurthy
2. Unix and shell programming by B.M. Harwani, OXFORD university press.



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| PART B | Minor Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| CLOUD COMPUTING | | | | | |

Course Objectives:

- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

Course Outcomes: At the end of the course, student will be able to

- Illustrate the key dimensions of the challenge of Cloud Computing
- Classify the Levels of Virtualization and mechanism of tools.
- Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.
- Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud
- Assess control storage systems and cloud security, the risks involved its impact and develop cloud application

UNIT I:

Systems Modeling, Clustering and Virtualization: Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, , Performance, Security and Energy Efficiency

UNIT II:

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT III:

Cloud Platform Architecture: Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure

UNIT IV:

Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.

UNIT V:

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system.

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.



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Reference Books:

4. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madiseti, University Press
5. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
6. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH



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Suggested Courses for Honors Program



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| II Year - II Semester | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| MATHEMATICS FOR MACHINE LEARNING (AI & ML) | | | | | |

Course Objectives:

The main objectives of this course is to make student understand and apply the basic mathematical concepts that are essential for machine learning algorithms

Course Outcomes:

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

- understand the basic notions of machine learning and of the related basic mathematical tools;
- comprehend the basic concepts and techniques of convex optimization
- have a good knowledge of the statistical and computational properties of some well known machine learning algorithms;
- implement machine learning algorithms on synthetic and real data sets using mathematical concepts like linear algebra, probability and calculus

UNIT-I

Linear Algebra: Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces

UNIT-II

Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions, Orthogonal Projections, Rotations

UNIT-III

Matrix Decompositions: Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigendecomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation, Matrix Phylogeny

UNIT-IV

Vector Calculus : Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation and Automatic Differentiation, Higher-Order Derivatives, Linearization and Multivariate Taylor Series

UNIT-V

Probability and Distributions: Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Summary Statistics and Independence, Gaussian Distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform
 Continuous Optimization: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization

Text Books:

1. "Mathematics for Machine Learning", Marc Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, Cambridge University Press.
2. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2017.



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Reference Books:

1. Machine Learning: An Applied Mathematics Introduction, Paul Wilmott, Panda Ohana Publishing 2019.



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| TEXT MINING AND TIME SERIES ANALYSIS (AI & ML) | | | | | |

Course Objectives: This course will cover the major techniques for mining and analyzing text data to discover interesting patterns, extract useful knowledge, and support decision making, with an emphasis on statistical approaches that can be generally applied to arbitrary text data in any natural language with no or minimum human effort. Develop the skills needed to do empirical research in fields operating with time series data sets. The course aims to provide students with techniques and receipts for estimation and assessment of quality of economic models with time series data.

Course Outcomes:

After completing the course Student will be able to:

- Student will be aware of fundamental concepts of text mining, unsupervised information extraction.
- Student will be aware of text clustering algorithms like feature selection, distance-based clustering and latent semantic indexing.
- Student will be aware of Text classification algorithm and text mining techniques.
- Student should aware of all the characteristics of time series and measures of dependencies.
- Student will be able to understand the ARIMA Models.

UNIT I:

Introduction to Text Mining: Introduction, Algorithms for Text Mining, Information Extraction from Text: Introduction, Named Entity Recognition, Relation Extraction, Unsupervised Information Extraction. Text Summarization Techniques: Extractive Summarization, Topic Representation Approaches, Influence of Context, Indicator Representation and Machine Learning for Summarization.

UNIT II:

Text Clustering Algorithms: Introduction, Feature Selection and Transformation Methods for Text Clustering, Distance-Based Clustering Algorithms, Word and Phrase-based Clustering, Probabilistic Document Clustering and Topic Modelling. Dimensionality Reduction and Topic Modelling: Latent Semantic Indexing, Topic Models and Dimension Reduction.

UNIT III:

Text Classification Algorithms: Introduction, Feature Selection for Text Classification, Decision Tree Classifiers, Rule-based Classifier, Probabilistic and Naïve Bayes Classifiers, Linear Classifier, Proximity-based Classifier, Meta-Algorithms for Text Classification, Probabilistic Models for Text Mining: Mixture models, Stochastic Processes in Bayesian Nonparametric Models, Graphical Models.

UNIT IV:

Characteristics of Time Series: Introduction, Nature of Time Series Data, Time Series Statistical Models, Measures of Dependence: Autocorrelation and Cross-Correlation, Stationary Time Series, Time Series Regression and Exploratory Data Analysis: Classical Regression, Exploratory Data Analysis, Smoothing.

UNIT V:

ARIMA Models: Introduction, Autoregressive Moving Average Models, Difference Equations, Autocorrelation and Partial Autocorrelation, Building ARIMA Models, Multiplicative Seasonal ARIMA Models, Spectral Analysis and Filtering: Cyclical Behaviour and Periodicity, Spectral Density, Periodogram and Discrete Fourier Transform, Nonparametric and Parametric Spectral Estimation, Linear Filters, Dynamic Fourier Analysis and Wavelets.



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Text Books:

1. Charu C. Aggarwal, Chengxing Zhai, “Mining Text Data”, Kluwer Academic Publishers, Springer, 2012.
2. Robert H. Shumway and David S. Stoffer, “Time Series Analysis and Its Applications with R Examples”, Springer, 2016.

Reference Books:

1. James D. Hamilton, Time Series Analysis, Princeton University Press, 2004.
2. Avishek Pal and PKS Prakash, Practical Time Series Analysis, Birmingham - Mumbai, 2017.
3. Box, G.E.P., G.M. Jenkins and G.C. Reinsel. n Time Series Analysis, Forecasting, and Control, 3rd ed. Englewood Cliffs, NJ: Prentice Hall, 1994.
4. Chan, N.H. Time Series: Applications to Finance. 2002, New York: Wiley.
5. Fuller, W.A. Introduction to Statistical Time Series, 2nd ed. New York: Wiley, 1996.



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| NATURAL LANGUAGE PROCESSING (AI & ML) | | | | | |

Course Objectives:

- This course introduces the fundamental concepts and techniques of natural language processing (NLP).
- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes: After completion of this course

- Demonstrate a given text with basic Language features
- To design an innovative application using NLP components
- Explain a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

UNIT I:

Introduction :Origins and challenges of NLP, Language Modeling: Grammar-based LM, Statistical LM, Regular Expressions, Finite-State Automata, English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II:

Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging, Hidden Markov and Maximum Entropy models.

UNIT III:

Syntactic Analysis : Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Dynamic Programming parsing, Shallow parsing, Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs, Feature structures, Unification of feature structures

UNIT IV:

Semantics And Pragmatics: Requirements for representation, First-Order Logic, Description Logics, Syntax-Driven Semantic analysis, Semantic attachments, Word Senses, Relations between Senses, Thematic Roles, selectional restrictions, Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods, Word Similarity using Thesaurus and Distributional methods.

UNIT V:

Discourse Analysis And Lexical Resources : Discourse segmentation, Coherence, Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm, Coreference Resolution, Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill’s Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).



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Text Books:

1. Daniel Jurafsky, James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, OReilly Media, 2009.

Reference Books:

1. Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkha and Fred J. Damerau, Handbook of Natural Language Processing, Second, Chapman and Hall/CRC Press, 2010. Edition
4. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| REINFORCEMENT LEARNING (AI & ML) | | | | | |

Course Objectives:

By the end of the class students should be able to:

- Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning.
- Given an application problem (e.g. from computer vision, robotics, etc), decide if it should be formulated as a RL problem; if yes be able to define it formally (in terms of the state space, action space, dynamics and reward model), state what algorithm (from class) is best suited for addressing it and justify your answer.

Course Outcomes:

By the end of this course, students should be able to do the following:

1. Learn how to define RL problems like Tic-Tac-Toe, Multi-arm.
2. Student will be able to understand the finite markov decision processes.
3. Student will be to Understand Monte Carlo Methods and how it is work with tabular methods to solve classical control problems
4. Student should aware of Eligibility Traces and Understand how to find with approximate solutions.
5. Explore imitation learning tasks and solutions
6. Recognize current advanced techniques and applications in RL

UNIT I:

Reinforcement Learning Problem: Introduction, Elements of Reinforcement Learning, Limitations and Scope, Tic-Tac-Toe, Multi-arm Bandits: n -Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandit, Associative Search.

UNIT II:

Finite Markov Decision Processes: Agent-Environment Interface, Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation, Dynamic Programming: Policy- Evaluation, Improvement, Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming.

UNIT III:

Monte Carlo Methods: Monte Carlo- Prediction, Estimation of Action Values, Control, Control without Exploring Start, Temporal- Difference learning: TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning, Games, Afterstates.

UNIT IV:

Eligibility Traces: n -Step TD Prediction, Forward and Backward View of TD(λ), Equivalences of Forward and Backward Views, $sar(\lambda)$, Watkin's Q(λ), Off-policy Eligibility Traces using Important Sampling, Variable λ .

UNIT V:

Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting and Learning, Prioritized Sweeping, Full vs. Sample Backups, Trajectory Sampling, Heuristic Search, Monte Carlo Tree Search.



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Text Book:

1. Rich S. Sutton, Andrew G. Barto, Reinforcement Learning: An Introduction, Second Edition, MIT Press, 2015.
2. Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone parisi, Reinforcement Learning Algorithms: Analysis and Applications, 1st Edition, Springer, 2021.

Reference Books:

1. Phil Winder, Reinforcement Learning: Industrial Applications of Intelligent Agent, 1st Edition, O'Reilly, 2020.
2. Kyriakos G. Vamvoudakis, Yan Wan, Frank, L. Lewis, Derya Cansever, Handbook of Reinforcement Learning and Control, 1st Edition, Springer, 2021.

NPTEL Link: Reinforcement Learning:
https://onlinecourses.nptel.ac.in/noc22_cs34/preview



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| II Year - II Semester | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| INTERNET OF THINGS (Systems Engineering) | | | | | |

Course Objectives:

The main objectives of this course are

- Vision and Introduction to Internet of Things (IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Course Outcomes (COs):

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

- Explain in a concise manner how the general Internet as well as Internet of Things work.
- Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
- Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
- Develop prototype models for various applications using IoT technology.

UNIT I:

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT II:

Business Models for Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High-level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.



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Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things, CunoPfister , Oreilly



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| DATA COMMUNICATIONS AND INFORMATION CODING THEORY (Systems Engineering) | | | | | |

Course Objective:

The objective of this course is to introduce the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding and so on.

Course Outcomes:

The students at the end of the course will be able to:

- Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.
- Describe the real life applications based on the fundamental theory.
- Calculate entropy, channel capacity, bit error rate, code rate, steady-state probability and so on.
- Implement the encoder and decoder of one block code or convolutional code using any program language

UNIT I:

Overview; Basic Concepts - Entropy and Mutual information; Lossless Source Coding – Source entropy rate; Kraft inequality; Huffman code; Asymptotic equipartition property; Universal coding; Noisy Channel Coding - Channel capacity

UNIT II:

Random channel codes; Noisy channel coding theorem for discrete memory-less channels; Typical sequences; Error exponents; Feedback; Continuous and Gaussian channels; Lossy Source Coding - Rate-Distortion functions; Random source codes; Joint source-channel coding and the separation theorem.

UNIT III:

Source coding- Text, Audio and Speech: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding

UNIT IV:

Source coding- Image and Video: Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard

UNIT V:

Error control coding- Block codes: Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC Error control coding

Text books:

1. Mark Kelbert(Author), Yuri Suhov, Information Theory and Coding by Example, Cambridge University Press,2013



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Reference books:

1. Simon Haykin and Michael Moher, Communication Systems, 5th Edition, Wiley, 2010
2. T.M. & Thomas, J.A. (2006). Elements of information theory. New York: Wiley.
3. Ad´amek, Foundations of coding, Wiley Interscience, 1991.
4. T. M. Cover and J. A. Thomas, Elements of information theory, Wiley, 1991.



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| SERVICE ORIENTED ARCHITECTURES (Systems Engineering) | | | | | |

Course Objectives:

- To gain understanding of the basic principles of service orientation
- To learn service oriented analysis techniques
- To learn technology underlying the service design
- To learn the concepts such as SOAP, Registering and Discovering Services.

Course Outcomes: At the end of this course, students are expected to gain the following learning:

1. Get the foundations and concepts of service based computing
2. Advocate the importance and means of technology alignment with business
3. Understanding the basic operational model of web services,
4. Gain the knowledge of key technologies in the service oriented computing arena
5. Apply and practice the learning through a real or illustrative project/case study.

UNIT I

Software Architecture: Need for Software Architecture, Objectives of Software Architecture, Types of Information Technology (IT) Architecture, Architectural Patterns and Styles

Architecting Process for Software Applications: Architectural Considerations, Architecting Process for Software Applications, Level 0: High-Level Architecture, Level 1: Solution Architecture Detailed Design

UNIT II

SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA Service-oriented Architecture and Microservices architecture –Drivers for SOA, Dimensions of SOA, Conceptual Model of SOA, Standards And Guidelines for SOA, Emergence of MSA

Service-Oriented Architecture: Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process, Service-oriented Analysis and Design (SOAD) Process

UNIT III

Service-Oriented Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model

Service-Oriented Analysis and Design: Need for Models, Principles of Service Design Non-functional Properties for Services, Design of Activity Services (or Business Services) Design of Data Services, Design of Client Services, Design of Business Process Services

UNIT IV

Microservices Architecture:

Trend in SOA – Microservices Architecture (MSA): Services Model for Cloud and Mobile Solutions, API Adoption on the Rise, Challenges and Takeways from SOA Implementations Architecture Trend – Microservices Architecture, Microservices Architecture in Action

Cloud and MSA: Cloud Services, Hybrid Cloud Services, Considerations for Hybrid Cloud Services, Cloud Services and MSA, MSA for SMAC Solutions



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UNIT V

Mobile and MSA: Mobile Technologies, Types of Mobile Applications, MSA for mobile solutions Case Study: SOA – Loan Management System (LMS) PoC, MSA – APIary PoC

Text Book:

1. Shankar Kambhampaty, Service - Oriented Architecture & Microservices Architecture, 3ed: For Enterprise, Cloud, Big Data and Mobile , ISBN: 9788126564064, Wiley.
2. Mark Richards, Microservices vs Service-Oriented Architecture, O'Reilly Media, Inc., 2016.

Reference Books:

1. Thomas Erl, Services-Oriented Architecture: Concepts, Technology and Design, Prentice Hall, 2005.
2. Guido Schmutz, Peter Welkenbach, Daniel Liebhart, Service-Oriented Architecture: An Integration Blueprint, Packt Publisher, 2010.



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| DESIGN OF SECURE PROTOCOLS (Systems Engineering) | | | | | |

Course Objectives:

The main objective of this course is that to explore various protocols and design of various protocols with deeper security.

Course Outcomes:

By the end of the course Student will

- Get the exposure to various protocols.
- Gain knowledge on various secure mechanisms through set of protocols.
- Efficiently design new set of protocols.
- Learn Security issues and overcome means with protocols.

UNIT – I:

OSI:ISO Layer Protocols: Application Layer Protocols, TCP/IP, HTTP, SHTTP, LDAP, MIME, POP & POP3, RMON, SNMP. Presentation Layer Protocols, Light Weight Presentation Protocol Session layer protocols.

UNIT – II:

RPC protocols, transport layer protocols, ITOT, RDP, RUDP, TALI, TCP/UDP, compressed TCP. Network layer Protocols, routing protocols, border gateway protocol-exterior gateway protocol, internet protocol IPv4, IPv6, Internet Message Control Protocol, IRDP Transport Layer Security, TSL, SSL, DTLS

UNIT – III:

Data Link layer Protocol, ARP, In ARP, IPCP, IPv6CP, RARP, SLIP .Wide Area and Network Protocols, ATM protocols, Broadband Protocols, Point to Point Protocols, Other WAN Protocols, security issues.

UNIT – IV:

Local Area Network and LAN Protocols, ETHERNET Protocols, VLAN protocols, Wireless LAN Protocols, Metropolitan Area Network Protocol, Storage Area Network and SAN

UNIT – V:

Protocols, FDMA, WIFI and WIMAX Protocols, security issues. Mobile IP, Mobile Support Protocol for IPv4 and IPv6, Resource Reservation Protocol. Multicasting Protocol, VGMP, IGMP, MSDP .Network Security and Technologies and Protocols, AAA Protocols, Tunneling Protocols, Secured Routing Protocols, GRE- Generic Routing Encapsulation, IPSEC– Security.

Text Books:

1. Jawin: “Networks Protocols Handbook”, 3rd Edition, Jawin Technologies Inc., 2005.
2. Bruce Potter and Bob Fleck : “802.11 Security”, 1st Edition, O’Reilly Publications, 2002.

Reference Books:

1. Ralph Oppliger :“SSL and TSL: Theory and Practice”, 1st Edition, Artech House, 2009.
2. Lawrence Harte: “Introduction to CDMA- Network services Technologies and Operations”, 1st Edition, Althos Publishing, 2004.
3. Lawrence Harte: “Introduction to WIMAX”, 1st Edition, Althos Publishing, 2005



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DEPARTMENT OF INFORMATION TECHNOLOGY

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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| NETWORK CODING (Systems Engineering) | | | | | |

Course Objectives:

- Students will gain the understanding of core network programming by using sockets and transport layer protocols like TCP and UDP
- Students will gain the understanding of inter process communication and implementation of different forms of IPC in client-server environment
- Students will get an exposure to various application layer protocols which are designed using sockets and transport layer protocols

Course Outcomes:

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

- Explain the client-server paradigm and socket structures.
- Describe the basic concepts of TCP sockets and TCP echo client-server programs.
- Discuss the UDP sockets and UDP echo client-server programs.
- Explain Socket options and ability to understand IPC
- Apply the applications of sockets and demonstrate skill to design simple applications like FTP, TELNET etc.

UNIT-I:

Introduction to Network Programming: OSI model, transport layer protocols: TCP, UDP and SCTP, network architecture: client-server and peer-to-peer systems, Sockets-socket Address structures: IPv4, IPv6 and Generic-value result arguments, Byte ordering functions, Byte manipulation functions, Address conversion functions

UNIT-II:

TCP: introduction to TCP, TCP connection establishment and termination TIME_WAIT State. Elementary TCP sockets, Socket, connect, bind, listen, accept, fork, exec function, concurrent servers, Close function, read and write functions

UNIT-III:

TCP echo client server program, getsockname and getpeername functions I/O multiplexing: I/O models, Select function, TCP echo server using select function, shutdown function, Poll function

UNIT-IV:

UDP: Introduction to UDP, difference between TCP and UDP, recvfrom() and sendto() functions, UDP echo client server program, UDP echo client server using select function. Socket Options: IPv4 socket options, IPv6 socket options

UNIT-V:

Socket Options: Generic socket options, TCP socket options. IPC: Introduction to IPC, forms of IPC, UNIX kernel support for pipes, FIFO, message queues, semaphores and shared memory Network programming concepts Implementation: FTP, ping, arp, SMTP, TELNET



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Text Books:

1. Unix Network programming, the socket networking API, W.Richard Stevens, bill fenner, Andrew m.rudoff ,PHI.

References Books:

1. Advanced programming in the UNIX environment, W.Richard Stevens, pearson education



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| II Year - II Semester | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| PRINCIPLES OF CYBER SECURITY (Information Security) | | | | | |

Course Objectives:

- To learn threats and risks within context of the cyber security architecture.
- Student should learn and Identify security tools and hardening techniques.
- To learn types of incidents including categories, responses and timelines for response.

Course Outcomes: At the end of the course, student will be able to

- Apply cyber security architecture principles.
- Demonstrate the risk management processes and practices.
- Appraise cyber security incidents to apply appropriate response
- Distinguish system and application security threats and vulnerabilities.
- Identify security tools and hardening techniques

UNIT-I:

Introduction to Cyber Security-Cyber security objectives, roles, differences between information security and cyber security, Cyber security principles-confidentiality, integrity, availability, authentication and non repudiation

UNIT-II:

Information Security within Lifecycle Management-Lifecycle management landscape, Security architecture processes, Security architecture tools, Intermediate lifecycle management concepts, **Risks & Vulnerabilities**-Basics of risk management, Operational threat environments, Classes of attacks

UNIT-III:

Incident Response-Incident categories, Incident response, Incident recovery, **Operational security protection**-Digital and data assets, ports and protocols, Protection technologies, Identity and access Management, configuration management

UNIT-IV:

Threat Detection and Evaluation Monitoring-Vulnerability management, Security logs and alerts, Monitoring tools and appliances, **Analysis**-Network traffic analysis, packet capture and analysis

UNIT-V:

Introduction to backdoor System and security-Introduction to metasploit, backdoor, demilitarized zone (DMZ), Digital signature, Brief study on Harding of operating system.

Text Books:

1. NASSCOM: Security Analyst Student Hand Book, Dec 2015
2. Information Security Management Principles, Updated Edition, [David Alexander](#), [Amanda Finch](#), [David Sutton](#), BCS publishers, June 2013

Reference Books:

1. Cyber Security Fundamentals-Cyber Security, Network Security and Data Governance Security, 2nd Edition, ISACA Publishers, 2019



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| COMPUTATIONAL NUMBER THEORY (Information Security) | | | | | |

Course Objectives: This course will focus on designing efficient algorithms (and providing complexity analysis) for the most important problems from number theory, with major applications in coding theory and cryptography.

Course Outcomes:

Upon completing the course the student will be able to

- understand with basics of number theory and its applications.
- demonstrate the arithmetic of finite fields, polynomials.
- analyze the elliptic curves, testing and factorization.
- Student will be able to solve the discrete logarithms and large sparse linear systems.
- Student will be able to apply the skills for writing programs of cryptography algorithms.

UNIT I:

Arithmetic of Integers: Basic Arithmetic Operations, GCD, Congruences and Modular Arithmetic, Linear Congruences, Polynomial Congruences, Quadratic Congruences, Multiplicative Orders, Continued Fractions, Prime Number Theorem and Riemann Hypothesis, Running Times of Arithmetic Algorithms.

UNIT II:

Arithmetic of Finite Fields: Existence and Uniqueness of Finite Fields, Representation of Finite Fields, Implementation of Finite Field Arithmetic, Arithmetic of Polynomials: polynomials over Finite Fields, Finding Roots of Polynomials over Finite Fields, Factoring Polynomials over Finite Fields, Properties of Polynomials with Integer Coefficients, Factoring Polynomials with Integer Coefficients.

UNIT III:

Arithmetic of Elliptic Curves: Elliptic Curve, Elliptic-Curve Group, Elliptic Curve over Finite Fields, Pairing on Elliptic Curves, Elliptic-Curve Point Counting, Primality Testing: Introduction, Probabilistic Primality Testing, Deterministic Primality Testing, Primality Testing for Number of Special Forms.

UNIT IV:

Integer Factorization: Trial Division, Pollard's Rho Method, Pollard's $p-1$ Method, Dixon's Method, CFRAC Method, Quadratic Sieve Method, Cubic Sieve Method, Elliptic Curve Method, Number-Field Sieve Method, Discrete Logarithms: Square-Root Methods, Algorithms: Prime Fields, Fields of Characteristic Two, General Extension Fields, Elliptic Curves(ECDLP).

UNIT V:

Large Sparse Linear Systems: Structured Gaussian Elimination, Lanczos Method, Wiedemann Method, Block Methods

Text Books:

1. Abhijit Das, Computational Number Theory, CRC Hall, 1st Edition, 2013.
2. T. H. Cormen, C. E. Leiserson, R. Rivest and C. Stein, Introduction to Algorithms, Prentice Hall India, 2nd Edition, 2002.



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Reference Books:

1. Victor Shoup, A Computational Introduction to Number Theory and Algebra, 2nd Edition, Cambridge University Press, 2008.
2. R. Lidl and H. Niederreiter, Introduction to finite fields and their applications, Cambridge University Press, 2021.
3. M. Mignotte, Mathematics for computer algebra, Springer-Verlag, 1992.



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DEPARTMENT OF INFORMATION TECHNOLOGY

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| | Honors Course | 4 | 0 | 0 | 4 |
| CRYPTANALYSIS (Information Security) | | | | | |



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| | Honors Course | 4 | 0 | 0 | 4 |
| ELLIPTIC CURVE CRYPTOGRAPHY (Information Security) | | | | | |



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| | | L | T | P | C |
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| | Honors Course | 4 | 0 | 0 | 4 |
| INTRODUCTION TO QUANTUM COMPUTING AND QUANTUM CRYPTOGRAPHY (Information Security) | | | | | |



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DEPARTMENT OF INFORMATION TECHNOLOGY

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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| PUBLIC KEY INFRASTRUCTURE AND TRUST MANAGEMENT | | | | | |
| (Information Security) | | | | | |

Course objectives:

The course is designed to train the graduates in depth understanding of Public Key Cryptography, Public Key Infrastructure, security credentials and design new or modify existing cryptographic techniques.

Course Outcomes:

Graduates after completing the course shall gain:

- In depth understanding of Public key cryptography and Infrastructure.
- Ability to design and analyze Public Key cryptographic techniques.
- Ability to solve network security issues in real time applications.
- Ability to take up doctoral level research work in security.

UNIT I:

Public key infrastructure: components and architecture. PKI interoperability, deployment and assessment PKI data structures – certificates, validation, revocation, authentication, cross-certification. Repository, Certification Authority (CA) and Registration Authority (RA), trusted third party, digital certificates.

UNIT II:

PKI Services: Authentication, Integrity and Confidentiality, Mechanisms, Secure Communication, Secure Time Stamping, Non-Repudiation, Privilege Management, Certificate policies, Certificate Authority, Registration Authority.

UNIT III:

Key and Certificate Management: Key/Certificate Life Cycle Management, Certificate Revocation: Periodic Public Mechanisms, performance, Scalability and Timeliness, Multiple Key pairs, Key Pair Uses, Real-World Difficulties, Independent Certificate Management.

UNIT IV:

Trust Models: Strict Hierarchy of Certification Authorities, Distributed Trust Architecture, Web Model, User-Centric Trust, Cross-Certification, Entity Naming, Certificate Path processing, PKI Information Dissemination: Repositories and Techniques, private Dissemination, Public and Repositories, In-Band Protocol Exchange.

UNIT V:

PKI Standards: Introduction, Major Standards Activities, X.509, PKIX, X.500, LDAP, ISO TC68, ANSI X9f, S/MIME, IPsec, TLS, SPKI, OpenPGP, EDIFACT.

Text Books:

1. Carlisle Adams, Steve Lloyd, Understanding Public-Key Infrastructure: Concepts, Standards, and Deployment Considerations, Sams, 1999.
2. [John R. Vacca](#), Public Key Infrastructure, Building Trusted Applications and Web Services, Auerbach Publications, 2004.



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Reference Books:

1. Messaoud Benantar, Introduction to the Public Key Infrastructure for the Internet, Pearson Education, Prentice Hall, 2011.
2. Ashutosh Saxena, Public Key Infrastructure, Tata McGraw Hill.



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| INFORMATION SECURITY ANALYSIS AND AUDIT (Information Security) | | | | | |

Course Objectives:

- Understanding and knowledge of Security Auditing, and introduce the Threats and defense in the systems.
- Acquiring the knowledge on Evidence collection and evaluation techniques.

Course Outcomes:

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

- Illustrate the fundamental concepts of information security and systems auditing
- Analyze the latest trend of computer security threats and defense
- Identify security weaknesses in information systems, and rectify them with appropriate security mechanisms
- Explain the security controls in the aspects of physical, logical and operational security control and case studies
- Evaluate the security of information systems

UNIT-I:

Overview of Information System Auditing- Effect of Computers on Internal Controls, Effects of Computers on Auditing, Foundations of information Systems Auditing, Conducting an Information Systems Audit.

UNIT-II:

The management Control Framework-I- Introduction, Evaluating the planning Function, Leading Function, Controlling Function, Systems Development Management Controls, Approaches to Auditing Systems Development, Normative Models of the Systems Development Process, Evaluating the Major phases in the Systems Development Process, Programming Management Controls, Data Resource Management Controls.

UNIT-III:

The Management Control Framework-II- Security Management Controls, Operations management Controls Quality assurance Management Controls, Case Studies.

UNIT-IV:

Evidence Collection- Audit Software, Code Review, Test Data, and Code Comparison, Concurrent Auditing techniques, Interviews, Questionnaires, and Control Flowcharts. Performance Management tools-Case Studies.

UNIT-V:

Evidence Evaluation- Evaluating Asset Safeguarding and Data Integrity, Evaluating System, Effectiveness, Evaluating System Efficiency, Information Systems Audit and Management: Managing the Information Systems Audit Function.



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Text Book:

1. Information Systems Control and Audit, 1st Edition, Ron Weber, Pearson Education, 2013

Reference Book:

1. Information System Audit and Assurance, D P Dube, TMH, New Delhi, 2008



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| | Honors Course | L | T | P | C |
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| CLOUD AND IOT SECURITY (Information Security) | | | | | |

Course Outcomes: At the end of the course, student will be able to

- Discuss about Security Requirements in IoT Architecture
- Explain Random number generation
- Demonstrate Authorization with Publish / Subscribe schemes
- Identify Lightweight and robust schemes for Privacy protection
- Explain about IoT cloud security architecture

UNIT I:

Introduction: Securing Internet of Things: Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications. Security Architecture in the Internet of Things, Security Requirements in IoT, Insufficient Authentication /Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability, Attacks Specific to IoT. Vulnerabilities, Secrecy and Secret-Key Capacity, Authentication/Authorization for Smart Devices, Transport Encryption, Attack, Fault trees

UNIT II:

Cryptographic Fundamentals for IoT: Cryptographic primitives and its role in IoT, Encryption and Decryption, Hashes, Digital Signatures, Random number generation, Cipher suites, key management fundamentals, cryptographic controls built into IoT messaging and communication protocols.

UNIT III:

Identity & Access Management Solutions for IoT: Identity lifecycle, authentication credentials, IoT IAM infrastructure, Authorization with Publish / Subscribe schemes and access control

UNIT IV:

Privacy Preservation and Trust Models for IoT: Concerns in data dissemination, Lightweight and robust schemes for Privacy protection, Trust and Trust models for IoT, self-organizing Things, Preventing unauthorized access.

UNIT V:

Cloud Security for IoT: Cloud services and IoT, offerings related to IoT from cloud service providers, Cloud IoT security controls, enterprise IoT cloud security architecture, New directions in cloud enabled IoT computing

Text Books:

1. Practical Internet of Things Security (Kindle Edition) by Bria Russell, Drew VanDuren

References Books:

1. Securing the Internet of Things, Elsevier
2. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| WEB SECURITY (Information Security) | | | | | |

Course Objectives:

- Underlying security principles of the web
- Overview of concrete threats against web applications
- Insights into common attacks and countermeasures
- Current best practices for secure web applications

Course Outcomes: At the end of the course, student will be able to

- Demonstrate security concepts, security professional roles, and security resources in the context of systems and security development life cycle
- Justify applicable laws, legal issues and ethical issues regarding computer crime
- Explain the business need for security, threats, attacks, top ten security vulnerabilities, and secure software development
- Apply information security policies, standards and practices, the information security blueprint
- Analyze and describe security requirements for typical web application scenario

UNIT-I:

Introduction-A web security forensic lesson, Web languages, Introduction to different web attacks, Overview of N-tier web applications, Web Servers-Apache, IIS.

UNIT-II:

Securing the Communication Channel- Understanding the dangers of an insecure communication channel. Practical advice on deploying HTTPS, and dealing with the impact on your application, Insights into the latest evolutions for HTTPS deployments.

UNIT-III:

Web Hacking Basics- HTTP & HTTPS URL, Web under the Cover Overview of Java security Reading the HTML source, Applet Security Servlets Security Symmetric and Asymmetric Encryptions, Network security Basics, Firewalls & IDS.

UNIT-IV:

Securely Handling Untrusted Data-Investigation of injection attacks over time, Understanding the cause behind both server-side and client-side injection attacks, Execution of common injection attacks, and implementation of various defenses.

UNIT-V:

Preventing Unauthorized Access-Understanding the interplay between authentication, authorization and session management. Practical ways to secure the authentication process prevent authorization bypasses and harden session management mechanisms, Securing Large Applications, Cyber Graffiti.

Text Books:

1. Web Hacking: Attacks and Defense, Latest Edition , McClure, Stuart, Saumil Shah, and Shreeraj Shah, Addison Wesley, 2003
2. Professional Java Security, 1.3 Edition, Garms, Jess and Daniel Somerfield, Wrox, 2001



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| BLOCK CHAIN ARCHITECTURE DESIGN AND USE CASES (Information Security) | | | | | |

Course Objectives:

By the end of the course, students will be able to

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from block chain technology into their own projects.

Course Outcomes:

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

- Demonstrate the foundation of the Block chain technology and understand the processes inpayment and funding.
- Identify the risks involved in building Block chain applications.
- Review of legal implications using smart contracts.
- Choose the present landscape of Blockchain implementations and Understand Crypto currencymarkets
- Examine how to profit from trading crypto currencies.

UNIT I

Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain.

Evolution of Blockchain : Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.

UNIT II

Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.

UNIT III

Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.

UNIT IV

Ethereum Blockchain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, MyEtherWallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, OpenZeppelin Contracts



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UNIT V

Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chaincode Functions Using Client Application.

Advanced Concepts in Blockchain: Introduction, InterPlanetary File System (IPFS), Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

Text Books:

- 1) Ambadas, Arshad Sarfarz Ariff, Sham “Blockchain for Enterprise Application Developers”, Wiley
- 2) Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain” , O’Reilly

Reference Books:

- 1) Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
- 2) Blockchain: Blueprint for a New Economy, Melanie Swan, O’Reilly

e-Resources:

- 1) <https://github.com/blockchainedindia/resources>



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| II Year - II Semester | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| DATA VISUALIZATION (Data Science) | | | | | |

Course Objectives:

The main objective of this course is to make it easier to identify patterns, trends and outliers in large data sets

Course Outcomes:

On completion of this course, the student will be able to

- Identify and recognize visual perception and representation of data.
- Illustrate about projections of different views of objects.
- Apply various Interaction and visualization techniques.
- Analyze various groups for visualization.
- Evaluate visualizations

UNIT-I:

Introduction to Data Visualizations and Perception: Introduction of visual perception, visual representation of data, Gestalt principles, Information overload.

UNIT-II :

Visual Representations: Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

UNIT-III :

Classification of Visualization Systems: Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

UNIT-IV :

Visualization of Groups: Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization. Various visualization techniques, data structures used in data visualization.

UNIT-V :

Visualization of Volumetric Data And Evaluation of Visualizations: Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, evaluating visualizations

Text Books:

1. Ward, Grinstein, Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick, 2nd edition, A K Peters, Ltd 2015.

Reference Books:

1. Tamara Munzner, Visualization Analysis & Design ,1st edition, AK Peters Visualization Series 2014
2. Scott Murray, Interactive Data Visualization for the Web ,2nd Edition, 2017



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| | Honors Course | L | T | P | C |
| | | 4 | 0 | 0 | 4 |
| STATISTICAL FOUNDATIONS FOR DATA SCIENCE (Data Science) | | | | | |

Course Objectives:

The course will introduce the fundamental concepts of probability and statistics required for a program in data science

Course outcomes:

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

- Use the statistical concepts in the field of data science.
- Employ the techniques and methods related to the area of data science in variety of applications.
- Apply logical thinking to understand and solve the problem in context.
- Explore statistical learning methods and their application to modern problems in science, industry, and society.
- Build analytics pipelines for regression problems and classification problems

UNIT I:

Basics of Data Science: Introduction; Typology of problems; Importance of linear algebra, statistics and optimization from a data science perspective; Structured thinking for solving data science problems.

UNIT II:

Probability, Statistics and Random Processes: Probability theory and axioms; Random variables; Probability distributions and density functions (univariate and multivariate); Expectations and moments; Covariance and correlation; Statistics and sampling distributions; Hypothesis testing of means, proportions, variances and correlations; Confidence (statistical) intervals; Correlation functions; White-noise process

UNIT III:

Probabilistic formulations of prediction problems: Plug-in estimators, empirical risk minimization, Linear threshold functions, perceptron algorithm, Risk bounds, Concentration inequalities, Uniform convergence, Rademacher averages; combinatorial dimensions, Convex surrogate losses for classification, Linear regression, Regularization and linear model selection, Feature Selection Methods, Cross Validation methods.

UNIT IV:

Game-theoretic formulations of prediction problems, High Dimensional methods, Lasso, Ridge Regression, Dimensionality Reduction, Minimax strategies for log loss, linear loss, and quadratic loss, Universal portfolios, Online convex optimization.

UNIT V:

Neural networks: Stochastic gradient methods, Combinatorial dimensions and Rademacher averages, Hardness results for learning, Efficient learning algorithms.



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Text Books:

1. Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc., NY, USA, 2010
2. Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011.
3. James, G., Witten, D., Hastie, T., Tibshirani, R. An Introduction to Statistical Learning with Applications in R, Springer, 2013.

Reference Books:

1. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition, Springer, 2009.



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| | Honors Course | L | T | P | C |
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| MINING MASSIVE DATA SETS (Data Science) | | | | | |

Course Objective: The course will discuss data mining and machine learning algorithms for analyzing very large amounts of data. The emphasis will be on MapReduce and [Spark](#) as tools for creating parallel algorithms that can process very large amounts of data.

Course Outcomes:

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

- Discuss research directions in Mining Massive Datasets, such as similarity search, streaming data, clustering, and graph mining.
- Analyze policy, focusing on methods for mining massive datasets and potential policy and management applications, by synthesizing and summarizing the current state of the art, and facilitating discussion by posing questions, preliminary conclusions, and ideas to explore.
- Develop a research project relevant to Mining Massive Datasets and produce a report describing the project's background, methods, results, and conclusions.
- Knowledge of basic computer science principles and skills, at a level sufficient to write a reasonably non-trivial computer program.
- Good knowledge of Java and Python will be extremely helpful since most assignments will require the use of Spark

UNIT I:

Data Mining: Data Mining, Statistical Limits on Data Mining, MapReduce: Distributed File Systems, MapReduce, Algorithms Using MapReduce, Extensions to MapReduce.

UNIT II:

Finding Similar Items: Applications of Near-Neighbor Search, Shingling of Documents, Distance Measures, Theory of Locality-Sensitive Functions, Applications of LSH Hashing.

UNIT III:

Mining Data Streams: Stream Data Model, Sampling Data in Streams, Filtering Streams, Link Analysis: PageRank, Efficient Computational of PageRank, Link Spam, Hubs and Authorities.

UNIT IV:

Frequent Itemsets: Market-Based Model, Market Based and A-Priori Algorithm, Limited- Pass Algorithms, Clustering: Introduction, Hierarchical Clustering and K-means Algorithm, CURE Algorithm.

UNIT V:

Dimensionality Reduction: Eigenvalues and Eigenvectors, Principal-Component Analysis, CUR Decomposition, Large-Scale Machine Learning: Machine Learning Model, Perceptrons, SVM's, Nearest Neighbors.

Text Books:

1. Jure Leskovec, Anand Rajaraman, Jeffery D. ULLman, Mining of Massive Datasets, Cambridge University Press, 2014.
2. Pattern Recognition and Machine Learning. Christopher Bishop. Springer-Verlag New York. 2006.



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Reference Books:

1. Machine Learning: A Probabilistic Perspective. Kevin Murphy. MIT Press. 2012
2. The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Trevor Hastie, Robert Tibshirani, Jerome Friedman. Springer. 2013



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| | Honors Course | L | T | P | C |
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| MEDICAL IMAGE DATA PROCESSING | | | | | |
| (Data Science) | | | | | |

Course Objectives:

The course will provide the participants with an up-to-date background in current state-of-the-art in medical imaging and medical image analysis. The aim of the course is to show how to extract, model, and analyze information from medical data and applications in order to help diagnosis, treatment and monitoring of diseases through computer science.

Course Outcomes: At the End of the Course:

1. Student will be able to explain the basic concepts of Medical Imaging Technologies, Systems and Formation Principles.
2. Student will be able to analyze the Medical Image Storage and Processing.
3. Student will be able to visualize the MRI, NMR and Artifacts.
4. Student should expertise the Segmentation and Classification techniques on Medical Image Data.
5. Student will be able to analyze the Nuclear Imaging like PET, SPECT and 3D Images.

UNIT I:

Introduction: Introduction to Medical Imaging Technology, Systems, and Modalities. Brief History, Importance, Applications, Trends, Challenges. Medical Image Formation Principles: X-Ray physics, X-Ray generation, Attenuation, Scattering, Dose Basic Principles of CT, Reconstruction Methods, Artifacts, CT hardware.

UNIT II:

Storage and Processing: Medical Image Storage, Archiving and Communication Systems and Formats Picture archiving and communication system (PACS); Formats: DICOM Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Processing, Enhancement, Filtering Basic image processing algorithms Thresholding, contrast enhancement, SNR characteristics; filtering; histogram modeling.

UNIT III:

Visualization: Medical Image Visualization Fundamentals of Visualization, Surface and Volume Rendering/Visualization, Animation, Interaction. Magnetic Resonance Imaging (MRI) Mathematics of MR, Spin Physics, NMR Spectroscopy, Imaging Principles and Hardware, Image Artifacts.

UNIT IV:

Segmentation And Classification: Medical Image Segmentation, Histogram-Based Methods, Region Growing and Watersheds, Markov Random Field Models, Active Contours, Model-Based Segmentation. Multi-Scale Segmentation, Semi-Automated Methods, Clustering-Based Methods, Classification-Based Methods, Atlas-Guided Approaches, Multi-Model Segmentation. Medical Image Registration Intensity-Based Methods, Cost Functions, Optimization Techniques.

UNIT V:

Nuclear Imaging: PET and SPECT Ultrasound Imaging Methods, Mathematical Principles, Resolution, Noise Effect, 3D Imaging, Positron Emission Tomography, Single Photon Emission Tomography, Ultrasound Imaging, Applications. Medical Image Search and Retrieval Current Technology in Medical Image Search, Content-Based Image Retrieval, New Trends: Ontologies, Applications, Other Applications Of Medical Imaging Validation, Image Guided Surgery, Image Guided Therapy, Computer Aided Diagnosis/Diagnostic Support Systems.



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Text Books:

1. Paul Suetens, "Fundamentals of Medical Imaging", Second Edition, Cambridge University Press, 2009.
2. J. Michael Fitzpatrick and Milan Sonka, "Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis", SPIE Publications, 2009.

Reference Books:

1. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press, 2005.
2. Geoff Dougherty, "Digital Image Processing for Medical Applications", First Edition, Cambridge University Press, 2009.
3. Jerry L. Prince and Jonathan Links, "Medical Imaging Signals and Systems", First Edition 1, Prentice Hall, 2005.
4. John L. Semmlow, "Biosignal and Medical Image Processing", Second Edition, CRC Press, 2008.