
# School of Engineering and Applied Sciences
## B. Tech Computer Science and Engineering

## Academic Batch: 2018-2022

## Department of Computer Science Engineering
## SRM University-AP, Andhra Pradesh.

**Department of Computer Science Engineering**
**SRM University-AP**

**Semester I**

| CODE | COURSE NAME | CREDIT | L - T – P |
|---|---|---|---|
| ENL101 (HS) | Communicative English | 3 | 3-0-0 |
| MAT 112 (BS) | Mathematics - I | 3 | 3-0-0 |
| CHE101 (BS) | Principles of Chemistry | 3 | 2-0-2 |
| HSE | Humanities Elective | 3 | 3-0-0 |
| CSE 102 (ES) | Basic Computer Science and Programming | 4 | 3-0-2 |
| ECO 121 (HS) | Principles of Economics | 3 | 3-0-0 |
| CDC 111 (HS) | Soft Skills 1 | 1 | 1-0-0 |
| | Total | 20 | 18-0-4 |

**Semester II**

| CODE | COURSE NAME | CREDIT | L - T – P |
|---|---|---|---|
| MAT 121 (BS) | Multi variable Calculus | 3 | 3-0-0 |
| BIO 101 (BS) | Introduction to Biology | 3 | 2-0-2 |
| ENG 101 (ES) | Engineering Fundamentals | 3 | 3-0-0 |
| PHY 221 (BS) | Electricity and Magnetism | 3 | 2-0-2 |
| CSE 223 (ES) | Data Structures and Algorithms using C | 4 | 3-0-2 |
| ENG 111 (ES) | Basic Electronics | 4 | 3-0-2 |
| CDC 102 (HS) | Soft Skills - II | 1 | 1-0-0 |
| | Total | 21 | 17-0-8 |

**Semester III**

| CODE | COURSE NAME | CREDIT | L - T – P |
|---|---|---|---|
| MAT 211 (BS) | Linear Algebra | 3 | 3-0-0 |
| PHY 112 (BS) | Classical Mechanics | 3 | 2-0-2 |
| ENV 111 (BS) | Environmental Science | 3 | 3-0-0 |
| CSE 201 (ES) | Design and Analysis of Algorithms | 4 | 3-0-2 |
| ECE 211 (ES) | Digital Electronics | 4 | 3-0-2 |
| CDC 203 (HS) | Soft Skills 3 | 1 | 1-0-0 |
| PRJ 100 | Project Internship | 2 | 0-0-2 |
| | Total | 20 | 15-0-8 |

**Semester IV**

| CODE | COURSE NAME | CREDIT | L - T – P |
|---|---|---|---|
| MAT 141 (BS) | Discrete Mathematics | 3 | 3-0-0 |
| CSE 202 (ES) | Web Technology | 4 | 3-0-2 |
| CSE 203 (ES) | Formal Languages and Automata Theory | 3 | 3-0-0 |
| CSE 204 (ES) | Computer Organization and Architecture | 3 | 3-0-0 |
| CSE 205 (ES) | Object Oriented Programming | 4 | 3-0-2 |
| CDC 204 (HS) | Soft Skills 4 | 1 | 1-0-0 |
| CSE 230 | Industry Standard Coding Practice -1 | 2 | 0-0-4 |
| | Total | 20 | 16-0-8 |

**Semester V**

| CODE | COURSE NAME | CREDIT | L - T – P |
|---|---|---|---|
| MAT 221 (BS) | Probability and Statistics | 3 | 3-0-0 |
| CSE 301 (ES) | Operating Systems | 4 | 3-0-2 |
| CSE 303 (ES) | Computer Networks | 4 | 3-0-2 |
| CSE 304 (ES) | Database Management Systems | 4 | 3-0-2 |
| CSE 306 (ES) | Compiler Design | 4 | 3-0-2 |
| CSE 311/ CSE 312 (CE) | CS Stream Elective 1 | 4 | 3-0-2 |
| CDC (HS) | Soft Skills - 5 | P/F | 1-0-0 |
| | Total | 23 | 19-0-10 |

**Semester VI**

| CODE | COURSE NAME | CREDIT | L - T – P |
|---|---|---|---|
| MAT 131 (BS) | Differential Equations | 3 | 3-0-0 |
| CSE 305 (ES) | Software Engineering | 4 | 3-0-2 |
| CSE 313/ CSE 314/ CSE 315 (CE) | CS Stream Elective 2 | 4 | 3-0-2 |
| CSE 321/CSE 322/CSE 323 (TE) | CS Technical Elective – 1 | 3 | 3-0-0 |
| OE | Open Elective -1 | 3 | 3-0-0 |
| OE | Open Elective -2 | 3 | 3-0-0 |
| CSE 340 | UROP | 3 | 0-0-6 |
| CCC | Industry Standard Coding Practice -2 | 2 | 0-0-4 |
| | Total | 25 | 18-0-14 |

**Semester VII**

| CODE | COURSE NAME | CREDIT | L - T – P |
|---|---|---|---|
| CSE 410/<br>CSE 411/<br>CSE 412<br>(CE) | CS Stream Elective 3 | 4 | 3-0-2 |
| CSE 421/…/429 (TE) | CS Technical Elective 2 | 3 | 3-0-0 |
| OE | Open Elective- 3 | 3 | 3-0-0 |
| OE | Open Elective – 4 | 3 | 3-0-0 |
| CSE 460 | Capstone Project Phase – I | 6 | 0-0-12 |
| | Total | 19 | 12-0-14 |

**Semester VIII**

| CODE | COURSE NAME | CREDIT | L - T – P |
|---|---|---|---|
| CSE 413/<br>CSE 414/<br>CSE 415<br>(CE) | CS Stream Elective – 4 | 4 | 3-0-2 |
| OE | Open Elective 5 | 3 | 3-0-0 |
| CSE 461 | Capstone Project – Phase II | 6 | 0-0-12 |
| | Total | 13 | 6-0-14 |

# List of Stream Electives

## Artificial Intelligence and Machine Learning Stream

CSE 311 Introduction to Machine Learning
CSE 314 Digital Image Processing
CSE 410 Principles of Soft Computing
CSE 413 Artificial Intelligence

## Cyber Security Stream

CSE 312 Introduction to Cryptography
CSE 315 Network Security
CSE 411 Mobile and Wireless Security
CSE 414 Internet Protocols and Networking

## Data Science Stream

CSE 311 Introduction to Machine Learning
CSE 313 Introduction to Data Science
CSE 412 Introduction to Big Data
CSE 415 Inference and Representation

# List of Technical Electives

1. CSE 321 Data and Web Mining
2. CSE 322 Complexity Theory
3. CSE 323 Advanced Computer Architecture
4. CSE 421 Natural Language Processing
5. CSE 422 Human Computer Interaction
6. CSE 423 Distributed Operating Systems
7. CSE 424 Fog Computing
8. CSE 425 Parallel Algorithms
9. CSE 426 Web Services
10. CSE 427 Advanced Database Management Systems
11. CSE 428 Computer Graphics and Multimedia
12. CSE 429 Advanced Data Structures and Algorithms

# SYLLABUS
# SEMESTER -1

SEMESTER – I

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ENL101 (HS) | Communicative English | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Introduction to Communication is designed to help students with the principles and practice of effective oral communication skills.
2. This course will help students through formal and informal speaking activities.
3. Strategies for effective communication in social, business, and professional situations are examined.
4. In all speaking assignments, articulation and the best way to frame ideas will be covered.
5. The course objectives are for students to demonstrate an understanding of the value of rhetorical speaking skills; Paraphrase and cite research correctly; write and speak well-developed, clear, unified ideas with appropriate college-level language choices; Demonstrate a growing understanding of critical thinking in speaking, writing and in public situations.

**Course Outcomes:**

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

1 Apply composition skills to craft clear and well-structured communications
2 Composition: Communicate with clear and precise style
3 Connotation: Understand and use connotations, tone, and style.
4 Organization: Effectively organize communications.
5 Professionalism: follow established guidelines to present yourself and your work products professionally.
6 Thesis: Formulate a well-defined thesis
7 Use evidence and argument along with knowledge of your audience to present information in an engaging and persuasive way.
8 Audience: Tailor oral and written work by considering the situation and perspective of the people receiving it.
9 Confidence: Present views and work with an appropriate level of confidence.
10 Critique: Actively and critically engage with texts and other forms of communication.
11 Evidence based: Identify and appropriately structure the information needed to support an argument effectively.
12 Medium: describe, analyze, and utilize distinctive characteristics of communicative and expressive mediums at the level of form and structure.

UNIT I: RHETORIC AND PUBLIC SPEAKING

Rhetoric, Critical Thinking and Public Speaking; Thinking Outside the Box;How to Deliver a Speech; Fundamentals of Persuasion.

UNIT II: NON VERBAL COMMUNICATION

Nonverbal Communication; Spatial distance, eye contact and appearances; How nonverbal communication is more important than words.

UNIT III: COMMUNICATION AND THE MEDIA

Persuasion and the media; Radio, television, film, social media and the internet; How the media sells ideas, images, products and lifestyles; Fundamentals of Informative/Scientific Speeches and Research; The Heart of the Speech – Powerful Narratives; The Power of Narrative.

UNIT IV: SMALL GROUP COMMUNICATION

Small group communication; Leadership, conflict and persuasion in groups; The importance of small groups in business; Dr. A. Fisher's Fundamentals of Small Groups; Group Problem Solving; Learning to say no – don't say you will when you won't, don't say yes and then don't do it, be true to your word.

UNIT V: PERSUASION, IDEOLOGY AND MEDIA BIAS.

Advanced Rhetoric; Ideology; Persuasive Fallacies; How to Construct a Persuasive Speech; How to Present Scientific Data in a Speech; Unmasking Media Bias and Ideology; Full circle – the dangers of rhetoric and ideology.

**List of practical experiments:**

1 Writing Journal 1
2 Essay on Images
3 Oral Presentation
4 Writing Journal 2
5 Essay on Community

**Text Books:**

1. Communication: Principles for a Lifetime. Beebe, Beebe and Ivy, 6th Edition, Pearson Publishing.

**Reference Books:**

1. Qualitative Communication Research Methods (2011) Bryan C. Taylor and Thomas R. Lindlof. Sage Publications, New Delhi, India, 3rd Edition.
2. The Fundamentals of Small Group Communication (2008) Scott A. Myers and Carolyn M. Anderson. Sage Publications, New Delhi, India.

SEMESTER-I

| SUBJECT CODE | SUBJECT TITLE | CORE/ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 112 (BS) | Mathematics - 1 | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

Calculus is a foundational course it plays an important role in the understanding of science, engineering, economics, and computer science, among other disciplines. This introductory calculus course covers differentiation and integration of functions of one variable, with applications.

**Course Outcomes:**

After completing this course, students should demonstrate competency in the following skills:

1 Use both the limit definition and rules of differentiation to differentiate functions.
2 Sketch the graph of a function using asymptotes, critical points, the derivative test for increasing/decreasing functions, and concavity.
3 Apply differentiation to solve applied max/min problems.
4 Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus
5 Apply integration to compute arc lengths, volumes of revolution and surface areas of revolution.
6 Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
7 Determine the convergence/divergence of an infinite series and find the Taylor series expansion of a function near a point.

UNIT I: DERIVTIVES AND DIFFERENTITATION

Limit, Continuity and limits of quotients, Derivatives and its geometrical Interpretation, Derivative as a function and calculating derivative, Leibnitz notation and higher derivatives, Trigonometric functions, Linear Approximations, Product and quotient rules, Chain rule, Implicit differentiation, Inverse, exponential and logarithm functions.

UNIT II: APPROXIMATIONS AND THEIR APPLICATIONS

Measurement error of linear approximation, Quadratic approximation, Newton’s method, 1 and 2nd derivative test, Limits and asymptotic, Max min problems, Related application in real-life problems.

UNIT III: THE INTEGRAL AND INTEGRATION THEORY

Mean Value Theorem, Differentials and anti-derivatives, Differential equations, The definite integral, First and Second Fundamental Theorem of Calculus.

UNIT IV: DIFFERENT INTEGRATION TECHNIQUES AND APPLICATIONS OF CALCULUS

Areas and Volumes, Average value, Probability, Numerical Integration, Integrals of Trigonometric Power, Trigonometric substitution, Partial fractions, Integration by Parts, Arc length and Surface area.

UNIT V: POLAR CO-ORDINATE SYSTEMS AND INFINITE SERIES

Parametric curves, Polar co-ordinates, L'Hospital's rule, Improper Integrals, Infinite Series, Taylor's series.

**Text Books:**


1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, Third edition, Wiley India , 2005.
2. S. R. Ghorpade and B. V. Limaye, An Introduction to Calculus and Real Analysis,
3. Michael Spivak, Calculus, Third Edition, Cambridge University, 2008.


**Reference Books:**


1. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 3rd Ed., Pearson Education India 9th Edition 1999
2. P.M. Fitzpatrick, Advanced Calculus, 2nd Edition, AMS Indian Edition, 2010.

SEMESTER-I

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CHE 101 (BS) | Principles of Chemistry | C | 2 | 0 | 2 | 3 |

**Course Objectives:**

1. The objective of this course is to provide a basic understanding of various states of matter (gas, liquid, and solids) and the chemical bonding within.
2. To help the students to understand various fundamental concepts when they are dealing respective core engineering subjects.
3. Along the way, students learning focus on sustainability, where priority is given to environmentally friendly materials.

**Course Outcomes:**

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

1. Distinguish the types of bonding and predict the structure, electronic and magnetic properties of molecules
2. Classify the types of chemical reactions based on reaction energetics and kinetics. Also, interprets stability of materials based on the temperature, pressure and concentration variables.
3. Gain in-depth knowledge on crystalline materials and their applications in electronic devices.
4. Identify the types of polymers and familiar with industrial applications of common synthetic and biodegradable polymers.
5. Know the storage mechanism of various electrochemical cells and their applications namely electronic and e-mobility.

UNIT I: CHEMICAL BONDING (10hours)

Ionic, covalent, and metallic bonds. Theories of bonding: Valence bond theory, nature of covalent bond, sigma ($\sigma$) bond, Pi($\pi$) bond. Hybridization: Types of hybridizations, $sp^2$, $sp^3$, $sp^3d$, $d^2sp^3$. Shapes of molecules(VSEPR Theory):$BeCl_2$,$CO_2$,$BF_3$,$H_2O$,$NH_3$, $CH_4$,$PCl_5$,$XeF_2$,$SF_6$,$XeF_4$.
Molecular orbital theory: Linear combination of atomic orbitals (LCAOMethod), bond order, homo($H_2$,$O_2$,$N_2$)and hetero nuclear diatomic molecules(NO,CO). Non-covalent interactions: Vander Waals interactions, dipole-ipole interactions, and hydrogen bonding.

UNIT II: PHASE RULE AND KINETICS (8 hours)

Phase rule: Introduction, Definition of the terms used in phase rule with examples. Application of phase rule to water system, Sulphur system and lead-silver system. Kinetics: Order and molecularity of reactions, zero order, first order and second order reactions.

UNIT III: WATER TECHNOLOGY (8 hours)

Standards for drinking water, Methods of Treatment of water for domestic and industrial purposes: Sedimentation, Coagulation, Filtration, Sterilization, Break point chlorination. Determination of Hardness of water by EDTA method. Demineralization of water. Softening of water: Lime-soda Process, Ion exchange process, Zeolite process. Boiler Troubles: Priming, Foaming, Scale, Sludge, Corrosion, Caustic Embrittlement.

UNIT IV: POLYMER CHEMISTRY (9 hours)

Classification of polymers: Natural and synthetic. Thermo plastic and Thermo setting. Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tactility, Molecular weight weight average, number average and poly dispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT V: ELECTOCHEMISTRY (10 hours)

Arrhenius theory of electrolytic dissociation, classification of electrolytes; degree of Dissociation of acids, dissociation constant of weak acids, concept of PhandpOH, buffer solutions, solubility product, common ion effect, indicators and theory of acid base indicators, conductance of solutions-specific, molar and equivalent conductance, Variation of molar conductance with dilution for strong and weak electrolytes; Migration of ions-Kohlrausch's law of independent migration of ions, Ostwald's dilution law; Nernste equation for single electrode and electrochemical cells.

**List of practical Experiments:**

1. Volumetric titration of HCl vs NaOH
2. Conductometric titration of HCl vs NaOH
3. Standardization of potassium permanganate by Oxalic acid
4. Iodometric Determination of Ascorbic Acid (Vitamin C)
5. Determination of hardness of water by EDTA method
6. Determination of strength of given hydrochloric acid using pH meter
7. Estimation of iron content of the given solution using potentiometer
8. Determination of sodium and potassium by flame photometry

**Text Books:**


1. A. Bahl and B. S. Bahl, G. D. Tuli, Essentials of physical chemistry, S Chand Publication,2014, ISBN: 8121929784.P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller and F.A. Armstrong Shriver andAtkins' Inorganic Chemistry, 5th Ed., Oxford University Press, London, 2010, ISBN 978-1-42-921820-7.
2. Atkins, P.W.; de Paula, J. Physical chemistry, 8th ed., 2006 Oxford Uni+versity Press. ISBN0-19-870072-5.
3. B. R. Puri, L. R. Sharma & M. S. Pathania, Principles of Physical Chemistry, 46th Ed.,2013, Vishal Publication Company.
4. F.W. Billmeyer, Text Book of Polymer Science, 3rd Ed., John Wiley & Sons, New York,2003.

**Reference Books:**

1. J. Bard and L.R. Faulkner, Electrochemical methods –Fundamentals and Applications, 2nd
Ed., John Wiley and Sons, 2001.
Jain P.C. & Monika Jain, Engineering Chemistry, Dhanpat Roy & Sons, 2015

SEMESTER-1

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 102 (ES) | Basic Computer Science and Programming | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

1. The course is designed to get the basic knowledge in Python.
2. Decision making and functions in python.
3. Helps to learn File handling and basics OOPs concept in python.

**Course Outcomes:**

1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
2. Express different Decision Making statements and Functions.
3. Interpret object oriented programming in Python
4. Understand and summarize different File handling operations

UNIT I

Introduction to Python: Knowledge, Machines, Languages, Types, Variables Operators and Branching –- Core elements of programs: Bindings, Strings, Input/Output, IDEs, Control Flow, Iteration, Guess and Check – Simple Programs: Approximate Solutions, Bisection Search, Floats and Fractions, Newton-Raphson.

UNIT II

Functions: Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Iteration vs Recursion, Inductive Reasoning, Towers of Hanoi, Fibonacci, Recursion on non-numeric, Files

UNIT III

Tuples and Lists: Tuples, Lists, List Operations, Mutation, Aliasing, Cloning – Dictionaries: Functions as Objects, Dictionaries, Example with a Dictionary, Fibonacci and Dictionaries, Global Variables – Debugging: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– Assertions and Exceptions, Assertions, Exceptions, Exception Examples.

UNIT IV

Classes and Inheritance: Object Oriented Programming, Class Instances, Methods Classes Examples, Why OOP, Hierarchies, Your Own Types – An Extended Example: Building a Class, Visualizing the Hierarchy, adding another Class, Using Inherited Methods, Gradebook Example, Generators

UNIT V

Computational Complexity: Program Efficiency, Big Oh Notation, Complexity Classes Analyzing Complexity – Searching and Sorting Algorithms: Indirection, Linear Search, Bisection Search, Bogo and Bubble Sort, Selection Sort, Merge Sort.

**List of practical experiments:**

| | |
|---|---|
| 1 | A company decided to give bonus of 5% to employee if his/her year of service is more than 5 years. Ask user for their salary and year of service and print the net bonus amount. |
| 2 | Write a program that computes the real roots of a quadratic function. Your program should begin by prompting the user for the values of a, b and c. Then it should display a message indicating the nature of real roots, along with the values of the real roots (if any). |
| 3 | Write a Python program to find the factorial of the given number (Example : 5!= 5*4*3*2*1 =120) |
| 4 | Write a Python program to read the numbers from the keyboard using a loop, perform the sum and average of all the input numbers until "-10" is encountered. |
| 5 | Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings. |
| 6 | Write a python program for bubble sort algorithm. What is the best case and worst case time complexity of Bubble sort algorithm? Explain with an example, where the list of elements is not sorted then what would be the output after each iteration/pass. |
| 7 | Write a python program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm? |
| 8 | Write a Program in python using object oriented concept to make calculator which has the following operations:<br>Addition , Subtraction, Multiplications, Divisions, Exponentials, Modulus |
| 9 | Define is inheritance? Explain with suitable example: Single level inheritance, Multiple Inheritance, Multi-level Inheritance. |
| 10 | Write a Program in python using object oriented concept to create a base class called Polygon and there are three derived classes named as triangle, rectangle and square. The base class consists of the input function for accepting sides length and the derived classes must have output function for displaying area of triangle, rectangle and square. |

**Text Book:**


1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)


**Reference Books:**


1. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10June2017),

ISBN-10: 0199480173.
2. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher(2016).
3. Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1st edition(6th February 2009)

SEMESTER I

| SUBJECT CODE | SUBJECT TITLE | CORE/ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ECO 121 (HS) | Principles of Economics | Elective | 3 | 0 | 0 | 3 |

**Course Objectives:**

This course will provide you with a basic understanding of the principles of microeconomics. At its core, the study of economics deals with the choices and decisions we make to manage the scarce resources available to us. Microeconomics is the branch of economics that pertains to decisions made at the individual level, such as the choices individual consumers and companies make after evaluating resources, costs, and tradeoffs

**Course Outcomes:**

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

1 Analyse relevant economic concepts and economic models which inform the study of microeconomics.
2 Apply the principles of microeconomics associated with supply and demand in determining market equilibrium and the effects of price controls and elasticity.
3 Apply the principles of microeconomics associated with production and consumption in determining the behavior of individuals and producers in successful markets and situations where markets fail or contribute to income inequality.
4 Analyze market structures and apply theoretical concepts of perfect competition to identify the behavior of monopolies and imperfect competition.
5 Analyze resource markets to understand the decision-making of resource allocation and interrelationships among key markets in the economy

UNIT I: INTRODUCTION (7 hours)

Nature and scope of Economics, Principles of Economics, Production Possibility Frontier, opportunity Costs, Comparative Advantage and Scope for Trade. Demand and Supply curves, Equilibrium, Shift in curve versus movement along the curve, Elasticity of Demand and Supply. Changes in equilibrium in response to policy changes, income, tastes and supply “shocks”

UNIT II: CONSUMER BEHAVIOR (6 hours)

Consumer preferences and Indifference curve analysis – substitution, income and price effect.

UNIT III: PRODUCTION AND COST (8 hours)

Production, short- run production function and returns to factor – Average-marginal relationship, long – run production function and laws of return to scale- role of technology.
Cost function and cost structure of a firm in the short- run, long run cost function and cost structure.

UNIT IV: TYPES OF MARKETS (7 hours)

Perfect competition including shut-down and break-even points. Monopoly. Monopolistic competition and product differentiation.

UNIT V: EQUILIBRIUM IN THE SHORT, MEDIUM AND LONG RUN (10 hours)

Short-run equilibrium: The Goods market, the money market and General equilibrium (IS-LM) Medium-run equilibrium: The labour market General Equilibrium (AD-AS)Long-run equilibrium: Introduction to growth, capital accumulation and growth, technological progress and growth.

Unit VI: THE OPEN ECONOMY (IINTERNATIONAL TRADE) (7 hours)

Openness in goods and financial markets, the goods market, the financial markets and General equilibrium. Exchange rate regime

**Books of Study:**

1. Principles of microeconomics, N. Gregory Mankiw, Publisher: Cengage Learning 5th edition.
2. Macroeconomics, Oliver Blanchard and David R Johnson, Publisher: Pearson; 6$^{th}$edition.

**Books of Reference:**

1. Intermediate Microeconomics: A Modern Approach, Hal R. Varian, Affiliated East-West Press Pvt. Ltd., 8thedition.
2. Principles of Macroeconomics with Course Mate, N. Gregory Mankiw, Cengage India, 6thedition.

SEMESTER-I

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CDC 111 (HS) | Soft Skills-1 | Mandatory | 1 | 0 | 0 | P/F |

**Course Objectives:**

To Enhance holistic development of students and improve their competitive skills, life skills and employability skills.

**Course Outcomes:**

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

1. Develop interpersonal skills and will be a good team player.
2. Develop socializing, positive attitude and behavioral skills.
3. Understand their barriers of Communication and will take conscious effort to improve their skill sets.
4. Set SMART Goals for themselves and should become better in terms of Time Management

UNIT I (2 Hours)
Know Thyself, Grooming & Social etiquette, SWOT Analysis, Psychometric Analysis using simple tests.

UNIT II (4 Hours)
Personality Development, Personality construct, The KSAB Model, Components of perception, perceptual errors, perception as a precursor of attitude and behavior.

UNIT III (6 Hours)
Communication : The 3 Vs of communication: Visual or Kinesics, Vocal (Articulation), Verbal, Active listening, Barriers to listening, GARF (Giving and Receiving Feedback)

UNIT IV (4 Hours)
Presentation Skills: The four Ps of presentation, Handling different types of target audience

UNIT V: TIME MANAGEMENT & GOAL SETTING (2 Hours)
Pressure Cooker (Activity based on Planning, Organizing and Prioritization), Roller Coaster (Activity on setting SMARTER goals, planning & organizing, short & long term goals).

**Reference Books:**


1. The Perception of Deception, David Icke, David Icke Books, 2014,
2. Eye and Brain: The Psychology of Seeing, Richard, Langton Gregory, Princeton University Press, 1997
3. Awaken The Giant Within, Anthony Robbins, Pocket Books, 2001

# SYLLABUS
# SEMESTER – II

SEMESTER-II

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 121(BS) | Multi-variable Calculus | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

This is a fundamental course Student able to learn how to find double integral, triple integral& surface integral.

**Course Outcomes:**

| | At the end of the course, student will be able to |
|---|---|
| 1 | An understanding of a parametric curve as a trajectory described by a position vector; the ability to find parametric equations of a curve and to compute its velocity and acceleration vectors. |
| 2 | A comprehensive understanding of the gradient, including its relationship to level curves (or surfaces), directional derivatives, and linear approximation. |
| 3 | The ability to compute derivatives using the chain rule or total differentials. |
| 4 | In understanding of line integrals for work and flux, surface integrals for flux, general surface integrals and volume integrals. Also, an understanding of the physical interpretation of these integrals. |
| 5 | The ability to set up and compute multiple integrals in rectangular, polar, cylindrical and spherical coordinates. |
| 6 | An understanding of the major theorems (Green's, Stokes', Gauss') of the course and of some physical applications of these theorems. |

UNIT I: VECTOR AND MATRICES (15 hours)

Vectors, Dot product, Determinants; cross product, Matrices; inverse matrices, Square systems; equations of planes, Parametric equations for lines and curves, Velocity, acceleration, Kepler's second law

UNIT II: PARTIAL DERIVATIVES (16 hours)

Level curves; partial derivatives; tangent plane approximation, Max-min problems; least squares, Second derivative test; boundaries and infinity, Differentials; chain rule, Gradient; directional derivative; tangent plane, Lagrange multipliers,Non-independent variables, Partial differential equations

UNIT III: DOUBLE INTEGRAL AND LINE INTEGRALS IN THE PLANE (15 hours)

Double integrals, Double integrals in polar coordinates; applications, Change of variables, Vector fields and line integrals in the plane, Path independence and conservative fields, Gradient fields and potential functions, Green's theorem, Flux; normal form of Green's theorem, Simply connected regions

Unit IV: TRIPLE INTEGRALS IN 3D (17 hours)

Triple integrals in rectangular and cylindrical coordinates, Spherical coordinates; surface area, Vector fields in 3D; surface integrals and flux, Divergence theorem: applications and proof.

Unit V: SURFACE INTEGRAL IN 3D (12 hours)

Line integrals in space, curl, exactness and potentials, Stokes' theorem, Topological considerations, Maxwell's equations.

**Text Books:**

Edwards, Henry C., and David E. Penney. Multivariable Calculus. 6th ed. Lebanon, IN: Prentice Hall, 2002.
G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, 9th Edn., Pearson Education India, 1996.

**Reference Books:**

1. T. M. Apostol, Calculus - Vol.2, 2nd Edn., Wiley India, 2003.

SEMESTER-II

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| BIO 101 (BS) | Introduction to Biology | C | 2 | 0 | 2 | 3 |

**Course Objectives:**

1. To introduce the concept of basic biology and hands-on experiments to biological experiments.
2. To understanding of living system and its interaction with the environment.
3. To acquire knowledge, conceptual understanding and skills to solve problems and make informed decisions in scientific and other contexts.

**Course Outcomes:**

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

1 Understand the importance of biological science
2 Identify the characteristics and basic needs of living organisms and ecosystems
3 To provide thorough training in written and oral communication of scientific information
4 Understand the structure and function of prokaryotic and eukaryotic cells, as whole entities and in terms of their subcellular processes

UNIT I: BASIS OF LIFE AND DIVERSITY

Molecular evolution, Elements to molecules: water, carbohydrates, lipids, proteins, nucleic acids, vitamins and minerals.
Diversity of life: virus, bacteria, archea and eukarya. Concept of terrestrial, aquatic and amphibians. Mode of energy & carbon utilization-auto, hetero and lithothrophs.

UNIT II: CELL BIOLOGY

Cell: morphology, cell organelles and functions. Concept of unicellular and multicellular organisms.
Cell cycle and cell division: mitosis and meiosis. Basis of cell-cell communication and signaling

UNIT III: MOLECULAR BIOLOGY

DNA and Chromosomes: structure and organization, DNA replication, Transcription, Translation. Introduction to genetic engineering.

UNIT IV: ENZYMES AND APPLICATIONS

Introduction to enzymes; classification, parameters influencing the enzyme activity, mechanism of enzyme action and enzyme inhibition. Commercial applications of microorganisms and enzymes.

UNIT V: BIOLOGICAL SEQUENCES AND DATABASES

DNA and Protein sequences, Concept of genomics, transcriptomics, proteomics and metabolomics.
File formats of sequence storage: FASTA file, GenBank. Biological databases – NCBI and EMBL browsers, KEGG and UniProt databases. Usefulness of biological Metadata-Array expression and 1000 genomes. Application of BLAST and Protein/Gene ID conversion.

**List of Practical experiments**

1. Isolation of starch from potato.
2. Estimation of carbohydrates.
3. Determination of enzyme activity (amylase assay).
4. Observation of various stages of mitosis in onion root tips.
5. Isolation, purification and observation of microbes from different sources.
6. Microbial gram staining.
7. Purification of DNA, restriction digestion, agarose gel electrophoresis and visualization.
8. Isolation of proteins and determination of protein concentration using Bradford's method
9. Separation of proteins using SDS-PAGE and Coomassie staining.

**Text Books:**


1. Thrives inBiochemistry and Molecular Biology, Edition 1, 2014, Cox, Harris, Pears, Oxford University Press.
2. Exploring Proteins, Ed. 1, 2014, Price and Nairn,Oxford University Press.
3. Thrives in Cell Biology, Ed. 1, 2013, Qiuyu Wang, Cris Smith and Davis, Oxford University Press.


**Reference Books:**


1. Cooper, G.M., Housman,R.E.Thecell:amolecular approach.(2009).ASMPress,Washington D. C.
2. Lehninger,A. L., Nelson, D.L., &Cox, M. M. Lehninger principles of biochemistry. (2000). Worth Publishers, New York.
3. Wilson, K.,Walker, Principle and techniques of bio chemistry and molecular biology,(2005). 6thedn. Cambridge University Press, Cambridge.
4. Harvey Lodish, Arnold Berk and Chris A. Kaiser, Molecular Cell Biology, Ed. 8, 2016, W. H Freeman & Co (Sd).
5. Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter. 2014. Molecular Biology of the Cell. (Sixth Edition). W. W. Norton & Company.
6. Scott Freeman, Kim Quillin, Lizabeth Allison, Michael Black, Emily Taylor, Greg Podgorski and Jeff Carmichael. 2016. Biological Science. (6th Edition). Pearson.

7. Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander D. Johnson, Julian Lewis, Martin Raff, Keith Robert and Peter Walter. 2014. Essential Cell Biology. (4th Edition). W. W. Norton & Company.
8. Lisa A. Urry , Michael L. Cain , Steven A. Wasserman , Peter V. Minorsky , Jane B. Reece. 2016. Campbell Biology (11th Edition). Pearson.
9. Peter H Raven, George B Johnson, Kenneth A. Mason, Jonathan Losos and Susan Singer. 2016. Biology. (11th Edition). McGraw-Hill Education.

SEMESTER – II

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ENG 101 (ES) | Engineering Fundamentals | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

This course provides students with basic mechanical engineering concepts and workings of mechanical equipment used in everyday life, generic engineering skills and professional responsibility to others that should be integral to their University studies and later professional practice. The course is taught through using several modes including: Problem-, Project- and Experiential-Based Learning. Students learn by undertaking a design project. Oral communication also forms major component of the course. The course includes guest speakers and class demonstrations too.

**Course Outcomes:**

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

1. Gain a general understanding of major fields of mechanical engineering that the students can apply in interdisciplinary projects.
2. Demonstrate teamwork skills and engineering design process.
3. Appreciate engineering ethics and become aware of social concerns in engineering practices.

UNIT I: THERMODYNAMICS

Sources of Energy, Types of Prime Movers. Basic concepts, Microscopic and macroscopic approach. Thermodynamic system and surrounding. Properties of a system, Intensive and extensive, Specific and total quantities, Path and point functions. Thermodynamic process, cycle and equilibrium, Quasi-static, Reversible and Irreversible processes. Heat and work transfer, displacement work, flow work and other modes of work, p-V diagram, Zeroth law of thermodynamics, concept of temperature. First law of thermodynamics, energy, enthalpy, specific heats, limitations of first law, cyclic heat engine, energy reservoirs. Applications of first law, Statements of second law and their equivalence. Reversibility, Irreversibility and Causes of irreversibility. Carnot cycle, Carnot theorem, Clausius theorem, Concept of entropy.

UNIT II: HEAT ENGINES

Classification of energy sources, Introduction to fuels and combustion, Classification of fuels, calorific value, Global warming, Thermal prime movers, elementary heat engines, working substances, classification of heat engines, Heat engine cycles – Carnot cycle and its efficiency. Properties of water, ideal Rankine cycle (vapor power cycle), methods to improve Rankine cycle efficiency. Air standard cycles, Piston cylinder geometry and arrangement. Ideal Otto cycle. Ideal Diesel cycle, differences between petrol and diesel engines 2 stroke engines, differences between 2 stroke and 4 stroke engines, IC Engine components

UNIT III: FLUID MECHANICS

Introduction, Physical Properties of Fluids, Relationship Between Stress and Strain-Rate for Newtonian and Non-Newtonian Fluids.
Description of Fluid Flow, Classification of Flows-Laminar and Turbulent Flows, Measurement of viscosity.

UNIT IV: MECHANICAL ENGINEERING EQUIPMENT

Pump basics – Classification, Centrifugal, Positive displacement, Reciprocating; Compressor basics - Air compressors, compressor cycle, centrifugal, axial compressor, Refrigeration basics – vapor compression refrigeration cycle, refrigerant properties, COP; Air conditioning (AC) principle and AC ratings.
Basics of brakes, couplings and clutches: types of couplings, clutches and brakes, Basics of power transmission elements – types of belt, chain, rope and gear drive systems.

UNIT V: MATERIALS AND PROPERTIES

Engineering materials and their classification – plastics, wood, composites, ceramics, metals, fabrics, smart materials, Stress-strain relationship, tensile test, compression test, tensile vs compression test. Mechanical properties of materials, material failure

**Text Books:**


1. Elements of Mechanical Engineering, Sadhu Singh, S. Chand and Company Ltd. 2013.
2. Elements of Mechanical Engineering, V. K. Manglik, PHI Publications, 2013.
3. An Introduction to Mechanical Engineering, Jonathan Wickert, Cengage Learning India Private Limited, 3rd edition, 2015.


**Reference Books:**


1. Basic Mechanical Engineering, C.M. Agrawal, Basant Agrawal, Wiley, 2008
2. Elementary Engineering Drawing (First Angle Projection), Bhatt, N.D., Charotar Publishing Co., Anand, 1999.
3. Studying Engineering: A Road Map to a Rewarding Career, Landis, R.B., Discovery Press, (1995)
4. A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R. Sangal and G.P. Bagaria, Excel Books, 2010.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| PHY 112 | Electricity and Magnetism | C | 2 | 0 | 2 | 3 |

**Unit I**

Introduction to Vector Algebra: Gradient, Divergence and curl and their physical significances, Gauss and Stokes theorems, Vector operators in different coordinate (Curvilinear, Cartesian, Cylindrical and spherical) systems

**Unit II**

Electrostatics: Coulomb's law, Gauss law, Electric field, Electrostatic Potential, Potential energy of system of charges.
Boundary Value problems in electrostatics-solution of Laplace equation in Cartesian system, Method of image charge

**Unit III**

Dielectrics and Polarization: Electric dipole and dipole moment, Electric potential due to dipole, Electric intensity due to dipole ,Polarization P, Electric displacement D, Electric susceptibility and dielectric constant, Bound volume and surface charge densities, Electric field at an exterior and interior point of dielectric.

**Unit IV**

Magnetostatics: Biot-savart law, Ampere's law for force between two current carrying loops, Ampere's circuital law, Equation of continuity, Magnetic vector potential A, Energy density in magnetic field, magnetization of matter (B,H,M)Magnetic susceptibility and permeability, Hysteresis loss, B-H curve, Diamagnetic, paramagnetic and ferromagnetic substances.

**Unit V**

Electrodynamics: Time varying fields: Faradays law of induction, generalization of Amperes' law, Maxwell's equation (Differential and Integral form), Wave equation and plane waves in free space, Poynting theorem, Polarizations of plane wave, Microscopic form of ohm's law ($J=\sigma.E$)

**Required Book:**

1. Introduction to Electrodynamics (4rd Edition) - David J. Griffiths (Publisher - PHI Learning, Eastern Economy Editions, 2012)

2. Electricity and Magnetism (Reprints 2007, 1st Edition 2001) A. S. Mahajan, A. A. Rangwala, (Publisher - McGraw-Hill Education)

**Reference Books:**


1. Electricity and magnetism Edward M Purcell, David J Morin, "", 3rd edition, Cambridge University, 2013
2. Classical Electrodynamics (3rd Edition ) - John David Jackson (Publisher – Wiley).

SEMESTER – II

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 223 (ES) | Data Structures and Algorithms using C | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

1. The objective of the course is to teach programming (with an emphasis on problem solving) and introduce elementary data structures.
2. The student should, at a rudimentary level, be able to prove correctness (loop invariants, conditioning, etc) and analyze efficiency (using the `O' notation).

**Course Outcomes:**

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

1. Select appropriate data structure to specific problem. Implement specific operations like searching, sorting, insertion, traversing and deletion on various data structure problems.
2. Solve both linear and nonlinear data structure problems.
3. Design and analyse the complexity of the given problems.

UNIT I

Introduction to C programming, identifiers, basic data types, constants, variables, keywords, operators: arithmetic, relational and logical, increment and decrement operators, conditional operator, assignment operators, Instruction: type declaration, Input-output, conditional, loop control, Arrays, Functions, pointers, dynamic memory management functions Derived types-structures- declaration, definition and initialization of structures, accessing member of structure, arrays of structures, structures and functions, pointers to structures, self-referential structures.

UNIT II

Introduction to data structures, Stacks and Queues: representation and application, implementation of stack and queue operations using C. Linked lists: Single linked lists, implementation of link list and various operation using C, Double linked list, circular list.

UNIT III

Trees: Tree terminology, Binary tree, Binary search tree, infix to post fix conversion, postfix expression evaluation. General tree, AVL Tree, Complete Binary Tree representation.

UNIT IV

Graphs: Graph terminology, Representation of graphs, Path matrix, BFS (breadth first search), DFS (depth first search), topological sorting, Shortest path algorithms.

UNIT V

Sorting and Searching techniques – Bubble sort, selection sort, Insertion sort, Quick sort, merge sort, Heap sort, Radix sort, implementation using C. Linear and binary search methods, implementation using C, Hashing techniques and hash functions.

**List of Practical Experiments:**

1. Write a C program to find the factorial of the given number (Example: 5!= 5*4*3*2*1 =120)
2. . Write a C program to read the numbers from the keyboard using a loop, perform the sum and average of all the input numbers until "-10" is encountered.
3. Write a C program for implementation of Stack operations using arrays
4. Write a C program for implementation of Queue operations using arrays
5. Write a C program for Linked list implementations and problems related to linked list such as inverting list, concatenation, etc
6. Write a C program for Linked list based implementation of stack and queue operations
7. Write a C program for Evaluation of expressions
8. Write a C program for implementation of Binary tree traversals techniques
9. Write a C program for implementation of Graph traversals techniques (BFS and DFS)
10. Write a C program for Linear search and Binary search algorithms. What is the best case and worst case time complexity of those searching algorithms?
11. Write a C program for bubble sort algorithm. What is the best case and worst case time complexity of Bubble sort algorithm?
12. Write a C program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm?
13. Write a C program for Insertion sort algorithm. What is the worst case or average case time complexity of Insertion sort algorithm?
14. Write a C program for Quick sort algorithm. What is the worst case or average case time complexity of Quick sort algorithm?
15. Write a C program for Merge sort algorithm. What is the worst case or average case time complexity of Merge sort algorithm?

**Text Books:**


1. "Data structure using C", Aaron M. Tenenbaum, Y Langsam and Mosche J. Augenstein, Pearson publication.
2. Data structures and Algorithm Analysis in C , Mark Allen Weiss, Pearson publications, Second Edition Programming in C. P. Dey and M Ghosh ,SecondEdition,Oxford UniversityPress.
3. Programming with C, Byron Gottfried, McGraw hill Education, Fourteenth reprint,2016

**Reference Books:**


1. “Fundamentals of data structure in C” Horowitz, Sahani & Anderson Freed, Computer Science Press.
2. “Fundamental of Data Structures”, (Schaums Series) Tata-McGraw-Hill.
3. G. A. V. Pai: “Data Structures & Algorithms; Concepts, Techniques & Algorithms” Tata McGraw Hill.
4. Gilberg and Forouzan, “Data Structure- A Pseudo code approach with C” by Thomson publication

SEMESTER-II

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ENG 111 (ES) | Basic Electronics | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

The course aims at introducing the Basic Electronic Device and Circuit concepts for all first year Engineering students. Students will get an understanding and appreciation of fundamental concepts, analyzing and designing simple Electronic Circuits for practical applications with devices such as Diodes, BJT, MOSFETs, etc.

**Course Outcomes:**

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

1 Get thorough understanding of fundamental concepts behind operation of basic Electronic devices and circuits in day to day applications
2 Analyze and design simple circuits with basic electronic devices
3 Analyze and design simple electronic circuits.

4 Have a project based learning through a course project as part of the evaluation and can learn to make a PCB

UNIT I: ELECTRICAL QUANTITIES AND THEIR MEASUREMENT (9 hours)

Ohm's law, permanent magnet moving coil (PMMC) instrument, Ammeter and Voltmeter using PMMC, Measurement of resistance using Wheat Stone's Bridge and Kelvin's double bridge, measurement of capacitance using Schering's bridge and De Sautee's bridge, and measurement of inductance using Maxwell's bridge and Hay's bridge. Operation of the oscilloscope.

UNIT II: SEMICONDUCTOR DEVICES (9 hours)

Forward and reverse bias characteristics of PN junction diode. Design of half-wave, full wave, bridge rectifiers, clipping and clamping using PN junction diode. Bipolar junction transistors (BJTs), common-base, common-collector and common-emitter configurations using BJTs. Voltage and current gain, transistor as amplifier and buffer. Photodiode and phototransistor.

UNIT III: A.C. CIRCUITS AND OPERATIONAL AMPLIFIER (9 hours)

Phasor analysis, impedance and reactance, resonance, tuned circuits using R-L-C components, series reactance and resistance, parallel reactance and resistance. Characteristics of an operational amplifier, inverting and non-inverting op-amps, integrator and differentiator design using op-amp. Differential operational amplifier and common mode rejection ratio.

UNIT IV: ELECTRONIC FILTERS (9 hours)

Low and high frequency noise in electronic circuits, basic low-pass, high-pass, band-pass and band-reject passive filters design using resistor, capacitor and inductor. Fourier transform, magnitude and phase response, bandwidth, bode plots. Design and analysis of higher order filters. Active filter design using operational amplifier, applications of electronic filters.

UNIT V: DIGITAL LOGIC FUNDAMENTALS (9 hours)

Number systems: binary, decimal, octal and hexadecimal number systems, number system conversions. Logic gates: AND, OR, NOT, NAND, NOR, X-OR, X-NOR. Logic gates design using PN diodes. De Morgan's laws, Karnaugh maps. Basic combinational logic blocks: half adder, half subtractor, full adder, full subtractor, multiplexer and de multiplexer.

**List of Practical Experiments:**

1 Verification of KCL, KVL and Ohm's Laws

2 Analysis of a Given Circuit with Resistors and Sources and Verification

3 Verification of PN Junction Diode I-V Characteristics in FB and RB Operation

4 Diode based Rectifier Circuits

5 Introduction to PCB design

6 Diode based Clipper and Clamper Circuits

7 Zener Diode As Voltage Regulator

8 BJT CE Configuration Input and Output Characteristics

9 MOSFET CS Configuration Input and Output Characteristics

10 MOSFET Single stage CS Amplifier Frequency Response

**Text Books:**


1. Principles of electronics by V K Mehta & Rohit Mehta, 2010 edition, S Chand and Co. Publisher, ISBN: 9788121924504.
2. Electronic devices and circuits by David A. Bell, 2008 edition, Oxford University Press, ISBN: 9780195693409.
3. Introduction to digital logic design by John P. Hayes, 1993 edition, Pearson Edition, ISBN: 9780201154610.


**Reference Books:**


1. Electronic measurements and Instrumentation by A K Sawhney, 2015 edition, Dhanpat Rai and Co., ISBN: 9788177001006.
2. Pulse, Digital and Switching waveforms by Mill man and Taube, 2011 edition, Tata McGraw Hill, ISBN: 9780071072724.

SEMESTER – II

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CDC 102 (HS) | Soft Skills - 2 | Mandatory | 1 | 0 | 0 | P/F |

**Course Objectives:**

The most conspicuous perceptual error is the thought that personality is confined to physical appearance alone. Personality is a complete package of an individual's identity; it is infact a person's reality. The development of one's personality is essential for having an impressive image both in the personal & professional areas to create an electrifying impact and a lasting impression.

**Course Outcomes:**

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

1 Develop Positive attitude and Self Motivated attitude.
2 Develop Lateral thinking skills and understand its importance.
3 To work in a Team dynamics.

UNIT I: MOTIVATION (3 Hours)

Soldiers' Walk and The Japanese Fan (Activities on factors of motivation), Steps to ward off de-motivation

UNIT II: CREATIVITY & INNOVATION (3 Hours)

Short Film: Students would be encouraged to make a ten-minute documentary on various topics to enhance the power of aesthetics and precision. This activity is aimed at creating an interest in research and think out of the box.

UNIT III: CRITICAL & LATERAL THINKING (3 Hours)

Fill Me Up, Stimulating Lateral Thinking, The Curious Case of Mary and Kevin (Activities triggering the different types of thinking), The Creative Collage. Critical and lateral thinking can be inculcated with a structured re programming of the neural pathways. These specially designed activities will enhance critical and lateral thinking

UNIT IV: TEAM DYNAMICS (3 Hours)

Story boarding, Frenzy, come to my Island, Striking Cars, Defend the Egg, Tallest Tower (Activities on the different stages of team building, team communication, coordination and collaboration)

Unit V: MINI PROJECT (2 Hours)

Individual projects on topics provided by faculties.

# SYLLABUS
# SEMESTER-III

SEMESTER-III

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 211 (BS) | Linear Algebra | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To emphasize the topics that will be useful in other disciplines, including systems of equations, vector spaces, determinants, eigenvalues, similarity, and positive definite matrices.
2. To make students understand the central ideas of linear algebra like solving linear equations performing matrix algebra, calculating determinants, finding eigenvalues and eigenvectors

**Course Outcomes:**

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

1 Solving systems of linear equations is a basic tool of many mathematical procedures used for solving problems in science and engineering
2 The main aim of this course is to make students understand the central ideas of linear algebra like solving linear equations
3 performing matrix algebra, calculating determinants, finding eigenvalues and eigenvectors

UNIT I (15 hours)

Vector Space: Elimination, LU factorization, null-spaces and other subspaces, bases and dimensions, vector spaces, complexity

UNIT II (16 hours)

Factorization: Orthogonality, projections, least-squares, QR, Gram–Schmidt, orthogonal functions

UNIT III (15 hours)

Matrices: Eigenvectors, determinants, similar matrices, Markov matrices, ODEs, symmetric matrices, definite matrices,

UNIT IV (17 hours)

Iterative methods: Defective matrices, SVD and principal-components analysis, sparse matrices and iterative methods, complex matrices, symmetric linear operators on functions.

UNIT V (12 hours)

Applications: Matrices from graphs and engineering.

**Text Books:**

1. G. Strang, Linear Algebra and Its applications, Nelson Engineering, 4th Edn., 2007
2. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall of India, 1996

**Reference Books:**

1. S. Axler, Linear Algebra Done Right, 2nd Edn., UTM, Springer, Indian edition, 2010.
2. G. Schay, Introduction to Linear Algebra, Narosa, 1997.

SEMESTER – III

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| PHY 112 (BS) | Classical Mechanics | C | 2 | 0 | 2 | 3 |

**Course Objectives:**

The course aims to cover the fundamental formalism and applications of classical mechanics. It mainly includes basic Newtonian mechanics and introduction to special theory of relativity.

**Course Outcomes:**

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

1. apply the fundamental concepts of mechanics such as force, energy, momentum etc. more rigorously as needed for further studies in engineering and technology.
2. students' physical intuition and thinking process through understanding the theory.
3. model simple mechanical systems by correlating it to the real-world practical problems.

UNIT I: REVIEW OF NEWTONIAN MECHANICS

Review of Scalars, Vectors, Kinematics: Equations of motion for constant acceleration and non-constant acceleration. Dynamics: Contact forces, Static friction, kinetic friction and worked examples. Free body force diagram; Applications of Newton's law, Worked examples, Tension, Pulley systems, worked examples, Solving various pulley systems using free body force diagram and Newton's law.

UNIT II: CIRCULAR MOTION

Polar Coordinates; conversion between Cartesian and polar coordinates, Angular position, velocity and acceleration, Angular motion for a constant angular acceleration, Radial and tangential acceleration, uniform Circular Motion, Period and Frequency, Free body force Sdiagrams.
Application of Newton's law in circular motion with worked examples. Worked examples, conversion from revolution per minute to angular Velocity, worked examples, Flat curved roads and Banking, Conical pendulum, circular motion in vertical plane.

UNIT III: MOMENTUM AND IMPULSE

Momentum and Impulse, Impulse momentum theorem, Average force, Worked examples, Conservation of Momentum, Momentum Diagrams, Worked examples, Center of Mass of point objects and continuous systems, worked examples, enter of Mass of a Uniform Rod, rectangular sheet and different objects.
Motion of the Center of Mass; Velocity and Acceleration of the Center of Mass, education of a System to a Point Particle, Center of Mass Trajectory, projectile blast problem.

UNIT IV: WORK ENERGY AND COLLISION

Kinetic Energy and Work in 1D, 2D and 3D; Work by a Constant and a non- Constant Force.
Work-Kinetic Energy Theorem and worked examples. Conservative and Non-conservative Forces with examples, Potential Energy due to gravity and Potential Energy of a spring.
Principle of energy conservation; worked examples. Collision and its type. Collision in 1D and 2D, Elastic and inelastic collision; worked examples.

UNIT V: ROTATIONAL MOTIONS, GRAVITATION

Rigid body, Rotational Motion, moment of inertia. Moment of inertia of various objects, worked examples, Parallel and perpendicular axis theorem. Torque and Angular momentum, conservation of angular momentum, worked examples.
Rolling motion, worked examples, Conservation of energy in rotational motion. Central forces, Newton's Law of Gravitation. Acceleration due to gravity and its variation, Gravitational Potential Energy.

**List of Experiments:**

1. Experimental data analysis
2. Error Analysis
3. Revisions of Vernier caliper
4. Revisions of Screw Gauge
5. Determination of Young's modulus of the material
6. Determination of rigidity modulus of the material - torsional pendulum
7. Determine moment of inertia of a flywheel
8. Determination of spring constant
9. Compound Pendulum
10. Determination of velocity of Sound in a medium
11. Determination of thermal conductivity of a given material
12. Measurement of specific heat capacity of any given material
13. Verification of Stefan`s Law
14. Determination of Joule's Constant

**Text Books:**


1. MIT-- 8.01X online course material.
2. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited)


**Reference Books:**


1. University Physics with Modern Physics with Mastering Physics, (12th Edition) - Hugh
2. D. Young, Roger A. Freedman and Lewis Ford (Publisher – Pearson Education).
3. Laboratory manuals.

SEMESTER – III

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ENV 111 (BS) | Environmental Science | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To provide an integrated, quantitative and interdisciplinary approach to the study of environmental systems.

**Course Outcomes:**

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

1 How to find sustainable solutions to various environmental issues?
2 Understand the ecological systems and different material cycles
3 Recognize the role of policies/laws on environmental conservation

UNIT I

Environment: Structure and functions in an ecosystem; Ecological succession; Ecological pyramids; Biosphere; Ecological systems and cycles – carbon cycle, water cycle, phosphorous cycle, nitrogen cycle, oxygen cycle; Broad nature of chemical composition of plants and animals; Natural resources covering renewable and non-renewable resources, forests, water, minerals, food and land; Energy sources, growing energy demands

UNIT II

Environmental Pollution: Structure and composition of atmosphere. Pollution – air, water, soil, thermal and radiation. Effects – acid rain, ozone layer depletion and greenhouse gas emission. Control measures. Determination of water and air quality – BOD, COD, TDS, AQI.

Unit III

Environmental Biotechnology: Environmental microbiology; Biomarkers; Biosensors; Biofuels; Biotransformation; Bioremediation, factors affecting bioremediation; Molecular Ecology

Unit IV

Biodiversity and its conservation: Biodiversity hotspots; Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; threats to biodiversity – habitat loss, poaching of wildlife; in-situ and ex-situ conservation.

Unit V

Environmental protection and sustainability: Problems related to urban living, waste management, climate change, sustainable solutions, environmental regulation, and environmental protection acts in India and environmental ethics

**Text Books:**


1) Basu. M, Xavier. S. "Fundamentals of Environmental Studies", 1st edition, Cambridge University Press, 2016.
2) Raina. M. Maier, Ian L. Pepper, Charles. P. "Environmental Microbiology" 2nd edition, Academic Press, 2004.


**Reference Books:**


1. Danial. D. C. "Environmental Science", 8th edition, Jones and Barlett Publishers, MA, 2010.

**Semester – III**

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 201 (ES) | Design and Analysis of Algorithms | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

1. To develop proficiency in problem analysis and choosing appropriate solving technique.
2. To be able to analyse Time and Space Complexity of algorithms and recurrence relations.
3. To develop basics for advanced applications in Computer Science.
4. Use and implement the fundamental abstract data types – specifically including Hash tables, Binary search trees, and Graphs – necessary to solve algorithmic problems efficiently.
5. Demonstrate the following abilities: to evaluate algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in simple programming contexts.
6. To understand the nature of NP problems and get familiar with Approximation algorithms.

**Course Outcomes:**

By the end of this course, the students will be able

1 To develop proficiency in problem analysis and choosing appropriate solving technique.
2 To be able to analyse Time and Space Complexity of algorithms and recurrence relations.
3 To develop basics for advanced applications in Computer Science.
4 Use and implement the fundamental abstract data types – specifically including Hash tables, Binary search trees, and Graphs – necessary to solve algorithmic problems efficiently.
5 Demonstrate the following abilities: to evaluate algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in simple programming contexts.
6 To understand the nature of NP problems and get familiar with Approximation algorithms.

UNIT I

Algorithmic thinking & motivation with examples, Reinforcing the concepts of Data Structures with examples. Complexity analysis of algorithms: big O, omega, and theta notation, Analysis of Sorting and Searching, Hash table, Recursive and non-recursive algorithms.

UNIT II

General Problem Solving (GPS) techniques:
Divide and conquer: Merge sort, Quicksort, BST, Master method for Complexity analysis
Greedy method: Fractional Knapsack, Minimum spanning trees (Prim's & Kruskal's), Shortest paths: Dijkstra's algorithm, Huffman coding
Dynamic Programming: 0/1 Knapsack, All-to-all shortest paths

UNIT III

BFS & DFS, Backtracking: 8-Queens problem, Knights tour, Travelling Salesman Problem (TSP), Branch-and-bound: 16-puzzle problem, TSSP, Randomized algorithms: Playing Cards, Scheduling algorithms.

UNIT IV

Pattern matching algorithms: Brute-force, Boyer Moore, KMP algorithms.
Algorithm analysis: Probabilistic Analysis, Amortized analysis, Competitive analysis.

Unit V

Non-polynomial complexity: examples and analysis, Vertex cover, Set cover, TSP, 3-SAT
Approximation Algorithms: Vertex cover, TSP, Set cover

**List of Practical Experiments:**

1. Implement two different programs with different time complexities to find the sum= $1+X+X^2+X^3+….+X^n$
2. Implement two different programs with different time complexities to find theprefix averages. The i-th prefix average of an array X is average of the first (i + 1) elements of X:
   $$A[i]= (X[0] + X[1] + … + X[i])/(i+1)$$
3. Selection sort, Insertion sort, Heap sort
4. OOP: Let us play cards
5. Creating singly linked list +Hash table as a set of linked lists
6. Towers of Hanoi (Recursive& Non-recursive)

Divide-and –Conquer

7. Binary search
8. Merge sort
9. Quick sort
10. $K^{th}$ largest number

Greedy method

11. Fractional Knapsack
12. Minimum-spanning tree
13. One-to all shortest paths

Dynamic Programming

14. All-to-all shortest paths
15. 0/1 knapsack
16. Transitive closure/ Reachability problem

Backtarcking& Branch and bound

17. Eight queens' problem
18. 16-puzzle
19. TSP approximation algorithm
20. Vertex cover: Approximate algorithm

Pattern Matching

21. Pattern Matching: Brute force
22. Pattern Matching: Boyer Moore
23. Pattern Matching: KMP

**Books of Study:**

Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", 3rd Edition, MIT press, 2009 Parag Dave & Himanshu Dave, "Design and Analysis of Algorithms", Pearson Education, 2008

**Reference Books:**

Michel Goodrich, Roberto Tamassia, "Algorithm design-foundation, analysis & internet examples", Wiley., 2006A V Aho, J E Hopcroft, J D Ullman, "Design and Analysis of Algorithms", Addison-Wesley Publishing. Algorithm Design, by J. Kleinberg and E. Tardos, Addison-Wesley, 2005 Algorithms, by S. Dasgupta, C. Papadimitriou, and U. Vazirani, McGraw-Hill, 2006

SEMESTER – III

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ECE 211 (ES) | Digital Electronics | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

The course aims at introducing the Digital logic devices and their applications for Electrical, Electronics and Computer science Engineering students. Students will get an understanding and appreciation of fundamental logic concepts, analyzing and designing combinational and sequential logic circuits for practical applications with logic devices at IC level.

**Course Outcomes:**

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

1. Perform conversions among decimal, binary, octal, BCD & hexadecimal number systems.
2. Analyze, design and apply combinational and sequential logic circuits such as adders, multiplexers, decoders, counters and registers.
3. Design and utilize memory devices such as RAM, ROM, PROM, etc
4. Design an ALU and data path for a given register transfer requirements using gates and components.

UNIT I

Digital Systems and Binary Numbers: Digital Systems – Number systems and base conversions – Representation of signed Binary Numbers – Binary codes – Logic gates.

UNIT II

Boolean Algebra: Introduction to Boolean Algebra – Axioms and Laws of Boolean Algebra – Boolean functions – Canonical and Standard Forms. Gate – Level Minimization: Introduction Two, Three, Four Variable K-map's – Don't Care Conditions – NAND and NOR Implementation

UNIT III

Combinational Logic: Introduction to combinational logic circuits – Binary adder and subtractor – Look Ahead Carry Adder - Magnitude comparator – Decoders – Encoders – Multiplexers – DE multiplexers.

UNIT IV

Synchronous Sequential Logic: Introduction to sequential circuits – Latch – Flip Flop – SR, JK, T, D Flip Flops – Flip Flop excitation tables. Analysis of clocked sequential circuit, Registers and Counters: Registers – Shift registers – Ripple counters – Synchronous counters – Other counters.

UNIT V

Memory and Programmable Logic: Introduction to Programmable Logic Devices(PLD's) Programmable ROM(PROM) – Programmable Logic Array(PLA) – Programmable Array Logic(PAL).

**List of Practical Experiments:**

1. Realization of Basic Logic Gates
2. Design of Code Converters (Binary to Gray) & (Gray to Binary)
3. Design of
   a) Half-Adder/Subtractor
   b) Full-Adder/Subtractor
   c) Multiplexers/De Multiplexers
   d) ALU Design
4. Design of Decoder and Encoder/ BCD 7SSD
5. Design of Magnitude Comparator (2-bit)
6. Design and Verification of Flip-Flops using IC
7. Design of Asynchronous Counter (Any Mod, Up and Down, Jhonson and Ring )
8. Design of Synchronous Counter (Any Mod, Decade counter 74ls90)
9. Design of Universal Shift Register (Serial to Parallel, Parallel to Serial, Serial to Serial and Parallel to Parallel Converters)
10. Design & Verification of Memory (SRAM)
11. FSM Based Design Project.

**Books of Study:**


1. Digital Design with an Introduction to the Verilog HDL by M. Moris Mano and MichaelD. Ciletti, 5th Edition.
2. Digital Principles and Applications by Leach, Paul Malvino, 5th Edition.


**References:**


1. Fundamentals of Digital Logic Design by Charles H.Roth, Jr. 5th Edition, Cengage
2. Digital Electronics by G.K. Kharate, Oxford University Press 3.
3. Switching Theory andLogic Design by A. Anand Kumar, PHI, 2nd Edition.

SEMESTER – III

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CDC 201 (HS) | Soft Skills - 3 | C | 1 | 0 | 0 | 1 |

**Course Objectives:**

To Enhance holistic development of student's mathematical techniques and problem solving skills which are required for their carrier building

**Course Outcomes:**

By the end of the course, students will be able to .

1 Get equipped with basic numerical ability
2 Apply numerical competence to real life problems
3 Operational strategy using logic and reasoning.
4 Execute a new model integrating quantitate aptitude
5 Get equipped with basic English grammar

UNIT I: QUANTITATIVE REASONING

Number properties, Percentage, Ratio and proportion, Profit and loss, Simple and compound interest, Averages, Speed, Time and work, Powers and roots, Linear equations, Quadratic equations, Pipes, cisterns.

UNIT II: VERBAL REASONING

Proposition, Premise: Syllogism: Verbal Analogies, Verification of truth of the statement, Assertion and reason, Situation reaction test, Decision making, Alpha-numerical sequence puzzle

UNIT III: VERBAL ABILITY

Preposition, Articles, Adverbs, Adjectives, Conjunctions and Parallel Structures

UNIT IV: DATA ANALYSIS AND INTERPRETATION

Statistics: Average, Median, Mode, Range, Standard deviation,

**Text Book:**


1. R.S. Agarwal, A Modern Approach to Verbal & Non Verbal Reasoning, S. Chand Publication
2. P. Anand, Quantitative Aptitude, Wiley, 2015

# SYLLABUS
# SEMESTER – IV

SEMESTER – IV

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 141 (BS) | Discrete Mathematics | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

The objective is to equip the students with the mathematical definitions, proofs and applicable methods

**Course Outcomes:**

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

1 To appreciate the basic principles of Boolean algebra, Logic, Set theory
2 Permutations and combinations and Graph Theory.
3 Be able to construct simple mathematical proofs
4 Be able to understand logical arguments and logical constructs. Have a better understanding of sets, functions, and relations
5 Acquire ability to describe computer programs in a formal mathematical manner

UNIT I: THE FOUNDATIONS LOGIC AND PROOFS (10 hours)

Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

UNIT II: SET THEORY (5 hours)

Laws of set theory, Set Operations, Functions, Sequences and Summations, Matrices.

UNIT III: ELEMENTARY NUMBER THEORY, INDUCTION AND RECURSION (10 hours)

Divisibility and Modular Arithmetic, Integer Representations and Algorithms, Primes and Greatest Common Divisors, Solving Congruence's; Mathematical Induction, Strong Induction and Well- Ordering, Recursive Definitions and Structural Induction.

UNIT IV: COUNTING PRINCIPLES (9 hours)

The Basics of Counting, the Pige on hole Principle, Permutations and Combinations, Binomial Coefficients and Identities, Applications of Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations.

UNITV: NTRODUCTION TO GRAPH THEORY (11 hours)

Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Eulerand Hamilton Paths, Shortest-Path Problems.

**Books of Study:**


1. Kenneth H. Rosen, Discrete Mathematics and Applications, Seventh edition, Tata McGraw-Hill,2012.
2. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.


**References:**


1. S.Lipschutz and M.L.Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics,3rd Ed., Tata McGraw-Hill, 1999.
2. M. K. Venkataraman, N. Sridharan, and N. Chandrasekaran, Discrete Mathematics, National Publishing Company, 2003.

SEMESTER – IV

| SUBJECT CODE | SUBJECT TITLE | CORE/ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 202 (ES) | Web Technology | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

On completion of this course, students will be familiar with client server architecture, HTML and XML technologies and able to develop a web based application using java technologies. Students will gain the skills and project-based experience needed for design and development of web applications.

**Course Outcomes:**

1. Students will be able to develop a dynamic webpage by the use of JavaScript and DHTML.
2. Students will be able to write a well formed / valid XML document.
3. Students will be able to connect a java prog
4. Students will be able to create simple web services

UNIT I

Introduction to WWW: Protocols and programs, secure connections, application and development tools, the web browser
Web Design: Web site design principles, planning the site and navigation
Introduction to XHTML- Editing XHTML, First XHTML Example, W3CXHTML Validation Service, Headers, Linking, Images, Special Characters and More Line Breaks, Unordered Lists, Nested and Ordered Lists, Internet and World Wide Web Resources.

UNIT II

Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2.
JavaScript: Functions- Introduction, Program Modules in JavaScript, Programmer-DefinedFunctions, Function Definitions, Random-Number Generation, Example: Game of Chance, Duration of Identifiers, Scope Rules, JavaScript Global Functions, Recursion, Example Using Recursion: Fibonacci Series, Recursion vs. Iteration, JavaScript Internet and World Wide Web Resources. JavaScript arrays, JavaScript objects.

UNIT III

Dynamic HTML: Object Model and Collections- Introduction, Object Referencing, Collections all and children, Dynamic Styles, Dynamic Positioning, Using the frames Collection, navigator Object, Summary of the DHTML Object Model, Dynamic HTML; Event Model- Introduction Eventon click, Event on load, Error Handling with on error, Tracking the Mouse with Event onmousemove, Rollovers with onmouseover and onmouseout, Form Processing with on focus and on blur, More Form Processing with on submit and on reset, Event Bubbling, More DHTML Events. Dynamic HTML

Filters and transitions, Dynamic HTML Data binding with tabular data control, Structured graphics and active X control.

UNIT IV

Extensible Markup Language (XML)- Introduction, Structuring Data, XML Namespaces, Document Type Definitions (DTDs) and Schemas, Document Type Definitions, W3C XMLSchema Documents, XML Vocabularies, Document Object Model (DOM), DOM Methods, Simple API for XML (SAX), Extensible Style sheet Language (XSL), Simple Object Access Protocol (SOAP), Internet and World Wide Web Resources,

UNIT V

Web Servers (IIS, PWS and Apache)- Introduction, HTTP Request Types, SystemArchitecture, Client-Side Scripting versus Server-Side Scripting, Accessing Web Servers.
Multimedia, PHP, String Processing and Regular Expressions, Form processing and Business logic, Dynamic content, Database connectivity, Applets and Servlets, JDBC connectivity, JSPand Web Development Frameworks.
Introduction to web services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client Describing Web Service, SOAP & REST with Example.

**List of practical experiments:**

| | |
|---|---|
| 1 | Familiarize all the basic HTML tags. |
| 2 | Implement a static HTML personal webpage by using all the possible basic tags. [Each student can develop his own bio-data page] |
| 3 | To create an html file to link to different html page which contains images, tables, and also link within a page use Frames, Forms, etc. also. |
| 4 | Create an HTML file by applying the different styles using inline, external and internal style sheets. |
| 5 | a) Create an html page to change the background color for every click of a button using Java script.<br>b) write a Java script program to define a user defined function for sorting the values in an array.<br>c) Create an html page with 2 combo box populated with month & year, to display the calendar for the selected month & year from combo box using javascript. |
| 6 | Develop a webpage with HTML and Java Script to read name and marks of five subjects obtained for that particular student using forms. Further, it should compute the Grade and display it as a message box. |
| 7 | Create a form to collects the name, email, user id, password and confirms password from the user. All the inputs are mandatory and email address should be entered in standard format. Also, the values entered in the password and confirm password textboxes should be the same. For the security reasons make sure that the password entered by the contains both small letters and capital letters, digits, special symbols also. If the given password does not contain all these give an error message to the user. After validating all the details using JavaScript display a message like “You have successfully entered all the details”. |

| | |
|---|---|
| 8 | Design an XML document to store information about the student of SRM University AP. The information must include Roll No, Name, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document. |
| 9 | Develop a registration form with various graphical user component interfaces like Text boxes (Roll No), Text boxes (Name) option buttons (gender), Qualification (Check boxes), State (Combo), etc. and store the information given by the user into a MySql database using JSP. |
| 10 | Develop a webpage to display the details of a student. For this the user will enter Roll Number in the text box given and the details of that particular student should be retrieved from the database and display it on the same webpage. Use JSP to solve this problem. |

**Reference Books:**


1. Deitel, Deitel and Nieto, Internet and Worldwide Web - How to Program, 5th Edition, PHI, 2011.
2. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education
3. Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001. 4. Bates, "Developing Web Applications", Wiley, 2006.
4. Kalin, Martin. Java Web Services: Up and Running: A Quick, Practical, and Thorough Introduction. " O'Reilly Media, Inc.", 2013.

SEMESTER – IV

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 203 (ES) | Formal Languages and Automata Theory | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. The course should provide a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical (and less magical) view towards algorithmic design and in general computation itself.
2. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part of computer science.

**Course Outcomes:**

After completing the course, the student will be able to:

1. Model, compare and analyse different computational models using combinatorial methods.
2. Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
3. Construct algorithms for different problems and argue formally about correctness on different restricted machine models of computation.
4. Identify limitations of some computational models and possible methods of proving them.
5. Have an overview of how the theoretical study in this course is applicable to and engineering application like designing the compilers.

UNIT I (8 hours)

Fundamentals: Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non-deterministic finite automaton, transition diagrams and Language recognizers.
Finite Automata: NFA with Î transitions - Significance, acceptance of languages. Conversions and Equivalence: Equivalence between NFA with and without Î transitions, NFA to DFA conversion, minimisation of FSM, equivalence between two FSM's, Finite Automata with output-Moore and Melay machines.

UNIT II (8 hours)

Regular Languages: Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets, closure properties of regular sets (proofs not required).
Grammar Formalism : Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings.

UNIT III (8 hours)

Context Free Grammars: Ambiguity in context free grammars. Minimisation of Context Free Grammars. Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL (proofs omitted).
Push Down Automata: Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, interconversion. (Proofs not required). Introduction to DCFL and DPDA.

UNIT IV (8 hours)

Turing Machine : Turing Machine, definition, model, design of TM, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines (proofs not required). linear bounded automata and context sensitive language.

UNIT V (8 hours)

Computability Theory: Chomsky hierarchy of languages, linear bounded automata and context sensitive language, LR(0) grammar, decidability of, problems, Universal Turing Machine, undecidability of posts. Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.

**Test Books:**


1. "Introduction to Automata Theory Languages and Computation". Hopcroft H.E. and Ullman J. D. Pearson Education
2. Introduction to Theory of Computation – Sipser 2nd edition Thomson


**References Books:**


1. Introduction to Forml languages Automata Theory and Computation Kamala Krithivasan Rama R.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. Theory Of Computation: A Problem - Solving Approach, Kavi Mahesh, Wiley India Pvt. Ltd.

SEMESTER – IV

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 204 (ES) | Computer Organization and Architecture | C | 3 | 0 | 0 | 3 |

**Course Objective:**

Students will be able to understand the organization of computer, performance evaluation of memory and CPU. They will also learn to design various components of computer system.

**Course outcomes:**

1 Understand basic structure and operation of digital computer
2 Understand the design of ALU to perform arithmetic and logic operations on fixed point and floating numbers
3 Understand different types instructions and addressing modes supported in the instruction set of CPU
4 Understand the design of control unit
5 Understand instruction and arithmetic pipeline processing
6 Understand different types of memory devices used in the computer system including cache memories
7 Understand different types of I/O communication techniques and standard I/O interfaces

UNIT I: BASIC STRUCTURE OF COMPUTERS

Functional units – Bus structures – Instruction set architecture: Instruction formats - addressing modes - Architecture and instruction set of 8086/8088 microprocessor- Assembly language programming - Fixed point and floating-point operations – ALU design

UNIT II: BASIC PROCESSING UNIT

Fundamental concepts – Execution of a complete instruction – Hardwired control – Micro programmed control design- Nano programming- CISC-RISC- principles

UNIT III: PIPELINE PROCESSING

Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Pipeline optimization techniques: Compiler techniques for improving performance

UNIT IV: MEMORY SYSTEM

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements– Associative memories - Secondary storage devices.

UNIT V: I/O ORGANIZATION

Accessing I/O devices – Programmed Input/output - Interrupts – Direct Memory Access– Interface circuits – Standard I/O Interfaces - I/ O devices and Processors.

**List of Practical Experiments:**

| | |
|---|---|
| 1 | Assembly language programming |
| 2 | Development of simulator for a hypothetical CPU |
| 3 | Development of Assembler for hypothetical CPU |
| 4 | Design of Hardwired control unit for a hypothetical CPU |
| 5 | Design of Microprogrammed control unit for a hypothetical CPU |

**Books of Study:**


1. Computer System Architecture, Morris Mano, Third edition, Pearson publications
2. Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, V Edition, McGraw-Hill publications
3. "Computer Organization and Architecture – Designing for Performance", William Stallings, Ninth edition, Pearson publications


**References:**


1. Structured Computer Organization, Andrew S. Tanenbaum
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface"
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill
4. V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education

SEMESTER – IV

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 205 (ES) | Object Oriented Programming | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

The course aims at providing the object oriented programming concepts through JAVA Programming. The object oriented concepts are applied to solve real-time problems in terms of classes and objects. The principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes. Problems are designed using the concepts of packages and interfaces with exception handling and multithreading. The design concepts of real time problems are realized using Graphical User Interface.

**Course Outcomes:**

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

Understand the importance of Object Oriented Concepts in solving real word problems through Java

Use the abstract class, inheritance, polymorphism for realizing the re-usability of objects and functions through Java

Use the packages and interfaces to re-use students own classes and implement function overriding through Java

Learn to develop GUI applications with controls and event handlers through Java

UNIT I: OBJECT-ORIENTED THINKING

A way of viewing world – Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling. Inheritance– Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, Polymorphism-ad hoc polymorphism, pure polymorphism, method overriding, abstract classes, Object class, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.

UNIT II: STREAM BASED I/O (JAVA.IO)

The Stream Classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing, generics.

UNIT III: EXCEPTION HANDLING

Fundamentals of exception handling, Exception types, Termination or presumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes. Multithreading- Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT IV: THE COLLECTIONS FRAMEWORKS (JAVA.UTIL)

Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hashtable, Properties, Stack, Vector More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner

UNIT V: GUI PROGRAMMING WITH SWING

Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout. Event Handling- The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes. A Simple Swing Application, Applets – Applets and HTML, Security Issues, Applets and Applications, passing parameters to applets. Creating a Swing Applet, painting in Swing, A Paint example, Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons- JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JCombo Box, Swing Menus, Dialogs.

List of Practical Experiments:

1. Declare a class named Teacher. The class will have all the data members as per your convenient. The class will have constructors. Write a function to read the values of the class variables. The values of the variable will be stored in a FILE (text file). The values will be stored in a structured format of your own choice.
Further, read the content of the FILE and display the content in an ordered form (First Name, Last Name).

Concept Learning:

1. FILE manipulation
2. Use try catch blocks
3. Use multiple try catch block
4. Finally statement
Try to have your own Exception

2. Create a three classes named Student, Teacher, Parents. Student and Teacher class inherits Thread class and Parent class implements Runnable interface. These three classes have run methods with statements. The task of the teacher class of the first assignment has to be synchronized.
Similarly, the other two classes should have run methods with few valid statements under synchronized.

3. Create two classes named Student and Teacher with required data members. Assume that the information about the Student and Teacher is stored in a text file. Read n and m number of Student and Teacher information from the File. Store the information in Arraylist of type Student and Teacher ArrayList<Student> and ArrayList<Teacher>. Print the information of Teacher who taught OOPS and Maths. Use Iterator and other functions of util in your program.

4. Watch any of the favorite movie of your choice (any language is fine, preferably English). Create a Text file to store at least 10 meaningful dialogs from the movie and store it in a text file. Process the file to remove the stop words (eg. the, is, was, …….) and create another file to have clean text (word).
5. Write a java program to create HashTable to act as a dictionary for the word collection. The dictionary meaning of the words, including synonyms, etc has to be displayed.

6. Create GUI for the above program to upload the dialog FILE, clean the FILE. The GUI should take input from the user for invoking the dictionary for displaying dictionary meaning.

7. Declare a class named Teacher. The class will have all the data members as per your convenient. The class will have constructors. Develop a GUI to read the values of the class variables from the keyboard. Use text field to read the values. Use button to store it in a file one by one. The values will be stored in a structured format of your own choice.
Have an option in the GUI to search the name of the students by roll number and display the content in the test field.

8. Create two classes named Student and Teacher with required data members. Read the information about the student and teacher using text fields. Use checkbox to choose the option to feed either teacher information or student information. Store the information about the Student and Teacher in a text file. Read n and m number of Student and Teacher information from the File. Show in the GUI about a Teacher who taught two subjects to a section. Develop at least one of the application (AWT problem) using swing package.

9. Create a Window based applications using various controls to handle subject registration for exams. Have a List Box to display the subject of semesters. Have one more List box having subject codes. Have a combo box to select the Semester, which will change the list of course and code in the list boxes. Display the subject registered for the examination on the right side of the window.

10. Declare a class named Teacher. The class will have all the data members as per your convenient. The class will have constructors. Develop a GUI to read the values of the class variables from the keyboard. Use text field to read the values. Use button to store it in a file one by one. The values will be stored in a structured format of your own choice.
Have an option in the GUI to search the name of the students by roll number and display the content in the test field. Develop at least one of the application (AWT problem) using swing package.

11. Create a Window based application for displaying your photo album. Create a Frame and Canvas. Change the border, foreground and background colours of canvas and other controls. Have buttons to start the image show, pause the image show and end the image show. Explore the options to play background music.

12. Create a Window application with menu bar and menu. The frame will also have a text area with scroll bar. In the menu, have File related options. Open a file and its content has to be displayed in the text area.

**Books of Study:**

Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.

**References:**


2. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
3. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
4. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
5. Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.

Java Programming and Object Oriented Application Development, R. A. Johnson, Cengage Learning

SEMESTER – IV

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CDC 204 (HS) | Soft Skills 4 | C | 1 | 0 | 0 | P/F |

**Course Objectives:**

To Enhance holistic development of student's mathematical techniques and problem solving skills which are required for their carrier building

**Course Outcomes:**

By the end of the course, students will be able to .

1 Get equipped with basic numerical ability
2 Apply numerical competence to real life problems
3 Operational strategy using logic and reasoning.
4 Execute a new model integrating quantitate aptitude
5 Get equipped with basic English grammar

UNIT I: QUANTITATIVE REASONING

Number properties, Percentage, Ratio and proportion, Profit and loss, Simple and compound interest, Averages, Speed, Time and work, Powers and roots, Linear equations, Quadratic equations, Pipes, cisterns.

UNIT II: VERBAL REASONING

Proposition, Premise: Syllogism: Verbal Analogies, Verification of truth of the statement, Assertion and reason, Situation reaction test, Decision making, Alpha-numerical sequence puzzle

UNIT III: VERBAL ABILITY

Preposition, Articles, Adverbs, Adjectives, Conjunctions and Parallel Structures

UNIT IV: DATA ANALYSIS AND INTERPRETATION

Statistics: Average, Median, Mode, Range, Standard deviation,

**Text Book:**

1. R.S. Agarwal, A Modern Approach to Verbal & Non Verbal Reasoning, S. Chand Publication
2. P. Anand, Quantitative Aptitude, Wiley, 2015

# SYLLABUS
# SEMESTER – V

SEMESTER – IV

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 221 (BS) | Probability and Statistics | C | 3 | 0 | 0 | 3 |

**Course Objectives:**

This course aims to provide an understanding of the basic concepts in probability theory and statistical analysis. Students will learn the fundamental theory of distribution of random variables, the basic theory and techniques of parameter estimation and tests of hypotheses. After taking this course, students will be able to use calculators and tables to perform simple statistical analyses for small samples and use popular statistics packages, such as SAS, SPSS, S-Plus, R or Maltab, to perform simple and sophisticated analyses for large samples.

**Course Outcomes:**

At the end of the course, student will be

1 Able to understand the basic knowledge on fundamental probability concepts, including random variable, probability of an event, additive rules and conditional probability
2 Able to understand the concept of Bayes' theorem S understand the basic statistical concepts and measures
3 Able to develop the concept of the central limit theorem understand several well-known distributions, including Binomial, Geometrical, Negative Binomial, Pascal, Normal and Exponential Distribution
4 Able to understand the concepts of various parameter estimation methods, like method of moments, maximum likelihood estimation and confidence intervals perform hypotheses testing
5 Able to apply the central limit theorem to sampling distribution use estimation technique to determine point estimates confidence interval and sample size.
6 Able to apply the appropriate Chi-Squared test for independence and goodness of fit perform and analyze hypotheses tests of means, proportions and variances using both one-and two-sample data sets.
7 Able to implement the analyses in SAS, S-PLUS, R or MATLAB
8 Able to appreciate the diversity of the applications of central limit theorem
9 Able to appreciate the diversity of the applications of hypothesis testing

UNIT I: INTRODUCTION TO PROBABILITY (15 hours)

Introduction, counting and set, terminologies and examples, conditional probability, independence and Bayes' theorem.

UNITII: PARTIAL DERIVATIVES (16 hours)

Discrete random variables, variance of discrete random variables, continuous random variables, Expectation, variance and standard deviation of continuous random variables, central limit theorem and law of large numbers, joint distributions and independence, covariance and correlation.

UNIT III: BAYESIAN INFERENCE (15 hours)

Introduction to statistics, Maximum likelihood estimate, Bayesian updating: discrete priors, probabilistic prediction, odds, continuous priors; Beta distribution, conjugate priors, probability intervals.

UNIT IV: NULL HYPOTHESIS SIGNIFICANCE TESTING (17 hours)

The frequentist school of statistics, Null hypothesis significant testing, comparison between frequentist and Bayesian inference

UNIT V: CONFIDENCE INTERVALS AND REGRESIONS (12 hours)

Confidence intervals: normal data, three views, mean of the non-normal data; Bootstrap confidence intervals, linear regression.

**Text Books:**


1. J. Jacod and P. Protter, Probability Essentials, Springer, 2004.
2. K. S. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, Wiley India, 2008.


**Reference Books:**


1. S. Ross, A First Course in Probability, 6th Edn., Pearson, 2002.

SEMESTER– V

| SUBJECT CODE | SUBJECT TITLE | CORE/ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 301 (ES) | Operating Systems | C | 3 | 0 | 2 | 4 |

**Course Objective:**

This course will introduce the core concepts of operating systems, such as processes, threads, scheduling, synchronization, memory management, file systems, input and output device management and protection.

**Course Outcomes:**

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

1. Understand the structure and functions of operating systems
2. Learn about processes and process scheduling in detail.
3. Understand the basics of process synchronization techniques
4. Learn about different memory management techniques
5. Understand various input, output and file management functions of operating system

UNIT I: INTRODUCTION TO OPERATING SYSTEM

What is an Operating System? Simple Batch Systems, Multiprogramming and Time Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real time Systems.
Operating System Structures: Operating System Services, System components, Protection system, Operating System Services, system calls

UNIT II: PROCESS MANAGEMENT

Process Concept, Process Scheduling, Operation on Processes, Interprocess communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms, Thread Scheduling.

UNIT III: PROCESS COORDINATION

Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.
Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

UNIT IV: MEMORY MANAGEMENT

Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation.
Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

UNIT V: STORAGE MANAGEMENT

File System Concept, Access Methods, File System Structure, File System Structure, File System Implementation, Directory implementation, Efficiency and Performance, Recovery, Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, I/O System Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operation.

**List of Lab Experiments:**

1 Shell Programming exercises
2 Implementing Linux system commands using system calls
3 CPU Scheduling Algorithms
4 Computing page faults for various page replacement algorithms
5 Simulation of Demand Paging System
6 Implement producer , consumer problem using semaphores
7 Implement deadlock avoidance and detections algorithms
8 Project Development

**Text Books:**

1. Operating Systems Concepts, Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Wiley, 2012.

**Books of Reference:**

1. Modern Operating Systems, Andrew S Tanenbaum and Herbert Bos, Fourth Edition, Pearson Education, 2014.
2. Operating Systems: Principles and Practice, Thomas Anderson and Michael Dahlin, Recursive Books, 2014.

SEMESTER-**V**

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 303 (ES) | Computer Networks | C | 3 | 0 | 2 | 4 |

**Course Objective:**

This course is to provide students with an overview of the concepts and fundamentals of computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.

**Course Outcomes:**

1 Understanding of computer networking fundamentals with data communication system and TCP/IP & OSI reference model

2 Analyze the requirements for a given organizational structure and selection of appropriate network architecture and topology

3 Specify and identify working limitation in existing protocols of networking layers and try to formulate new and better protocols

4 Explain the services and design issues of Transport layer, Session layer and Presentation layer and able to Compare and contrast TCP and UDP protocol.

5 State basic understanding of the use of cryptography and network security

6 Explain the functions of Application layer and Presentation layer paradigms and Protocols.

UNIT I

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model.
Physical Layer: Guided transmission media, wireless transmission media.
Data Link Layer - design issues, CRC codes, Elementary Data Link Layer Protocols, sliding window protocol

UNIT II

Multi Access Protocols - ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.

UNIT III

Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control.

UNIT IV

Inter-networking: Tunneling, Internetwork Routing, Packet fragmentation, IPv4, IPv6 Protocol, IP addresses, CIDR, IMCP, ARP, RARP, DHCP.
Transport Layer: Services provided to the upper layer's elements of transport protocol-addressing connection establishment, connection release, Connection Release, Crash Recovery.

UNIT V

The Internet Transport Protocols UDP-RPC, Real Time Transport Protocols, The Internet Transport Protocols- Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The future of TCP.
Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS, SSH.

**List of practical experiments:**

1. Explain about wireshark and display how to send packets or packets from one layer to another.
2. Write a Java program to implement Error Detection Technique using CRC Algorithm.
3. Write a Java program to implement Error Correction Technique using Hamming code.
4. Write a Java program to implement TCP Client Server programming.
5. Write a Java program to implement UDP Client Server Programming.
6. Write a Java program to implement 1-bit Stop and Wait Protocol at data link layer.
7. Write a Java program to implement N-bit Sliding Window Protocol at data link layer
8. Write a Java program to implement Dijkstra Shortest path routing protocol.
9. Write a Java program to implement Distance Vector Routing.
10. Write a Java program to implement echo command in client server socket programming
11. Write a Java program to implement Trace-route command
12. Write a Java program to implement Ping command
13. Write a Java program to display the class of IP address, network mask and generate the subnet IP address based on the subnet bits entered from the keyboard
14. Write a Java program to implement sliding window protocol at the transport layer
15. Write a Java program to transfer file using TCP ?

**Text Books:**

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.

2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

**Reference Books:**


1. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Edication.
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
3. Introduction to Computer Networks and Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press.
4. Computer Networks, L. L. Peterson and B. S. Davie, 4th edition, ELSEVIER.
5. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

SEMESTER V

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 304 (ES) | Database Management Systems | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

Students will understand

1. To store data using fixed and variable length records in the file
2. To implement index structures in the file
3. To implement query parsing and execution
4. Concurrency control protocols used for transaction processing
5. Recovery techniques for recovering from transaction failures

**Course Outcomes:**

Students will be able to:

1. Store data in the files and to implement indexing schemes for the fast retrieval of data
2. Implement query complier, planner and executor
3. Implement concurrency control protocols for transaction processing system

**UNIT I: Introduction to DBMS and Relational model**

File Processing System, Advantages of DBMS over File Processing System, Database System Applications. DBMS Architecture: The three schema architecture, Data Independence : Logical and Physical, Data Models: Hierarchical, network and relation models, Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, Database constraints (Domain, Key constraints, integrity constraints) and their
importance.

**UNIT II : Query processing**

Relational Algebra, Relational Calculus, Introduction to SQL: Database Objects- DDL Schema definitions, DML- Insert, select, update, delete, Views, exercise on SQL queries, Transaction support in SQL, Aggregate Functions, Null Values, Views, Complex Integrity Constraints in SQL, Assertions, Triggers

**UNIT III : Conceptual model and database design**

Entity Relationship model Entity types, Entity Sets, Attributes, and Keys Relationships, Relationship types and constraints, Weak Entity types, Enhanced ER (EER) Modeling : Super/Sub Classes Specialization and Generalization. Constraints and characteristics of Specialization and Generalization , Basics of Normalization, Normal Forms: First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), BCNF

**UNIT IV: Transaction Processing, Concurrency Control and Recovery**
Introduction of transaction processing, advantages and disadvantages of transaction processing system, Serializability and Recoverability of transaction, Concurrency Control, Lock based Protocols, Timestamp Based Protocols – Validation based Protocols - Multiple Granularity Locking, Recovery techniques

**UNIT V: Overview of Storage and Indexing**
Data on External Storage, File Organization and Indexing - Clustered Indexes, Primary and Secondary Indexes, Indexed Sequential Access Methods(ISAM) B+ Trees: Tree Structure, Search, Insert, Delete, Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendible vs. Linear Hashing.

**Books of Study:**


1. Database System Implementation, Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Person publications, First Edition, 2002


**Books of References:**


1. Database system the complete book: Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Person New International Edition, Second Edition, 2013
2. Navathe, Shamkant B., and Ramez A. Elmasri. *Fundamentals of Database Systems with Cdrom and Book*. Addison-Wesley Longman Publishing Co., Inc., 2001.
3. Silberschatz, Abraham, Henry F. Korth, and Shashank Sudarshan. *Database system concepts*. Vol. 5. New York: McGraw-Hill, 1997.
4. Date, Christopher John. *An introduction to database systems*. Pearson Education India, 2004.
5. Heller stein, Joseph, and Michael Stonebreaker. Readings in Database Systems (The RedBook). 4th ed. MIT Press, 2005. ISBN:9780262693141.

SEMESTER V

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 306 (ES) | Compiler Design | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

1. Explain the phases of compiler.
2. Illustrate the concepts of Lexical Analysis.
3. Design and Implement parsers.
4. Analyzing the methods to define syntax and semantics of languages
5. Provide practical training for the usage of LEX/Flex and YACC/Bison tools
6. Develop syntax directed translation schemes.

**Course Outcomes:**

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

1. Delineate various phases of compiler design
2. Understand the need and role of lexical analyser and design some lexical analysers using LEX
3. Understand and design parsers
4. Generate various forms of intermediate code
5. Enforce various schemes for optimizing code and describe the role of code generator and its design issues Code Generation

UNIT I: INTRODUCTION TO COMPILERS

Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools - Programming Language basics.

UNIT II : LEXICAL ANALYSIS

Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying Lexical Analyzers-LEX-Design of Lexical Analyzer for a sample Language.

UNIT III: SYNTAX ANALYSIS

Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies-Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item-

Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC/Bison-Design of a syntax Analyzer for a Sample Language .

UNIT IV: SYNTAX DIRECTED TRANSLATION & RUN TIME ENVIRONMENT

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions. RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Storage Allocation- Parameter Passing-Symbol Tables-Dynamic Storage Allocation-Storage Allocation in FORTAN.

UNIT V: CODE OPTIMIZATION AND CODE GENERATION

Principal Sources of Optimization-DAG- Optimization of Basic Blocks-Global Data Flow Analysis-Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

**List of Practical Experiments:**

1. Implement lexical analyzer using C
2. Implement lexical analyzer using LEX/Flex
3. Implementation of Recursive Descent
4. Implementation of Predictive Parser using C for the Expression Grammar
5. Implementation of Shift Reduce parser using C
6. Implement LALR parser using LEX/Flex and YACC/Bison
7. Generate quadruples for given arithmetic expression using LEX/Flex and YACC/Bison.
8. Generate 3-address code for a control statement using LEX/Flex and YACC/Bison.
9. Implementation of code optimization techniques
10. Implementation of Code generation

**Books of Study:**

1. Compilers – Principles, Techniques and Tools,Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, 2 nd Edition, Pearson Education, 2007.

**Books of References:**

1. Optimizing Compilers for Modern Architectures: A Dependence-based Approach, Randy Allen, Ken Kennedy, Morgan Kaufmann Publishers, 2002.
2. Advanced Compiler Design and Implementation, Steven S. Muchnick, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Engineering a Compiler, Keith D Cooper and Linda Torczon, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Crafting a Compiler with C,Charles N. Fischer, Richard. J. LeBlanc, Pearson Education, 2008.

SEMESTER V

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CDC 305 (HS) | Soft Skills – 5<br>Interview Handling Skills-1 | Mandatory | 1 | 0 | 0 | P/F |

**Course Objective:**

To Enhance holistic development of student's ability to perform in interviews and business presentations.

**Course Outcomes:**

1. To crack competitive exams

UNIT I: RESUME WRITING

The difference between resume and CV, Types of resume, Inclusions in a resume, Technicalities of a resume.

UNIT II: COVER LETTER

Resume Vs Cover Letter, Types of cover letter, Structure of cover letter, Content of cover letter

UNIT III: BUSINESS WRITING

Four types of Business Writing: Instructional, Informational, Persuasive and Transactional

UNIT IV: CREATING A PERSONAL BRAND
Creating a communication strategy based on:
Who are you?
What do you offer?
What makes you unique?

UNIT V: PRACTICE SESSIONS& ASSESSMENTS

# SYLLABUS
# SEMESTER-VI

SEMESTER – VI

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 131 (BS) | Differential Equations | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

This introductory course on ordinary differential equations (ODEs) covers the theory, solution techniques, and applications surrounding linear and non-linear first and second-order differential equations, including systems of equations.

**Course Outcomes:**

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

1 model some elementary physical situations by writing an appropriate differential equation.
2 be able to solve first order simple, linear, and separable equations
3 solve higher order differential equations using characteristic roots, undetermined coefficients, and the Laplace transform.
4 understand the qualitative nature of the solution to the linear and non-linear systems of equations.

UNIT I (7 Hours)

First Order Differential Equations: Geometric meaning of $y' = f(x, y)$, Direction Fields, Euler's Method, Classification of ODEs ( Linear, Non-linear, Exact, Separable), Integrating Factor, Bernoulli Equations, Initial Value Problem, Modelling (Free falling object, Radioactivity, RL-circuit).

UNIT II (8 Hours)

Second and Higher Order Linear ODEs: Homogeneous Linear ODEs, Modelling of Free Oscillations of a Mass-Spring System, Euler-Cauchy Equations, Non-homogeneous ODEs, Variation of Parameters, Modelling (Forced Oscillations, Electric Circuits),

UNIT III (10 Hours)

System of ODEs: Modelling Engineering problems (Electric Network, Mixing problem in two tanks etc.) as systems of ODEs, Wronskian, Phase-Plane Method, Critical Points & Stability, Qualitative Methods for Nonlinear Systems, Non homogeneous Linear Systems of ODEs.

UNIT IV (7 Hours)

Series Solutions of ODEs: Introduction to power series method, Legendre's equation & polynomials, Frobenius Method, Bessel's Equations & Functions.

UNIT 5 (12 Hours)

Laplace Transforms: 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). Application: Solutions of ordinary differential equations using Laplace transforms.

**Text Books:**

5. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

**References Books:**

1. Mary L. Boas, Mathematical Methods in Physical Sciences, 3rd Edition, Wiley-India.
2. G. F. Simmons, Differential Equation with Applications and Historical Notes, TATA McGraw Hill.
3. S. Vaidyanathan, Advanced Applicable Engineering Mathematics, CBS Publishers.

SEMESTER-VI

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 305 (ES) | Software Engineering | C | 3 | 0 | 2 | 4 |

**Course Objectives:**

1. Comprehend software development life cycle and prepare SRS document.
2. Explain software design and development techniques
3. Demonstrate various software modelling techniques.
4. Illustrate various software testing techniques and their applicability.
5. Detail the project management life cycle.

**Course Outcomes:**

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

1. Understand the principles of software engineering, life cycle models.
2. Specify, analyze and document software requirements through a productive working relationship with project stakeholders
3. Understand the importance of software modeling and learn various modeling languages
4. Understand the necessity of software testing and design various test cases for a software.
5. Adapt Software maintenance and understand the concepts of project management.

UNIT I: SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II: REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III: SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV: TESTING AND MAINTENANCE 9

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT V: PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

**List of experiments:**

1. Develop requirements specification for a given problem
2. Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem
3. To perform the function oriented diagram : DFD and Structured chart
4. To perform the user's view analysis : Use case diagram
5. To draw the structural view diagram : Class diagram, object diagram
6. To draw the behavioral view diagram : Sequence diagram, Collaboration diagram
7. To draw the behavioral view diagram : State-chart diagram, Activity diagram
8. To draw the implementation view diagram: Component diagram
9. To draw the environmental view diagram : Deployment diagram
10. To perform various testing using the testing tool unit testing, integration testing

**Text Books:**

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", 7th International Edition, McGraw-Hill Education (Asia), Singapore

**References:**

1. Ian Somerville, "Software Engineering", 8th Edition, 2007, Pearson Education Inc., New Delhi.
2. Fundamentals of Software Engineering – Rajib Mall. (PHI-3rd Edition), 2009.

# Specialization Streams

# Specialization:

# Artificial Intelligence and Machine Learning

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 311 | INTRODUCTION TO MACHINE LEARNING | Core Elective | 3 | 0 | 2 | 4 |

**Course Objectives:**

This course provides an introduction to basic skill set required in this fast expanding field of machine learning. Students will learn relevant basics in machine learning such as regression, clustering and classification. In addition, this course introduces advanced Python programming as a standard and common language for machine learning. This course is proposed to meet a growing business needs of individuals skilled in artificial intelligence, data analytics, statistical programming and other software skills. The proposed course will combine theory and practice to enable the student to gain the necessary knowledge to compete in the ever changing work environment.

**Course Outcomes:**

1. Develop an appreciation for what is involved in learning models from data.
2. Understand a wide variety of learning algorithms.
3. Understand how to evaluate models generated from data.
4. Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

UNIT I

Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation Linear Regression: Introduction, Linear regression, Python exercise on linear regression

UNIT II

Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Python exercise on Decision TreeInstance based Learning: K nearest neighbour, theCurse of Dimensionality, Feature Selection: forward search, backward search, univariate, multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on kNN and PCA Recommender System: Content based system, Collaborative filtering based

UNIT III

Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem, python exercise on SVM

UNIT IV

Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm, python exercise on neural network
Introduction to Computational Learning Theory: Introduction, sample complexity, finite hypothesis space, VC dimension

UNIT V

Ensembles: Introduction, Bagging and boosting Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering

**Text Books:**

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.

**Reference Books:**

1. Introduction to Machine Learning Edition 2, by EthemAlpaydin
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 314 | Digital Image Processing | E | 3 | 0 | 2 | 4 |

**Course Objective:**

1. Develop an overview of the field of image processing.
2. Understand the fundamental algorithms and how to implement them.
3. Prepare to read the current image processing research literature.
4. Gain experience in applying image processing algorithms to real problems.

**Course Outcomes:**

Students are able to

1. understand the need for digital image processing and various task involved in image processing pipeline.
2. learn different techniques employed for the enhancement of images.
3. learn different causes for image degradation and overview of image restoration techniques.
4. understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
5. learn different feature extraction techniques for image analysis and recognition
6. develop any image processing application.
7. understand the rapid advances in Machine vision.

UNIT I

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels,

Image acquisition and Pre-processing: Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening

UNIT II

Filtering in the Frequency Domain: basic filtering in the frequency domain, image smoothing and sharpening

Image Restoration: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function

UNIT III

Image segmentation: Fundamentals, point, line detection, basic edge detection techniques, Hough transform, Thresholding, basic global threholding, optimal thresholding using Otsu’s method, multi-spectral thresholding, Region based segmentation, region growing, region splitting and merging.

UNIT IV

Color Image Processing: color models, Color transformation

Image Compression: Fundamentals, Some basic compression methods

UNIT V

Image Representation: Shape features (Region-based representation and descriptors), area, Euler's number, eccentricity, elongatedness, rectangularity, direction, compactness, moments, covex hull, texture features, color features.

Object and Pattern Recognition: Pattern and pattern classes, Matching, minimum distance or nearest neighbor classifier, matching by correlation, Optimum statistical classifier, Neural network classifier.

**Text Books:**

1. R.C. Gonzalez, R.E. Woods, Digital Image Processing, 3rd Edition, Pearson Education

**Reference Books:**

1. S.Sridhar, Digital Image Processing, Oxford University Press, 2011
2. Milan Sonka, Vaclav Hlavac and Roger Boyele,Image processing, analysis, and machine vision. 3e, Cengage Learning, 2014.
3. Computer Vision A modern approach, David A. Forsyth and Jeam Ponce, Pearson Education.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 410 | PRINCIPLES OF SOFT COMPUTING | Core Elective | 3 | 0 | 2 | 4 |

**Course Objectives:**

Upon successful completion of the course, students will have an understanding of the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms. Provide the mathematical background for carrying out the optimization associated with neural network learning.

**Course Outcome:**

Upon completion of the course, the students are expected to

1. To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations
2. Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
3. Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
4. Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
5. Understand the Genetic Algorithm and able to identify the application area
6. Reveal different applications of these models to solve engineering and other problems

UNIT I

Introduction to Soft Computing, Artificial Neural Network (ANN) : Fundamentals of ANN, Basic Models of an artificial Neuron, Neural Network Architecture, Learning methods, Terminologies of ANN, Hebb network, Supervised Learning Networks: Perceptron, Adaline, Madaline, Multi-Layer Perceptron, Feed forward Back propagation Network : back propagation learning, Learning Effect of Tunning parameters of the Back propagation

UNIT II

RBF Network, Associative memory: Auto, hetero and linear associative memory, network, Adaptive Resonance Theory: ART1, ART2, Introduction to Computer vision, Introduction to Convolutional neural network, Popular architectures: Alex Net, Google Net, VGG Net

UNIT III

FUZZY LOGIC: Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations, Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, Defuzzification Methods, Fuzzy rule based reasoning

UNIT IV

Genetic Algorithms: Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction. Genetic Modeling: Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. Applications, Real life Problems. Particle Swarm Optimization and its variants.

UNIT V

Hybrid Soft Computing Techniques Hybrid system, neural Networks, fuzzy logic and Genetic algorithms hybrids. Genetic Algorithm based Back Propagation Networks: GA based weight determination applications: Fuzzy logic controlled genetic Algorithms soft computing tools, Applications.

**Text Books:**

Principles of Soft Computing- S.N. Sivanandan and S.N. Deepa, Wiley India, 2nd Edition,2011

**Reference Books:**

1. Neuro Fuzzy and Soft Computing, J. S. R. JANG, C.T. Sun, E. Mitzutani, PHI
2. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application)
3. Rajasekaran, G.A. Vijayalakshmi Pai, PHI

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 413 | ARTIFICIAL INTELLIGENCE | Core Elective | 4 | 0 | 0 | 4 |

**Course Objective:**

1. To create understanding of both the achievements of AI and the theory underlying those achievements.
2. To introduce the concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems
3. To review the different stages of development of the AI field from human like behavior to Rational Agents.
4. To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.
5. To create an understanding of the basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as minimal, resolution, etc. that play an important role in AI programs.
6. To introduce advanced topics of AI such as planning, Bayes networks, natural language processing and Cognitive Computing

**Course Outcome:**

1. Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
2. Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
3. Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
4. Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
5. Formulate and solve problems with uncertain information using Bayesian approaches.
6. Apply concept Natural Language processing to problems leading to understanding of cognitive computing.
7.

UNIT I

Introduction: What is Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents.

UNIT II

Search: Introduction to Search, Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, current-best-hypothesis search, least commitment search

UNIT-III

Knowledge Representation and Reasoning: Inference, Propositional Logic, Predicate Logic (first order logic), Logical Reasoning, Forward &Backward Chaining, Resolution; AI languages and tools - Lisp, Prolog, CLIPS

UNIT-IV

Problem Solving: Formulating problems, problem types, Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.

UNIT-V

Learning: Overview of different forms of learning, decision trees, rule based learning, neural networks, reinforcement learning.
Game playing: Perfect decision game, imperfect decision game, evaluation function, minimax, alpha-beta pruning.

**Text Books:**


1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
3.E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education
4. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002

# Specialization:

# Cyber Security

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSES 312 | Introduction to Cryptography | E | 3 | 0 | 2 | 5 |

**Course Objective:**

1. To introduce fundamental concepts of symmetric cipher models and asymmetric cipher models.
2. To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
3. To understand how to deploy encryption techniques to secure data in transit across data networks
4. To understand the various key distribution and management schemes.

**Course Outcomes:**

The Students will be able to:

1. summarize different classical encryption techniques
2. identify mathematical concepts for different cryptographic algorithms
3. demonstrate cryptographic algorithms for encryption/key exchange
4. summarize different authentication schemes
5. demonstrate various digital signature schemes

UNIT I
History and overview of cryptography, Overview of cryptography. What is a cipher? Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

UNIT II
Block ciphers, Attacks on block ciphers, Block Cipher Principles, The Data Encryption Standard (DES), Block Cipher Design Principles, Block cipher modes of operation, The Euclidean Algorithm, Finite Fields of the Form GF(2n), Advanced Encryption Standard (AES), Stream Ciphers, RC4.

UNIT III
Testing for Primality, The Chinese Remainder Theorem, The RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT IV
Cryptographic Hash Functions, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.

**References:**

Stallings, William. Cryptography and network security, 4/E. Pearson Education India, 2006.
D. Stinson Cryptography, Theory and Practice (Third Edition)
Handbook of Applied Cryptography by A. Menezes, P. Van Oorschot, S. Vanstone.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSES 315 | Network Security | Core ELective | 3 | 0 | 2 | 5 |

**Course Objective:**

1. To introduce fundamental concepts of security.
2. To introduce and discuss the relevance of security in operating system, web services etc.
3. To introduce fundamental concepts of secure electronic transactions.

**Course Outcomes:**

The Students will be able to :

1. Identify the common threats faced today
2. Appreciate the relevance of security in various domains
3. Identify security issues in network, transport and application layers and outline appropriate security protocols
4. Develop secure web services and perform secure e-transactions
5. Design a secure system

UNIT I

Need for Security, Security Attack, Security Services, Information Security, Methods of Protection. Network Concepts, Threats in Networks, Network Security Controls.

UNIT II

Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange.

UNIT III

Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET), Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats.

UNIT IV
Firewalls: Firewalls – Types, Comparison of Firewall Types, Firewall Configurations.

**References:**


1. Network Security and Cryptography, Bernard Menezes, CENGAGE Learning.
2. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
3. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition.
4. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

| SUBJECT CODE | SUBJECT TITLE | CORE/ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 411 | Mobile and Wireless Security | Core Elective | 3 | 0 | 2 | 4 |

**Course Objectives:**

1. Gaining factual knowledge ( terminology, classifications, methods)
2. Understand the terminology and classification associated with wireless security.
3. Be familiar with current applications of wireless security networks and issues that might arise.
4. Describe the major software and hardware components and subcomponents used to secure mobile and wireless networks.
5. Be familiar with different wireless security protocols and algorithms for different mobile networks

UNIT I

Fundamentals of Wireless & Mobile Systems: key features and mechanisms of wireless and mobile systems, Security Standards in current Wireless & Mobile Systems: WiFi Security (WEP, WPA, WPA-Enterprise); Cellular Security (GSM, 3G, LTE); Internet of Things / Wireless Sensor Networks / RFID, Emerging Privacy concerns: location, tracking, traffic analysis, mobile and the cloud.

UNIT II

Wireless and Mobile as a Cyber Physical Infrastructure (CPS), Denial of Service Attacks Cellular, WiFi, GPS, Implications to CPS: e.g., Electricity grid, Internet of Things

UNIT III

Security of Mobile Computing Plaforms, Android and iOS security models, Threats and emerging solutions (e.g., side channel attacks)

UNIT IV

Security of GSM Network, Security of UMTS Networks, Android Security Model, IOS Security Model, Security Model of the Windows Phone, SMS/MMS, Mobile Geolocation and Mobile Web Security, Security of Mobile VoIP Communications, Emerging Trends in Mobile Security

**Course Outcome:**

The students will be able to :

1. understand the main security goals and adversarial models of wireless and mobile networks;
2. gain a broad knowledge regarding real-world security architectures of WLANs, GSM/UMTS, WSNs, RFIDs, etc.;
3. be able to reason about wireless security protocols and protection techniques, discuss proposed solutions and their limitations;
4. have an overview of the recent advances regarding lightweight authentication, key management for wireless networks, secure localization, and wireless device pairing.

**References:**

1. Noureddine Boudriga, Security of Mobile Communications, 2010.
2. Levente Buttyán and Jean-Pierre Hubaux, Security and Cooperation in Wireless Networks, 2008. [Available Online]
3. James Kempf, Wireless Internet Security: Architectures and Protocols, 2008.
4. Android Security Internals: An In-Depth Guide to Android's Security Architecture, Author: Nikolay Elenkov, No Starch Press, First Edition, Nov. 2014

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 414 | Internet Protocols and Networking | E | 3 | 0 | 2 | 5 |

**Course Objective:**

The broad objective of this course is to understand –

1. The architecture and principles of today's Internetworking of computer Networks
2. The protocols and their functionalities
3. The requirements for the future Internet and its impact on the computer network architecture

**Course Outcomes:**

Upon completion of this course students will be able to:

1. To understand the fundamentals of organisational interconnectivity, Internet technologies, and to relate them to a business environment.
2. Recognise common Internet communication protocols and describe the services associated with them.
3. Demonstrate understanding of manager role in developing a communication infrastructure.

UNIT I

Network Models: Layered Tasks, The OSI Model, Layers in OSI Model, TCP/IP Protocol suite, Addressing. Connecting devices: Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks.

UNIT II

Principles of Internetworking, Connectionless Interconnection, Application Level Interconnection, Network Level Interconnection, Properties of the Internet, Internet Architecture, Interconnection through IP Routers TCP, UDP & IP: TCP Services, TCP Features, Segment, A TCP Connection, Flow Control, Error Control, Congestion Control, Process to Process Communication, User Datagram, Checksum, UDP Operation, IP Datagram, Fragmentation, Options, IP Addressing: Classful Addressing, IPV6.

UNIT III

Data Traffic, Congestion, Congestion Control, Congestion Control in TCP, Congestion Control in Frame Relay, Source Based Congestion Avoidance, DEC Bit Scheme, Quality of Service, Techniques to Improve QOS: Scheduling, Traffic Shaping, Admission Control, Resource Reservation, Integrated Services and Differentiated Services.

UNIT IV

Concepts of Buffer Management, Drop Tail, Drop Front, Random Drop, Passive Buffer Management Schemes, Drawbacks of PQM, Active Queue Management: Early Random Drop, RED Algorithm.

**References:**


1) Douglas. E.Comer, “Internetworking with TCP/IP “, Volume I PHI
2) Behrouz A Forouzan, “TCP/IP Protocol Suite”, TMH, 3rd Edition
3) B.A. Forouzan, “Data communication & Networking”, TMH, 4th Edition.

# Specialization:

# Data Science and Analytics

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 311 | INTRODUCTION TO MACHINE LEARNING | Core Elective | 3 | 0 | 2 | 4 |

**Course Objectives:**

This course provides an introduction to basic skill set required in this fast expanding field of machine learning. Students will learn relevant basics in machine learning such as regression, clustering and classification. In addition, this course introduces advanced Python programming as a standard and common language for machine learning. This course is proposed to meet a growing business needs of individuals skilled in artificial intelligence, data analytics, statistical programming and other software skills. The proposed course will combine theory and practice to enable the student to gain the necessary knowledge to compete in the ever changing work environment.

**Course Outcomes:**

1. Develop an appreciation for what is involved in learning models from data.
2. Understand a wide variety of learning algorithms.
3. Understand how to evaluate models generated from data.
4. Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

UNIT I

Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation Linear Regression: Introduction, Linear regression, Python exercise on linear regression

UNIT II

Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Python exercise on Decision TreeInstance based Learning: K nearest neighbour, theCurse of Dimensionality, Feature Selection: forward search, backward search, univariate, multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on kNN and PCA Recommender System: Content based system, Collaborative filtering based

UNIT III

Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem, python exercise on SVM

UNIT IV

Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm, python exercise on neural network
Introduction to Computational Learning Theory: Introduction, sample complexity, finite hypothesis space, VC dimension

UNIT V

Ensembles: Introduction, Bagging and boosting Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering

**Text Books:**

2. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.

**Reference Books:**

4. Introduction to Machine Learning Edition 2, by EthemAlpaydin
Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 313 | Introduction to Data Science | Core Elective | 3 | 0 | 0 | 3 |

**Course Objective**:

This course will introduce the rapidly growing field of data science and equip the students with some of its basic principles and tools as well as its general mind-set.
Course Description: Data Science is the study of the generalizable extraction of knowledge from data. Being a data scientist requires an integrated skill set spanning mathematics, statistics, machine learning, databases and other branches of computer science. Students will learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication. The focus in the treatment of these topics will be on breadth, rather than depth, and emphasis will be placed on integration and synthesis of concepts and their application to solving problems. To make the learning contextual, real datasets from a variety of disciplines will be used. As prerequisites, students are expected to have basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics.

**Course outcome**:

At the conclusion of the course, students should be able to:

1. Describe what Data Science is and the skill sets needed to be a data scientist.
2. Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
3. Use R to carry out basic statistical modeling and analysis.
4. Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
5. Describe the Data Science Process and how its components interact.
6. Use APIs and other tools to scrap the Web and collect data.
7. Apply EDA and the Data Science process in a case study.
8. Apply basic machine learning algorithms (Linear Regression, k-Nearest Neighbors (k-NN),k-means, Naive Bayes) for predictive modeling. Explain why Linear Regression and k-NN are poor choices for Filtering Spam. Explain why Naive Bayes is a better alternative.
9. Identify common approaches used for Feature Generation. Identify basic Feature Selection algorithms (Filters, Wrappers, Decision Trees, Random Forests) and use in applications.
10. Identify and explain fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine (dimensionality reduction, singular value decomposition, principal component analysis). Build their own recommendation system using existing components.
11. Create effective visualization of given data (to communicate or persuade).
12. Work effectively (and synergically) in teams on data science projects.
13. Reason around ethical and privacy issues in data science conduct and apply ethical practices.

UNIT I

Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

UNIT II

Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Real Direct (online real estate firm) - Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means

UNIT III

One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT IV

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system - Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs

UNIT V

Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

**Books and Reference:**


1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
4. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)

6. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science. (Note: this is a book currently being written by the three authors. The authors have made the first draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)
7. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
8. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 412 | Introduction to Big Data | E | 3 | 0 | 0 | 3 |

**Course Objective:**

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs • Provide hands on Hadoop Eco System
5. Apply analytics on Structured, Unstructured Data.
6. Exposure to Data Analytics with R.

**Course Outcomes:**

1. The students will be able to:
2. Identify Big Data and its Business Implications.
3. List the components of Hadoop and Hadoop Eco-System
4. Access and Process Data on Distributed File System
5. Manage Job Execution in Hadoop Environment
6. Develop Big Data Solutions using Hadoop Eco System
7. Apply Machine Learning Techniques using R.

UNIT I

Big Data introduction - definition and taxonomy - Big data value for the enterprise - The Hadoop ecosystem - Introduction to Distributed computing- Hadoop ecosystem – Hadoop Distributed File System (HDFS) Architecture - HDFS commands for loading/getting data - Accessing HDFS through Java program.

UNIT II

Introduction to Map Reduce frame work - Basic Map Reduce Programming: - Advanced Map Reduce programming: Basic template of the Map Reduce program, Word count problem- Streaming in Hadoop- Improving the performance using combiners- Chaining Map Reduce jobs- Joining data from different sources.

UNIT III

Querying big data with Hive - Introduction to Hive QL- Hive QL: data definition- data manipulation

UNIT IV

Querying big data with Hive – Hive QL queries- Hive QL Views – Hive QL indexes

UNIT V

Data Analytics using R: Introduction to R, Creating a dataset, Getting started with graphs, Basic data management, Advanced data management.

**Reference:**


1. Big Data Fundamentals: concepts, Drivers and Techniques: Person Education, 2016
2. Hadoop The Definitive Guide, IV edition, O'Reilly publications
3. Hadoop in Action, Chuck lam, Manning publications
4. Programming, Hive, O'Reily publications,
5. Apache Hive Cookbook, PACKT publications
6. R in Action, Robert I. Kabacoff, Manning publications
7. Practical Data Science with R, Nina Zumel John Mount, Manning publications

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 415 | Inference and Representation | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Course covers how to think about, formulate, and model data.
2. Introduces the tools of probabilistic graphical models as a means of representing and manipulating data, modelling uncertainty, and discovering new insights from data.
3. Will particularly emphasize latent variable models, examples of which include latent Dirichlet allocation (for topic modelling), factor analysis, and Gaussian processes.
4. Will also discuss modelling temporal data (e.g., hidden Markov models), hierarchical models, deep generative models, and structured prediction.

**Course Outcomes:**

Upon completion of the course, the students are expected to:

1. Take a new problem or data set, formulate an appropriate model, learn the model from data.
2. Answer their original question using inference in the model.

UNIT I

Introduction- Bayesian networks- Probability review - Bayesian network basics- Probabilistic Programming and Bayesian Methods - Algorithm for d-separation-PyMC3 tutorial – Introduction to Probabilistic Topic Models - Probabilistic modelling in neuroscience - political science - Review of case studies and BN structure learning - Undirected graphical models - Conditional random fields, Gaussian MRFs Case study : Astronomy (Dan Foreman-Mackey)- Some subtleties on BNs, MRF review, CRF introduction

UNIT II

Exact inference - Variable elimination, treewidth, belief propagation Graph separation in MRFs, revisiting CRFs, BP, pruning barren nodes - Unsupervised learning Expectation Maximization Case study - Monte-Carlo methods - Gibbs sampling - Causal inference & Bayesian additive regression trees

UNIT III

Topic modeling - Introduction to Probabilistic Topic Models - Case study: Musical influence via dynamic topic models - Modeling musical influence with topic models - Gaussian processes - Application to predicting wind flow - Learning Markov random fields - Moment matching, Chow-Liu algorithm, pseudo-likelihood - Case study: Cognitive science Idea - Exponential families, learning MRFs, and GPs - An Introduction to Conditional Random Fields - Approximate maximum entropy learning in MRFs

UNIT IV

Variation inference - Mean-field approximation - Graphical models, exponential families, and vibrational inference - Learning deep generative models - Stochastic vibrational inference, Variation auto-encoder - Structured prediction - Overview of structured prediction, parametrizing CRFs - Integer linear programming - MAP inference, linear programming relaxations, dual decomposition - Derivation relating dual decomposition & LP relaxations - Integer Programming for Bayesian Network Structure Learning

**References:**


1. Kevin Murphy, Machine Learning: a Probabilistic Perspective, MIT Press, 2012. You can read this online for free from NYU Libraries. We recommend the latest (4th) printing, as earlier editions had many typos. You can tell which printing you have as follows: check the inside cover, below the "Library of Congress" information. If it says "10 9 8 … 4" you've got the (correct) fourth print.
2. Daphne Koller and Nir Friedman, Probabilistic Graphical Models: Principles and Techniques, MIT Press, 2009.
3. Mike Jordan's notes on Probabilistic Graphical Models
4. MIT lecture notes on algorithms for inference.
5. Probabilistic Programming and Bayesian Methods for Hackers by Cam Davidson Pilon

# TECHNICAL ELECTIVES

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 321 | Data and Web Mining | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

The course objectives of the data and web mining course are given below:

1. Discuss the need for data mining
2. Discuss various stages in data mining process
3. Learn about various data mining algorithms and its application domain
4. Learn about web mining in detail and the need for web mining
5. Discuss the use of web mining in social network analysis.

**Learning Outcomes:**

1. Identify appropriate data mining algorithms to solve the given real-world problems
2. Compare and evaluate different data mining techniques like classification, prediction, clustering, association rule mining, etc.
3. Know the basics of web crawling, web-page pre-processing and page ranking which will help to design and develop strategies in this domain
4. Acquire data from social networking websites and they can analyze it for efficient recommendation purpose.

UNIT I

Introduction to Data Mining: What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics. Data Mining Goals .Stages of the Data Mining Process, Data Mining Techniques , Knowledge Representation Methods. Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations.

UNIT II

Data preprocessing: Data cleaning .Data transformation , Data reduction. Data mining knowledge representation, Attribute-oriented analysis. Data mining algorithms: Association rules: Motivation and terminology, Basic idea: item sets, Generating item sets and rules efficiently , Correlation analysis.

UNIT III

Data mining algorithms: Classification, Basic learning/mining tasks, Inferring rudimentary rules: 1R algorithm , Decision trees , Covering rules. Data mining algorithms: Prediction , The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), Linear models.

UNIT IV

Web crawling: Basic crawler algorithm, Focused crawlers, Topical crawlers, Web search: Web page pre-processing, Inverted index, HITS algorithm, Page ranking algorithm, Leadership algorithm.

UNIT V

Social network analysis: Co-citation and bibliographic coupling, Community discovery. Web usage mining: Recommender systems. Mining Twitter, Mining Face book, Mining Instagram.

**Text books:**


1. Han, J., Kamber, M., & Pei, J. (2011). Data mining: Concepts and techniques (3rd ed.). Morgan Kaufmann publications.
2. Introduction to Data Mining, Vipinkumar, Michael Steinbach, Pang-Ning Tan, Person publications,2016
3. Mining the Web, SoumenChakrabarti, Elseier publications, 2002
4. Web Data Mining, Bing Liu, Second Edition, Springer publications, 2011.
5. Mining the Social Web, Mathew A. Russel, Mikhail Klassen, Third edition, Oreily publications, 2018.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 322 | Complexity Theory | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

The complexity of a problem describes whether the problem can be solved using algorithms, and how much resources (in form of time and space) it takes to solve a problem algorithmically. The course studies problems that cannot be solved and problems for which it is difficult to design efficient algorithms. We see how we can recognize such hard problems. The course gives a precise definition of what an algorithms is via Turing machines. The main focus is on central complexity classes, in particular NP-complete problems.

**Course Outcomes:**

1. Understands what an algorithm is, and which problems that be solved by an algorithm.
2. Understands the relationship between formal languages and Turing machines.
3. Knows about various complexity classes and the relationship between them
4. Recognize problems that cannot be solved computationally, and recognize NP-hard problems.
5. Prove the NP-completeness of some of the most basic hard problems.
6. Perform polynomial-time reductions
7. The student can recognize computationally hard problems, and contribute to research on classification of new problems as tractable or intractable.

UNIT I: COMPUTABILITY

Review of Turing Machines, view of PDAs, 2DFAs, FAs as restricted TMs and related theorems. Tape reduction, and robustness of the model. Encoding and Enumeration of Turing Machines, Undecidability. Rice-Myhill-Shapiro theorem. Relativisation. Arithmetic and Analytic Hierarchy of languages. Proof of Godel's incompleteness theorem based on computability. Kolmogorov Complexity. Resource bounded computation. Notion of a computational resource. Blum's Speedup theorem.

UNIT II: TIME COMPLEXITY

Time as a resource, Linear Speedup theorem. Crossing Sequences and their applications. Hierarchy theorems. P vs NP. Time Complexity classes and their relationships. Notion of completeness, reductions. Cook-Levin Theorem. Ladner's theorem. Relativization Barrier : Baker-Gill-Solovoy theorem.

UNIT III: SPACE COMPLEXITY

Space as a resource. PSPACE, L and NL. Reachability Problem, Completeness results. Savitch's theorem, Inductive Counting to show Immerman-Szelepscenyi theorem. Reachability Problems, Expander Graphs, SL=L

UNIT IV: COMPLEXITY OF COUNTING AND RANDOMIZATION

Counting Problems. Theory of #P-completeness. The complexity classes PP, ParityP, BPP, RP, BPP is in P/poly, Toda's theorem.

**Text Books:**

1. Automata and Computability - Dexter Kozen
2. Theory of Computation - Dexter Kozen
3. Theory of Computational Complexity - Du and Ko - (Reviews) , (Errata)
4. Complexity Theory: A Modern Approach - Sanjeev Arora and Boaz Barak.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
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| | | | L | T | P | C |
| CSE 323 | Advanced Computer Architecture | E | 3 | 0 | 0 | 3 |

**Course objectives:**

This course introduces the hardware side of high-performance computing, which became a necessary knowledge to fully exploit the performance of not only the high-end supercomputers, but general PCs, in the last decades.

**Course outcome:**

Students will be able to understand the key issues to enhance, limit, or degrade the performance of modern computers, so that they can immediately apply this set of knowledge to improve the efficiency of their own program codes.

**UNIT -I: FUNDAMENTALS OF COMPUTER DESIGN:**

Fundamentals of Computer design - Quantitative principles of computer design-Instruction set principles and examples – Classifications of instruction set - memory addressing- type and size of operands – RISC vs CISC - Encoding an instruction set. MIPS Bench Mark Analysis.

**UNIT –II: INTRODUCTION TO PIPELINING AND INSTRUCTION LEVEL PARALLELISM:**

Introduction to pipelining – Types of pipelining – Hazards in pipelining - Introduction to instruction level parallelism (ILP) – Challenges in ILP - Basic Compiler Techniques for exposing ILP - Reducing Branch costs with prediction - Overcoming Data hazards with Dynamic scheduling - Hardware-basedspeculation - Exploiting ILP using multiple issue and static scheduling - Exploiting ILP using dynamic scheduling, multiple issue and speculation - Tomasulo's approach, VLIW approach for multi-issue.

**UNIT III: MULTIPROCESSORS AND THREAD –LEVEL PARALLELISM:**

Introduction to multi processors and thread level parallelism - Characteristics of application domain - Systematic shared memory architecture - Distributed shared – memory architecture – Synchronization – Multithreading - Multithreading-fined grained and coarse grained, superscalar and super pipelining, hyperthreading. Vector architectures, organizations and performance tuning. GPU architecture and internal organization, Elementary concepts in CUDA programming

**UNIT IV: MEMORY HEIRARCHY DESIGN**

Introduction to cache performance - Cache Optimizations - Virtual memory - Advanced optimizations of Cache performance - Memory technology and optimizations - Protection: Virtual memory and virtual machines - multi-banked caches, critical word first, early restart approaches, hardware pre-fetching, write buffer merging.

**UNIT –VI: INTER CONNECTION AND NETWORKS:**

Introduction to inter connection networks and clusters - interconnection network media - practical issues in interconnecting networks- examples - clusters - designing a cluster – System on Chip (SoC) Interconnects – Network on Chip (NOC).

**TEXT BOOK:**


1. Dezsosima, Terence Fountain, Peter Kacsuk "Advanced Computer Architectures-A Design Space Approach", Pearson Education India.


**REFERENCES:**


1. Hennessy, John L., and David A. Patterson. "Computer architecture: a quantitative approach", Morgan Kaufman 4th and 5th edition
2. Shen, John Paul, and Mikko H. Lipasti. "Modern processor design: fundamentals of superscalar processors" Waveland Press
3. Hwang, Kai, and A. Faye. "Computer architecture and parallel processing.", Tata McGraw-Hill
4. Culler, D., Singh, J. P., and Gupta A, "Parallel computer architecture: a hardware/software approach", Gulf Professional Publishing.
5. Dally, William James, and Brian Patrick Towles. Principles and practices of interconnection networks. Elsevier, 2004.
6. Online reference – Intel (will be specified during lecture)
7. Online reference – Nvidia (will be specified during lecture)

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 421 | Natural Language Processing | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

The basic objectives of natural language processing course are the following:

1. Learn the basics of natural language processing and understand various steps in it.
2. To introduce the fundamentals of language processing from the algorithmic viewpoint.
3. To discuss various issues that make natural language processing a hard task.
4. To discuss some well-known applications of natural language processing

**Course Outcomes:**

At the end of the course, the student should be able to:

1. Appreciate the fundamental concepts of natural language processing.
2. Design algorithms for natural language processing tasks.
3. Develop useful systems for language processing and related tasks involving text processing.

UNIT I: INTRODUCTION

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues – Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.

UNIT II: WORD LEVEL AND SYNTACTIC ANALYSIS

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT III: SEMANTIC ANALYSIS AND DISCOURSE PROCESSING

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV: NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation-Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

UNIT V: INFORMATION RETRIEVAL AND LEXICAL RESOURCES

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame Net-Stemmers-POS Tagger- Research Corpora.

**Text Books:**


1. Daniel Jurafsky , James H. Martin , "Speech & language processing", Pearson publications.
2. Allen, James. Natural language understanding. Pearson, 1995.


**References:**


1. Pierre M. Nugues, "An Introduction to Language Processing with Perl and Prolog" , Springer.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 422 | Human Computer Interaction | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

The course objectives of the human computer interaction (HCI) course are as follows:

1. Discuss the capabilities of both humans and computers from the viewpoint of human information processing.
2. Demonstrate typical HCI models, styles and various historic HCI paradigms.
3. Apply an interactive design process and universal design principles to designing HCI systems.
4. Illustrate and utilize HCI design principles, standards and guidelines.
5. Analyze and identify user models, user support, socio-organizational issues and stakeholder requirements of HCI systems.
6. Discuss tasks and dialogues of relevant HCI systems based on task analysis and dialogue design.

**Course Outcomes:**

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

1. Identify the user requirements for HCI and challenges
2. Apply the theories and principles to design new Interface concepts
3. Design and development of HCI interfaces for mobile applications and web interfaces

UNIT I: FOUNDATIONS OF HCI

The Human: I/O channels – Memory – Reasoning and problem solving - The computer: Devices – Memory – Processing and networks - Interaction: Models – frameworks – Ergonomics – styles – elements – Interactivity- Paradigms.

UNIT II: DESIGN AND SOFTWARE PROCESS

Interactive design basics – Process – Scenarios – Navigation – Screen design – Iteration and prototyping - HCI in software process – Software life cycle – Usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III: MODELS AND THEORIES

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV: Mobile HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V: WEB INTERFACE DESIGN

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

**Text Books:**


1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Pearson Education.
2. Brian Fling, “Mobile Design and Development”, O’Reilly Media Inc.Bill Scott and Theresa Neil, “Designing Web Interfaces”, O’Reilly.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
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| | | | L | T | P | C |
| CSE 423 | Distributed Operating Systems | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To understand the concepts that underlie distributed computing systems along with design and implementation issues.
2. To study the key mechanisms and models for distributed systems.
3. Expected Outcome:

The Students will be able to:

1. Demonstrate various architectural models and design issues in distributed systems.
2. Illustrate various time services in distributed systems.
3. Explain different concurrent programming languages.
4. Identify various Inter Process Communication techniques.
5. Compare distributed scheduling algorithms.

UNIT I

Fundamentals: What is distributed operating system, issues in designing distributed operating system, Computer networks: Lan, WAN technologies, communication protocols, internetworking, Message passing: Issues in IPC by message passing, synchronization, buffering group communication, case study. .

UNIT II

Remote procedure calls: The RPC model, Implementing RPC, RPCs in heterogeneous environment, lightweight RPC, case study. Distributed shared memory: General architecture of DSM systems, Design and implementation issues of DSM, Consistency models, Replacement strategies, Advantages of DSM. .

UNIT III

Process management: Introduction, Process migration, Threads. Synchronization: Clock synchronization, event ordering, Mutual exclusion, deadlock, Election Algorithms. Resource management: Global scheduling algorithm, Task assignment, Load sharing and balancing approaches.

UNIT IV

Distributed File system: Desirable features of a good DFS, file models, file accessing models, file sharing semantics, file caching schemes, file replication, fault tolerance, atomic transactions, Design principles, Case study: Google DFS and Hadoop DFS.

UNIT V

Naming: Desirable features of a good naming system, system oriented names, object locating mechanisms, human oriented names, name caches, naming and security. Security: potential attacks, cryptography, authentication, access control, digital signatures, design principles.

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**References:**


1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Advanced Concepts in Operating Systems, MukeshSinghal and NiranjanShivratri, McGrawhill publications, 2017
3. Andrew S. Tanenbaul, Maarten Van Steen, Distributed Systems, Principles and Paradigms, Pearson publications, 2nd edition.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
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| | | | L | T | P | C |
| CSE 424 | Fog Computing | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To understand the limitations of today's Cloud computing models which are not designed for the volume, variety, and velocity of data generated by billions of IoT devices.
2. To understand the Fog Computing architecture and business model that address the challenges of resource management and optimization.
3. To analyse the requirements of Fog Computing model for handling IoT data: minimizing latency, conserving bandwidth, and data movement across geo-locations.
4. To familiarize with Fog applications that monitor real-time data from network-connected things and initiating action involving machine-to-machine (M2M) communication.
5. To understand how developers, write IoT applications for Fog Computing nodes that are closest to the network edge and ingest the data from IoT devices.
6. To understand how Fog Nodes, extend the Cloud to the Network Edge through the Case studies for Response time, Data storage time, coverage area, and kinds of applications.

**Course Outcomes:**

Upon completion of the course, the students are expected to:

1. Demonstrate various architectural models and design issues in Fog Computing.
2. Identify and mitigate Resource management and optimization challenges of Fog Computing model.
3. Learn and apply various Fog+IoT Programming paradigms and Fog+Edge Middleware.
4. Develop useful applications with examples: Smart Building, Predictive Analysis with FogTorch, and application of ML Techniques for defending IoT Devices, etc.
5. Will gain hands on experience with three Case studies for real-life Fog applications.

UNIT I: FOG COMPUTING

Limitation of Cloud computing, Differences between Cloud and Fog computing, What is Fog? Advantages of Fog computing, Business Models, Architecture of Fog computing, Opportunities and Challenges

UNIT II: ADDRESSING THE CHALLENGE IN FOG RESOURCES

Introduction, Taxanomy and Characteristics, Resource Management Challenge , Optimisation challenges, Miscellaneous Challenges, IoT and Fog: Introduction . Programming paradigms for IoT+ Fog, Research challenges and Future Research Directions

UNIT III

Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds
Introduction, Background ,Network Slicing in 5G , Network Slicing in Software-Defined Clouds , Network Slicing Management in Edge and Fog , Future Research Directions: Middleware for Fog and Edge Computing: Design Issues , Introduction. Need for Fog and Edge Computing Middleware: Design Goals ,State-of-the-Art Middleware Infrastructures, System Model , Clusters for Lightweight Edge Clouds , Architecture Management – Storage and Orchestration , IoT Integration, Security Management for Edge Cloud Architectures, Future Research Directions

UNIT IV: DATA MANAGEMENT AND ANALYSIS IN FOG COMPUTING

Introduction, Background, Fog Data Management, Future Research and Directionm Motivating Example: Smart Building, Predictive Analysis with Fog Torch, Survey of ML Techniques for Defending IoT Devices, Machine Learning in Fog Computing, Future Research Directions

UNIT V: CASE STUDIES

Uscase 1: Introduction, Human Object Detection, Object Tracking, Lightweight Human Detection. Use case 2: Introduction, Data-Driven Intelligent Transportation Systems, Mission-Critical Computing Requirements of Smart Transportation Applications, Fog Computing for Smart Transportation Applications, Case study 3: Intelligent Traffic Lights Management (ITLM) System, Testing Perspectives
Reference book:

1. Fog and Edge Computing, Rajkumar Buyya, Satish Narayana Srirama, Wiley Publications, 2019.
2. Fog computing in the Internet of Things: Springer publications, 2018

(Other reference: Research papers from IEEE, ACM, Springer and Elsevier)

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
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| | | | L | T | P | C |
| CSE 425 | Parallel Algorithms | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

The course provides a modern introduction to design, analysis and implementation of sequential and parallel algorithms. In particular, the course is based on a pragmatic approach to parallel programming of message-passing algorithms through the C language and the MPI library. This course introduces critical methods and techniques related to parallel computing. Particularly, the course focuses on hardware, algorithms, and programming of parallel systems, providing students a complete picture to understand pervasive parallel computing.

**Course Outcomes:**

1. An ability to apply knowledge of computing and mathematics appropriate to the discipline.
2. An ability to analyze a problem and identify the computing requirements appropriate for its solution; an ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs
3. An ability to apply mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
4. An ability to apply design and development principles in the construction of software systems of varying complexity.
5. An ability to function effectively as a member of a team in order to accomplish a common goal.

UNIT I

Sequential model, need of alternative model, parallel computational 8 models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT II

Performance Measures of Parallel Algorithms, speed-up and 8 efficiency of PA, Cost- optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

UNIT III

Parallel Sorting Networks, Parallel Merging Algorithms on on 8 CREW/EREW/MCC, Parallel Sorting Networks CREW/EREW/MCC/, linear array.

UNIT IV

Parallel Searching Algorithm, Kth element, Kth element in X+Y on 8 PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT V

Graph Algorithms - Connected Graphs, search and traversal, 8 Combinatorial Algorithms-Permutation, Combinations, Derrangements.

**Text Books:**


1. M.J. Quinn, “Designing Efficient Algorithms for Parallel Computer”, McGrawHill.
2. S.G. Akl, “Design and Analysis of Parallel Algorithms” 3. S.G. Akl, ”Parallel Sorting Algorithm” by Academic Press

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
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| | | | L | T | P | C |
| CSE 426 | Web Services | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

Students will try to learn:

1. To get familiar with the basics of the Service Oriented Architecture & Web Services.
2. To explore different web extensions and web services standards
3. To get familiar with Service Registry, Discovery, Selection and Composition.
4. To get familiar with semantic web

**Course Outcome:**

Students will able to:

1. Describe and differentiate different Web Extensions and Web Services.
2. Develop web service using SOAP and REST
3. Understand, and evaluate different service composition mechanism.
4. Semantic Web and Ontologies

UNIT I

Introduction to Web Services - fundamental of web services, basic operational model of web services, Business motivations for web services, B2B, B2C, Technical motivations, basic steps of implementing web services, benefits and challenges of using web services, tools and technologies enabling web services, Web services Architecture and its characteristics, web services communication models, core building blocks of web services, web services technology stack.

UNIT II

Service–oriented Architecture (SOA), implementation view, logical view, process view, deployment view, composition of web services, from application server to peer to peer, life in the runtime. Fundamentals of SOAP-SOAP Message Structure, SOAP encoding, Encoding of different data types, SOAP communication and messaging, SOAP message exchange models, limitations of SOAP.

UNIT III

Transport protocols for web services, messaging with web services, WSDL, Anatomy of WSDL, manipulating WSDL, web service policy, discovering web services, UDDI, Anatomy of UDDI, Web service inspection, Ad – Hoc Discovery, Securing web services.

UNIT IV

Discovering Web Services, service discovery mechanisms, role of service discovery in a SQA, UDDI-UDDI registries, uses of UDDI Registry, UDDI data structures, Programming with UDDI, Publishing, searching and deleting information in a UDDI Registry, Publishing API, limitations of UDDI.

UNIT V

Semantic Web – Role of Metadata in web content, Resource Description Framework, RDF schema, Architecture of semantic web.
Web Services Interoperability - Means of ensuring Interoperability, creating Java client for a Web service, Goals of Cryptography, Digital signature, Digital Certificate, Challenges in Web Services Interoperability. Web Services Security, XML security framework, XML Encryption.

**Text Books:**

1. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.

**Reference Books:**

1. Java Web Service Architecture, James McGovern, Sameer Tyagi etal., Elsevier
2. Building Web Services with Java, 2 Edition, S. Graham and others, Pearson Edn.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly,SPD.
4. Web Services, G. Alonso, F. Casati and others, Springer.Outcomes

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 427 | Advanced Database Management Systems | E | 3 | 0 | 2 | 4 |

**Course Objectives:**

Students will understand

6. To store data using fixed and variable length records in the file
7. To implement index structures in the file
8. To implement query parsing and execution
9. Concurrency control protocols used for transaction processing
10. Recovery techniques for recovering from transaction failures

**Course Outcomes:**

Students will be able to:

4. Store data in the files and to implement indexing schemes for the fast retrieval of data
5. Implement query complier, planner and executor
6. Implement concurrency control protocols for transaction processing system

UNIT I

Overview of the DBMS, Introduction to DBMS implementation using Megatron 2000 database system, Data storage using main memory and hard disks, Disk failures, Recovery from disk crashes. Representing data elements: Record, Representing block and record address, Variable length data and records, Record modifications

UNIT II

Index structures: Indexes on sequential files, secondary indexes, B-Trees, Hash tables. Multidimensional indexes: Hash and tree like structures for multidimensional data, Bitmap indexes

UNIT III

Query execution: Algebra for queries, Introduction to Physical-Query-Plan Operators. One-Pass Algorithms for Database Operations, Nested-Loop Joins, Two-Pass Algorithms Based on Sorting Two-Pass Algorithms Based on Hashing, Index-Based Algorithms, Buffer Management, Algorithms Uging More Than Two Passes, Parallel Algorithms for Relational Operations

UNIT IV

The query compiler: Parsing, Algebraic Laws for Improving Query Plans, From Parse Trees to Logical Query Plans, Estimating the Cost of Operations, Introduction to Cost-Based Plan Selection, Choosing an Order for Joins, Completing the Physical-Query-Plan Selection,

UNIT V

Concurrency control: Conflict-Serializability, view serializability, Enforcing Serializability by Locks, Locking Systems With Several Lock Modes, An Architecture for a Locking Scheduler, Concurrency control by timestamps and validation, Transactions that Read Uncommitted Data, Coping with system failures: Undo logging, Redo logging, Undo/Redo logging, Protecting media failures.

**Books of Study:**


2. Database System Implementation, Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Person publications, First Edition, 2002


**Books of References:**


6. Database system the complete book: Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Person New International Edition, Second Edition, 2013
7. Research papers on DBMS implementation

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 428 | Computer Graphics and Multimedia | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To learn the basic principles of 3-dimensional computer graphics.
2. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
3. Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.
4. To discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.
5. To comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles

**Course Outcomes:**

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

1. Understand the overview of Graphics system
2. Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
3. Describe the importance of viewing and projections.
4. Model, implement and apply fractal geometry concepts.
5. Understand and apply illumination models

UNIT I

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices.
Output Primitives: Line drawing Algorithms: DDA and Bresenham's Line Algorithm, Circle drawing Algorithms: Midpoint Circle Algorithm and Bresenham's Circle drawing Algorithm.

UNIT II

Two Dimensional Geometric Transformation: Basic Transformation (Translation, rotation, Scaling) Matrix Representation, Composite Transformations, Reflection, Shear, Transformation between coordinate systems.
Two Dimensional Viewing: Window-to- View port Coordinate Transformation.

UNIT III

Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm). Aliasing and Antialiasing, Half toning, Thresholding and Dithering, Scan conversion of Character. Polygon Filling: Seed Fill Algorithm, Scan line Algorithm.
Two Dimensional Object Representation: Spline Representation, Bezier Curves and B-Spline Curves.

UNIT IV

Fractal Geometry: Fractal Classification and Fractal Dimension.
Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite Transformation.
Projections: Parallel Projection and Perspective Projection.
Visible Surface Detection Methods: Back-face Detection, Depth Buffer, A- Buffer, Scan- line Algorithm and Painters Algorithm.

UNIT V

Illumination Models: Basic Models, Displaying Light Intensities.
Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading and Phong Shading.
Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, methods of controlling Animation, Morphing.
Virtual Reality: Types of Virtual reality systems, Input and Output Virtual Reality devices.

**Text Books:**

1. Computer Graphics with Virtual Reality System, Rajesh K.Maurya, Wiley Dreamtech.
2. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education

**Reference Books:**

1. Computer Graphics Principle and Practice , J.D. Foley, A.Dam, S.K. Feiner, Addison, Wesley.

| SUBJECT CODE | SUBJECT TITLE | CORE/ ELECTIVE | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 429 | Advanced Data Structures and Algorithms | E | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To understand the techniques for analysing the complexity of algorithms
2. To learn the concepts of utilizing advanced data structures
3. To design algorithms for complex problem solving with appropriate data structures
4. To provide knowledge in various advanced data structures and algorithms for further research
5. To introduce various algorithm design methods for better programming skills

**Course Outcomes:**

On successful completion of this course, students should be able to:

1. Show the ability to analyse the efficiency of algorithms.
2. Explain a variety of advanced data structures and their implementations.
3. Identify different algorithm design techniques to solve problems.
4. Solve complex problems by implementing learned algorithm design techniques and data structures.
5. Explain approximation algorithms and NP-completeness.

UNIT I

Advanced Data Structures: Importance and need of good data structures and algorithms Heaps, AVL Trees (Search, Insertion, Deletion) Red-Black Trees(Search, Insertion and Deletion), Splay Trees( Search, Insertion and Deletion),B-trees, B+ Trees ( Search, Insertion and Deletion), Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures

UNIT II

Algorithms Complexity and Analysis: Probabilistic Analysis with example, Amortized Analysis with example, Competitive Analysis with example, Internal and External Sorting algorithms like external merge sort, distribution sorts.

UNIT III

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, Topological sort, Max flow: Ford Fulkerson algorithm, max flow – min cut, Dynamic Graphs, Few Algorithms for Dynamic Graphs, Union-Find Algorithms.

UNIT IV

Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover Problems.

UNIT V

Randomized algorithms: Introduction, Type of Randomized Algorithms, Quick Sort, Min- Cut, 2-SAT; Game Theoretic Techniques, Random Walks.

**Text Books:**


1. Thomas Coremen, Introduction to Algorithms, PHI (2009).
2. David E. Goldberg, Genetic Algorithm, Pearson education (2005).
3. Roger Sedgewick and Kevin Wayne , Algorithms, Addison-Wesley Professional(2011) .


**Reference Books:**


1. Sahni, Sartaj, Data Structures, Algorithms and Applications in C++, MIT Press (2005)