B.TECH (CSE) SYLLABUS

[W.E.F. 2019 – 2020]

A four year fulltime semester based degree programme in

Computer Science and Engineering

Department of Computer Science & Engineering

Aliah University

II A/27, New Town

Kolkata – 700156, West Bengal, India.

B.Tech (CSE) Program Outcome (PO)

After completion of B.Tech (CSE) Program, a student should be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences..

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

The Program Specific outcome (PSOs):

Upon successful completion of B.Tech (CSE) Program, student will be able to:

PSO1: Apply the knowledge and skills of Computer Science and Engineering for solving real life problems

PSO2: Design, develop, test, and maintenance of software systems based on requirements

PSO3: Pursue higher education including research by applying the knowledge of Computer Science and Engineering

PSO4: Adapt to changing technical, organizational, and societal needs with ability to work and communicate effectively as a team member or leader

Semester I:

Engineering Mechanics

Code: MENUGES01
Contracts:3L+1T
Credits:4

This is the foundation course that will help to understand the advanced courses in the subsequent semesters. A working knowledge of statics using force equilibrium and free body diagrams. It provides an understanding of deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behaviour of materials under various load conditions.

Module no	Content of the module	Allotted hour
1	Importance of Mechanics in engineering. Introduction to Statics; Concept of Particle and Rigid Body; Types of forces: collinear, concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Force as a vector; Transmissibility of a force.	3
	Introduction to Vector Algebra; Parallelogram law; Lami's theorem; Co-ordinate representation of vector; Cross product and Dot product and their applications.	3
	Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its equivalent force-couple system; Resultant of forces	4
2	Concept and Equilibrium of forces; Free body concept and diagram; Equations of equilibrium, plane frames and trusses.	4
	Concept of Friction; Coulomb friction; Angle of Repose; Coefficient of friction	4
3	Distributed Force: Centroid and Centre of Gravity; Centroids, circular sector, quadrilateral, composite areas consisting of different figures.	4
	Moments of inertia: Parallel axis theorem; Perpendicular axis theorem; Mass moment of inertia of symmetrical bodies e.g. cylinder, sphere, cone etc.	4
	Concept of virtual work and energy; Concept of simple stresses and strains; Torsion; Concept of fluid statics	4
4	Introduction to Dynamics: Kinematics and Kinetics; Newton's laws of motion; Law of gravitation & acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs.	4
	Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion). Relative motion.	4
5	Kinetics of particles: Newton's second law; Equation of motion; D'Alembert's principle and free body diagram; Principle of work and energy; Principle of conservation of energy; Power and efficiency; Impulse and Momentum.	6
	Steady flow; Vibration	2

Upon completion of this course, students will able to grasp the following concepts –

- Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.

- Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
- Understand basic dynamics concepts – force, momentum, work and energy;
- Understand and be able to apply Newton's laws of motion;
- Understand and be able to apply other basic dynamics concepts – the Work-Energy principle, Impulse – Momentum principle and the coefficient of restitution;
- Learn to solve dynamics problems choosing an appropriate solution strategy;
- Attain an introduction to basic machine parts such as pulleys and mass-spring systems etc.

Suggested Books:

1. Meriam &Kraige: "Engineering Mechanics [Vol I & II]",Wiley India.
2. R.C. Hibbeler: "Engineering Mechanics: Statics & Dynamics",Pearson.
3. F. P. Beer and E. R. Johnston: "C++: Vector Mechanics for Engineers [Vol I & II]", TMH.
4. Timoshenko, Young and Rao: "Engineering Mechanics",TMH.

Basic Electronics Engineering

Code: ECEUGES01
Contracts: 3L
Credits: 3

Engineering Mathematics I

Code: MATUGBS01
Contracts: 4L
Credits: 4

Engineering Physics

Code: PHYUGBS01
Contracts: 3L
Credits: 3

Elementary Arabic and Islamic Studies

Code: UCCUGAU01
Contracts: 4L
Credits: 0

Engineering Graphics & Design

Code: CENUGES01
Contracts: 1T+3P
Credits: 2.5

Module no	Content of the module	Allotted hour
1	**Introduction:** Basic concepts of Electrostatics and Electromagnetic.	4
2	**DC Circuit**: Introduction of Electric Circuit & Elements, Loop Analysis, Node analysis, Star (Y) - Delta (Δ) & Delta (Δ)-Star (Y) Transformations.	6
3	**DC Network Theorem**: Superposition Theorem, Thevenin's theorem, Norton's theorems, Maximum Power Transfer Theorem, Reciprocity Theorem, Time-domain analysis of first-order RL and RC circuits.	8
4	**Single-phase AC Circuits** Generation of Sinusoidal Voltage Waveform (AC) and Some Fundamental Concepts, Representation of Sinusoidal Signal by a Phasor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	8
5	**Transformer:** Definition, working principle & construction, EMF equation, Equivalent circuit, Open circuit & Short circuit tests, Efficiency & Regulation.	4
6	**DC Machines**: Constructional Features of D.C Machines , Principle of Operation of D.C Machines, EMF & Torque Equation , D.C Generators, D.C Motors, Losses, Efficiency, 3-point Starter and speed control of DC shunt Motor.	4
7	**Three-phase Induction Motor**: Introduction to 3-phase induction motor	1
8	**Introduction to Power System:** Basic concepts of Power System	1

Suggested Books:

1. D.P. Kothari & I.J. Nagrath: "Basic Electrical Engineering", TMH.
2. Hughes: "Electrical and Electronics Technology", Pearson Education.
3. V.N Mittle& Arvind Mittal: "Basic Electrical Engineering", TMH[Second Edition].
4. V. D. Toro: "Electrical Engineering Fundamentals", Prentice Hall India.
5. C L Wadhwa: "Basic Electrical Engineering", New Age International Publishers.

Basic Electrical Engineering Lab

Code: EENUGES02
Contracts: 3P
Credits: 1.5

List of experiments:

1. Verification of Thevenin's Theorem
2. Verification of Norton's Theorem
3. Verification of Superposition Theorem
4. Verification of Maximum Power Transfer theorem
5. Power Measurement of Fluorescent Lamp
6. V-I characteristics of Incandescent Lamp
7. Speed Control of DC motor Using Field and Armature Control Method
8. Starting and reversing of DC motor
9. Open circuit and Short circuit test of Single Phase Transformer
10. Calibration of Voltmeter and Ammeter
11. Characteristics of Series R-L-C Circuit
12. Characteristics of Parallel R-L-C Circuit
13. Resistance measurement and continuity test of DC motor using Megger

Basic Electronics Engineering Lab

Code: ECEUGES02
Contracts: 3P
Credits: 1.5

Engineering Physics Lab

Code: PHYUGBS02
Contracts: 3P
Credits: 1.5

List of experiments:

1. Measurements of length (or diameter) using vernier scale, slide caliper, screw gauge and travelling microscope.
2. Determination of the radius of curvature of a spherical surface by using spherometer.
3. Determination of moment of inertia of (a) a cylinder and (b) a rectangular solid bar.
4. To determine the focal length of a concave lens by combination method and hence to determine the refractive index of the material of the lens by measuring the radii of curvature of both lenses
5. Determination of the average resistance per unit length of the meter bridge wire by Carey-Foster's method and hence to determine an unknown resistance
6. Determination of the horizontal component of the earth's magnetic field and the magnetic moment of a magnet by employing magnetometers
7. Determination of Young's Modulus of elasticity of a material of a bar by the method of flexure.
8. Determination of rigidity modulus of a material of a wire by static method.
9. Determination of rigidity modulus of a material of a wire by dynamic method.
10. Determination of unknown frequency of a tuning fork by using a sonometer

Semester II:

Programming for Problem Solving

Code: CSEUGES01
Contracts: 3L
Credits: 3

Course Objectives:

- To provide a comprehensive study of the C programming language and problem solving, stressing upon the strengths of C.
- To provide the writing modular, efficient, maintainable, and portable code.

Course Outcomes:

CO 1: Students should be able to write, compile and debug programs in C language.
CO 2: They should be able to use different data types in a computer program.
CO 3: They should be able to design programs involving decision structures, loops and functions.
CO 4: Students should be able to explain the difference between call by value and call by reference.
CO 5: Students should be able to understand the dynamics of memory by the use of pointers.
CO 6: Students should be able to use different data structures and create/update basic data files.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√							
CO2	√				√						√	
CO3	√	√		√	√							
CO4	√		√		√			√				
CO5	√	√							√			√
CO6	√		√						√			√

Module no	Content of the module	Allotted hour
1	**Introduction to computing:** block architecture of a computer, bit, bytes, memory, and representation of numbers in memory.	1
2	**Introduction to problem solving:** Basic concepts of an algorithm, program design methods, flowcharts.[1]	1
3	**Introduction to C programming:** A Brief History of C, C is middle-level Language, is a Structured Language, Complier Vs Interpreters, The Form of a C Program, Library & Linking, Compilation & Execution process of C Program . [2]	2

4	**Variables, Data Types, Operator & Expression:** Character Set, Token, Identifier & Keyword, Constant, Integer, Floating Point, Character, String, Enumeration, Data Types in C, Data Declaration & Definition Operator & Expression, Arithmetic, Relational, Logical, Increment & Decrement, Bit wise, Assignment, Conditional, Precedence & Associability of Operators.	3
5	**Console I/O:** Introduction, Character input & Output, String Input & Output, Formatted Input/Output (scanf/printf), sprintf&sscanf.	2
6	**Control Statement:** Introduction, Selection Statements, Nested if, if-else-if, The "?" Alternative, The Conditional Expression, switch, Nested switch, Iteration Statements, for loop, while loop, do-while loop, Jump Statements, Goto& label, break & continue, exit() function.	4
7	**Array & String:** Single Dimension Arrays, Accessing array elements, Initializing an array, Multidimensional Arrays, Initializing the arrays, Memory Representation, Accessing array elements, String Manipulation Functions, searching, sorting an array.	6
8	**Function:** Introduction, advantages of modular design, prototype declaration, Arguments & local variables, Returning Function Results by reference & Call by value, passing arrays to a function, Recursion.	4
9	**Storage Class & Scope:** Meaning of Terms, Scope - Block scope & file scope, Storage Classes Automatic Storage, Extern Storage, Static, Storage, Register Storage.	2
10	**Pointers:** Introduction, Memory Organization, The basics of Pointer, The Pointer operator Application of Pointer, Pointer Expression, Declaration of Pointer, Initializing Pointer, De-referencing Pointer,Void Pointer, Pointer Arithmetic, Precedence of &, * operators Pointer to Pointer, Constant Pointer, Dynamic memory allocation, passing pointer to a function, array of pointers, accessing arrays using pointers, handling strings using pointers.	4
11	**Structure, Union, Enumeration & typedef:** Structures, Declaration and Initializing Structure, Accessing Structure members, Structure, Assignments, Arrays of Structure, Passing, Structure to function, Structure Pointer, Unions.	2
12	**C Preprocessor:** Introduction, Preprocessor Directive, Macro Substitution, File Inclusion directive, Conditional Compilation.	2
13	**File handling:** Introduction, File Pointer, Defining & Opening a File, Closing a File, Input/Output Operations on Files, Operations on Text mode files and binary mode files, Error Handling During I/O Operation, Random Access To Files, Command Line Arguments	3

Suggested Books:

1. B.S. Gottfried: "Programming in C", TMH.
2. B.W. Kernighan and D.M. Ritchie: "The C Programming Language", PHI.
3. H. Schildt: C++: "The Complete Reference", TMH, 4e.
4. B. Stroustrup: "The C++ Programming Language", Addison-Wesley.
5. E. Balagurusamy: "Programming in ANSI C", TMH.
6. Yashwant Kanetkar: "Let Us C", BPB Publications.
7. K. N. King: "C Programming: A Modern Approach", W. W. Norton and Company.
8. Pradip Dey and Manas Ghosh: "Programming in C", Oxford University Press

Basic Electrical Engineering

Code: EENUGES01
Contracts: 3L
Credits: 3

Module no	Content of the module	Allotted hour
1	**Introduction:** Basic concepts of Electrostatics and Electromagnetic.	4
2	**DC Circuit**: Introduction of Electric Circuit & Elements, Loop Analysis, Node analysis, Star (Y) - Delta (Δ) & Delta (Δ)-Star (Y) Transformations.	6
3	**DC Network Theorem**: Superposition Theorem, Thevenin's theorem, Norton's theorems, Maximum Power Transfer Theorem, Reciprocity Theorem, Time-domain analysis of first-order RL and RC circuits.	8
4	**Single-phase AC Circuits** Generation of Sinusoidal Voltage Waveform (AC) and Some Fundamental Concepts, Representation of Sinusoidal Signal by a Phasor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	8
5	**Transformer:** Definition, working principle & construction, EMF equation, Equivalent circuit, Open circuit & Short circuit tests, Efficiency & Regulation.	4
6	**DC Machines**: Constructional Features of D.C Machines , Principle of Operation of D.C Machines, EMF & Torque Equation , D.C Generators, D.C Motors, Losses, Efficiency, 3-point Starter and speed control of DC shunt Motor.	4
7	**Three-phase Induction Motor**: Introduction to 3-phase induction motor	1
8	**Introduction to Power System:** Basic concepts of Power System	1

Suggested Books:

1. D.P. Kothari & I.J. Nagrath: "Basic Electrical Engineering", TMH.
2. Hughes: "Electrical and Electronics Technology", Pearson Education.
3. V.N Mittle& Arvind Mittal, "Basic Electrical Engineering", TMH [Second Edition].
4. V. D. Toro: "Electrical Engineering Fundamentals", Prentice Hall India.
5. C L Wadhwa: "Basic Electrical Engineering", New Age International Publishers.

Engineering Mathematics II

Code: MATUGBS02
Contracts: 4L
Credits: 4

Engineering Chemistry

Code: CHMUGBS01
Contracts: 3L
Credits: 3

Module no	Content of the module	Allotted hour
1	**Thermodynamics:** Importance and scope, definitions of system and surroundings; type of systems; Extensive and intensive properties; Steady state and equilibrium; Zeroth law of thermodynamics; First law of thermodynamics, internal energy and Enthalpy as a state function; Second law of thermodynamics; Kelvin, Planck and Clausius statements; Carnot cycle and refrigerator; Carnot's theorem; Physical concept of entropy.	12
2	**Water and its treatment:** Sources of water, Impurities in water, Hardness of water, Determination of hardness of water, Water quality parameter, Treatment of water for domestic purpose, Waste water.	8
3	**Polymers:** Terminology, Classification of polymers, Polymerization techniques, Molecular weight of polymers, Plastics, Rubbers, Fibers, Conducting and semiconducting polymers, Natural polymers.	8
4	**Green Chemistry:** Definition and concept of green chemistry, Emergence of green chemistry, Alternative solvents, Design of safer chemicals, Microwave radiation of green synthesis, Green laboratory Technology.	8

Suggested Books:

1. K. S. Maheswaramma and M. Chugh: "Engineering Chemsitry"; Pearson, 2016.
2. Wiley: "Engineering Chemistry", Wiley, 2nd Edn., 2014.

Communicative English

Code: ENGUGHU01
Contracts: 3L
Credits: 3

Objectives of the Course: To impart basic Communication skills to the first year UG students in the English language through rigorous practice and use of various categories of common words and their application in sentences; to enable them to achieve effective language proficiency for their social, professional & inter personal communication both in speaking & writing.

Module no	Content of the module	Allotted hour
1	**Fundamentals of Communication:** Communication: Meaning, Nature, Process, Importance and Function of Communication; Levels of Communication: Intra-personal, Interpersonal, Organizational, Mass Communications; The Flow of Communication: Downward, Upward, Lateral or Horizontal, Diagonal, Grapevine Communication; Network in an Organization; Principles for Effective Communication; Verbal and Non-Verbal Communication; Barriers to Communication, Gateways to Communication.	
2	**Listening and Speaking Skills** The Process of Listening; Barriers to Listening; Types of Listening: Active	

	and Passive Listening; Methods for improving listening skills, Benefits of Effective Listening. Presentation Strategies: Defining Purpose; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Dimensions of Speech – Accent, Pitch, Rhythm, Intonation, Strong and Weak Forms, Connected Speech- Assimilation and Elision, Paralinguistic Features of Voice; Articulation of Speech Sounds- Vowels and Consonants; Spelling and Pronunciation; Problems of Indian speakers of English and their remedial measures.	
3	**Reading and Writing Skills** **Reading Skills:** Purpose, Process, Methodologies, and Strategies; Special Reading Situations – Skimming and Scanning, Intensive and Extensive Reading, Critical Reading, Drawing Inferences, Reading Technical Reports, etc. **Writing Skills:** Words and Phrases: Word Formation, Synonyms and Antonyms, Homophones, One Word Substitutes, Words Often Confused, Word Choice - Right Words, Appropriate Words, Idioms and Phrases; Correct Usage: Parts of Speech, Modals, Concord, Articles, Infinitives, Requisites of Sentence Construction. Elements of Effective Writing, Main Forms of Written Communication: Paragraph - Techniques and Methods (Inductive, Deductive, Linear, Spatial, Chronological etc.), The Art of Condensation- various types (Précis, Summary and Abstract, etc.), Description, Agenda, Minutes, Notices, Circulars, Memo, Advertisements, Drafting an E-mail, Press Release.	
4	**Business Communication** Business Letters: Principles; Sales & Credit letters; Claim and Adjustment Letters; Job application and Résumés. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal. Negotiation & Business Presentation skills.	

Suggested Books:

1. Sethi, J & et al.:"A Practice Course in English Pronunciation", Prentice Hall of India, New Delhi.
2. Berry Cicely: "Your Voice and How to Use it Successfully", George Harp & Co. Ltd, London
3. Bansal, R.K. and J.B. Harrison:"Spoken English", Orient Longman.
4. Hornby's, A.S.:"Oxford Advanced Learners Dictionary of Current English", 7th Edition, Oxford University Press.
5. Pillai, Sabina &Agna Fernandez: "Soft Skills & Employability Skills",Cambridge Univ. Press.
6. Sudharshana, N.P. & C. Savitha: "English for Technical Communication", Cambridge Univ. Press.
7. Raman, Meenakshi & Sangeeta Sharma: "Technical Communication: Principles and Practice",Oxford Univ. Press.
8. Prasad, P.:"The Functional Aspects of Communication Skills", Delhi.
9. McCarthy, Michael:"English Vocabulary in Use", Cambridge University Press, Cambridge.
10. Leech, G &Svartvik, J. A: "Communicative Grammar of English", Pearson Education. New Delhi.
11. Narayanaswamy V.R.:"Strengthen your Writing", Orient Longman, London.
12. Dean, Michael:"Write it", Cambridge University Press, Cambridge.
13. Sen, Leena:"Communication Skills", Prentice Hall of India, New Delhi.
14. Bown, G.:"Listening and Spoken English", Longman, London

Programming for Problem Solving Lab

Code: CSEUGES02
Contracts: 4P
Credits: 2

Course Objectives:

- To make acquaint the students to know the programming language.
- To know how "C" can be used to write serious program to solve the problems.
- Programs will be based on the theoretical paper and to cover the concept of basic arithmetic operations, control statements, arrays, strings, functions, recursions, pointers, structures, unions, file handling, etc.

Course Outcomes:

CO 1: Students should be able to write, compile and debug programs in C language.
CO 2: Understand and use different data types in a computer program.
CO 3: Understand various problem solving methods.
CO 4: Able to design programs involving decision structures, loops and functions.
CO 5: Understand the dynamics of memory by the use of pointers.
CO 6: Able to use different data structures and create/update basic data files.
CO 7: Understand File I/O and Preprocessor directives.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√		√							
CO2	√				√		√				√	
CO3	√	√		√	√							
CO4	√		√		√			√				
CO5	√	√							√	√		√
CO6	√		√						√	√		√
CO7	√		√							√		√

Week 1 Ubuntu and Linux Commands.
Week 2 Designing of flowcharts and algorithms using raptor tool 1.Areas of Polygons. 2. Calculation of Simple and Compound Interest. 3. Swapping of Two numbers with and without temporary variable. 4. Checking whether a number is even or odd. 5. Sum of first 'n' natural numbers. 6. Checking a number whether it is divisible by any given number. 7. Evaluation of mathematical expressions. 8. Programs using scanf( ) and printf( ) statements.
Week 3,4 Programs on operators. (Minimum 4 Programs) Programs on Conditional Statements. (Minimum 4 Programs) Programs on Control Statements. (Minimum 4 Programs)
Week 5 Programs on Functions. (Minimum 6 Programs)
Week 6 Programs on One Dimensional and Two Dimensional Arrays. (Minimum 2 Programs)
Week 7 Programs on Strings with and without string built-in Functions. (Minimum 4 Programs)
Programs on Accessing Structures and Nested Structures. (Minimum 2 Programs)
Week 8 Programs on Array of Structures, Structures and Functions. (Minimum 4 Programs) Programs on Unions, typedef and enum. (Minimum 2 Programs)

Week 9 Programs on Pointers, pointer arithmetic, pointer expression, One Dimensional and Two dimensional arrays. (Minimum 4 Programs)
Week 10 Programs on Pointer to structure, Call by Reference, Pointer to Pointer. (Minimum 3 Programs) Programs on Dynamic Memory Allocation Functions. (Minimum 3 Programs)
Week 11 Programs on Stacks and Queues using Arrays.
Week 12 & 13 Programs on Single Linked List.
Week 14 & 15 Programs on File Operations. (Minimum 6 Programs)
Week 16 Review

Suggested Books:

1. B.S. Gottfried: "Programming in C", TMH.
2. B.W. Kernighan and D.M. Ritchie: "The C Programming Language", PHI.
3. H. Schildt: "C++: The Complete Reference", TMH, 4e.
4. B. Stroustrup: "The C++ Programming Language", Addison-Wesley.
5. E. Balagurusamy: "Programming in ANSI C", TMH.
6. Yashwant Kanetkar: "Let Us C", BPB Publications.
7. K. N. King: "C Programming: A Modern Approach", W. W. Norton and Company.
8. Pradip Dey and Manas Ghosh: "Programming in C", Oxford University Press.

Workshop Practice

Code: MENUGES02
Contracts: 1T+2P
Credits: 2

Introduction to various hand tools e.g. allen keys, spanners, punch, files, hacksaw, hammers, chisels, vices, marking block, angle plates, etc.
Introduction to basic instruments: Vernier Caliper, Micrometer, Tri-square, Surface Plate, Height Gauge, Vernier Bevel Protractor, Screw Pitch Gauge, Radius Gauge, etc.
Demonstration on different machines and Equipments: Lathe, Milling, Drilling, Shaping, Radial Drilling, Grinding, Welding, Power Saw, Power Press, Planer Machine, Microscope, Profile Projector, etc.
Practical Exercises: Exercises involving the following operations: measuring and marking, sawing, chipping, filing, maintaining of perpendicularity of all surfaces by filing, making of taper surface by filing, making of curved surface by filing, plain turning, step turning and drilling.

Suggested Books:

1. 1. Hazra Choudhury&Hazra Choudhury:"Elements of Workshop Technology, Vol. I & II", Media Promoters and Publishers Pvt. Ltd.
2. Rajender Singh:"Introduction to Basic Manufacturing Process and Workshop Technology", New Age International.

Engineering Chemistry Lab

Code: CHMUGBS02
Contracts: 3P
Credits: 1.5

List of experiments:

1. Acidimetric estimation of Sodium Carbonate and Sodium bi-Carbonate in their mixture.
2. Estimation of Total Hardness of water by Complexometric method
3. Estimation of Fe^{II} in Mohr's Salt by Permanganometric Titration.
4. Qualitative analysis of single solid organic compounds.

Language Lab

Code: ENGUGHU02
Contracts: 2P
Credits: 1

Objectives of the Course: To impart basic Communication skills to the first year UG students in the English language through rigorous practice and use of various categories of common words and their application in sentences; to enable them to achieve effective language proficiency for their social, professional & inter personal communication both in speaking & writing; to improve their English pronunciation.

Laboratory Practical:

1. Group Discussion: Practical based on Accurate and Correct Grammatical Patterns.
2. Conversational Skills under suitable Professional Communication Lab conditions with emphasis on Kinesics: Interview, Greeting and Introducing, Leave taking, Asking Questions and Giving Replies, Inviting Friends and Colleagues, Negotiating, Persuading, Taking Initiatives, Praising and Complementing People, Expressing Sympathy, Seeking and Giving Permission, Complaining and Apologizing, Official/Public Speaking, Telephoning etc.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic/ Kinesics.
4. Presentation Skills for Technical Paper/Research Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Extempore, Argumentative Skills, Role Play Presentation with Stress and Intonation.
6. Comprehension Skills based on Reading and Listening Practical on a model Audio-Visual Usage.

Suggested Books:

1. Bansal R.K. & Harrison: "Phonetics in English", Orient Longman, New Delhi.
2. Sethi& Dhamija: "A Course in Phonetics and Spoken English", Prentice Hall, New Delhi.
3. Pandey, L.U.B. &R.P.Singh: "A Manual of Practical Communication", A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans, Daniel:"Cambridge English Pronouncing Dictionary", Cambridge Univ. Press.
5. Sudharshana, N.P. & C. Savitha: "English for Technical Communication", Cambridge Univ. Press.

Semester III:

Data Structures & Algorithms

Code: CSEUGPC01
Contracts: 3L+1T
Credits: 4

Course Objectives:

- Identify and use appropriate data structure for a given problem with effective utilization of space and time.
- Describe the linear and nonlinear data structures.
- Analyze the complexities of different sorting techniques.
- Identify trees, recursive functions and Graphs.

Course Outcomes:

CO 1: Understand basic concepts of Data Structure and data types.
CO 2: Analyze the time and space complexities of Algorithms.
CO 3: Design a solution to a given problem using arrays and using pointers, functions.
CO 4: Develop applications using stacks, queues and linked lists
CO 5: Choose the appropriate nonlinear data structure and perform operations on them.
CO 6: Choose suitable sorting techniques to maximize the performance.
CO 7: Illustrate operations on Efficient Binary Search Trees and Multiway Search Trees. Select the hashing techniques to perform dictionary operations.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√										
CO2	√	√	√		√							
CO3	√	√	√		√							
CO4		√	√		√							√
CO5		√	√	√	√							√
CO6			√	√	√							
CO7	√	√			√							

Module - 1 [12 Hrs]

Introduction: Data and Information, Program Structures, Abstract Data Type, Data Structure - Static and Dynamic Data Structures. [2L]
Array as a Data Structure: Representation of Polynomials and Sparse Matrix, Linear List, Implementation using array, Review of Pointers and Functions. [4L]

Linked List representations: Single Linked Lists, Doubly Linked Lists, Circularly Linked Lists, Linked List Representation of Polynomial And Applications. [6L]

Module - 2 [12 Hrs]

Concepts of Algorithm Design Techniques: Divide and Conquer, Greedy, Dynamic Programming, Backtracking, Branch and Bound. [3L]
Concepts of Algorithm Analysis: Performance Measurement and Analysis, Time Complexity and Space Complexity, Introduction to Order functions, Examples of Analysis. [3L]
Sorting and searching algorithms: Bubble sort, Insertion sort, Selection sort, Merge, Quick, Heap, Radix, Bucket sort, Linear and Binary Search. [6L]

Module - 3 [12 Hrs]

Stack and Queue: Implementations using Arrays and Linked List, Applications, Expression Evaluation and Conversions. [4L]
Trees: Binary Trees, Binary Search Trees, Height-Balanced And Weight-Balanced Trees, 2-3 Tree, B-Trees, B+ -Trees. Applications of Trees. [8L]

Module - 4 [12 Hrs]

Recursion: Basic concept, Design of recursive algorithms, Tail recursion. [2L]
Graphs: Adjacency Matrix and List, Graph Search Algorithms, Spanning Tree Algorithms, Shortest Path Algorithms. [6L]
Hashing: Terminologies, Hashing Functions, Collision Resolution Techniques, Types of Hashing. [4L]

Suggested Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed:"Fundamentals of Data Structures in C", Second Edition, Universal Press. 2007.
2. M. A. Weiss:"Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2002.
3. A. V. Aho, J. E. Hopcroft and J. D. Ullman:"Data Structures and Algorithms", First Edition, Pearson Education, 2002.
4. R. K. Kruse, Bruce P. Leung:"Data Structures and Program Design", Prentice Hall, 2006.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein:"Introduction to Algorithms", Third Edition, PHI Learning Pvt. Ltd, 2010.
6. Y. Langsam, J. M. Augenstein, M. A. Tenenbaum:"Data Structures using C and C++", Second Edition, Pearson Education. 2015.

Digital Logic

Code: CSEUGPC02
Contacts: 3L
Credits: 3

Course objectives:

1. To provide the basic concept of various number systems, Boolean algebra and basic logic gates.
2. To explain the design and analyze ofthe combinational logic circuits.
3. To describe the design and analyze of the sequential logic circuits.
4. To provide knowledge about digital integrated circuits such as diode, transistor, logic gate circuits etc.

Course outcomes:

CO 1: Understand the principles and methodology of digital logic design.
CO 2: Understand the different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.
CO 3: Understand Boolean algebra and basic properties of Boolean algebra, able to simplify simple Boolean functions by using the basic Boolean properties.
CO 4: Realize the functionality of basic combinational logic circuits such as Adder, subtractor, encoder, decoder, comparator etc.
CO 5: Realize the functionality of basic sequential logic components such as flip-flops, registers and counters.
CO 6: Understands the concepts of Diodes, transistors, MOS, CMOS etc.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√									
CO2	√				√							
CO3	√				√							
CO4			√		√						√	
CO5			√		√						√	
CO6			√		√						√	

Module-1: [12 Hrs]
Number Systems, Boolean Algebra & Logic Gates: Binary numbers & Boolean algebra, Venn diagram, Logic gates, Truth Tables and function minimization using algebraic method, Karnaugh map, Quine- Mcclusky method; BCD, ASCII, EBDIC, Gray codes and their conversions, Signed binary number representation with 1's and 2's complement methods, Maxterm, Minterm, Representation in SOPand POS forms ;Realization of Boolean functions using NAND/NOR gates, two-level and multilevel logic circuit synthesis.

Module-2: [12 Hrs]
Combinational circuits: Adder and Subtractor circuits (half & full adder &subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and checker; ROM, PLA .

Sequential Circuits: Latch, Flip-flop. Design of Flip-flops with logic gates, counters, registers. Design and analysis of sequential circuits -Moore and Mealy model description, state diagram and state table – Minimization methods.Memoryunit.Racing and Logic hazards.Implementation of hazard free logic circuit,asynchronous sequential circuit synthesis.

Module-3: [12 Hrs]

Digital Integrated Circuits: Diode as switch. Use of diodes in AND, OR Circuits.Transistor as a switch. RTL, DTL, TTL logic gate circuits. MOS as a switch.Basic MOS inverter.MOS and CMOS logic gates. Fan -in and Fan-out of logic gates, propagation delay, Tristate logic.

Suggested Books:

1. Floyed and Jain: "Digital Fundamentals", Pearson Education.
2. Morries Mano: "Digital Logic Design", PHI.
3. Leach &Malvino: "Digital Principles & Application, 5/e", Tata McGraw Hill.
4. Kharate: "Digital Electronics", Oxford.
5. BigmellandR.Donovan: "Digital Electronics - Logic & Systems", Cambridge Learning.
6. D.J.Comer: "Digital Logic and State Machine Design, 3/e", OUP.
7. P.Raja: "Digital Electronics",Scitech Publications.
8. R.P.Jain: "Modern Digital Electronics, 2/e",Tata McGraw Hill.
9. H.Taub and D.Shilling: "Digital Integrated Electronics",Tata McGraw Hill.
10. D.RayChaudhuri: "Digital Circuits, vol I & II, 2/e", Platinum Publishers.
11. Tocci and Widmer: "Moss-Digital Systems, 9/e", Pearson Education.
12. J. Bignell andR.Donovan: "Digital Electronics, 5/e", Cenage Learning.

Discrete Mathematics

Code: MATUGBS04
Contacts: 4L
Credits: 4

Course Objectives:

- To provide a basic exposure to the fundamental terminology of discrete mathematics.
- To familiarize with the elementary combinatorics.
- To provide a thorough understanding of recurrence relations.
- To familiarize with relations and diagraphs.
- To offer a basic exposure to the fundamental concepts of graph theory and familiarize with various types of graphs.

Course Outcomes:

CO 1: Students will be able to understand the fundamental terminologies of discrete mathematics.
CO 2: Students will be able to acquaint with the elementary combinatorics.
CO 3: Students will be able to familiarize with recurrence relations.
CO 4: Students will be able to familiarize with relations and diagraphs.
CO 5: Students will be able to learn the fundamental concepts of graph theory and familiar with various types of graphs.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√	√	√					√		
CO2	√	√	√	√	√	√		√				√
CO3	√	√	√	√	√			√		√		√

CO4	√	√	√	√	√			√		√		√
CO5	√	√	√	√	√		√	√		√	√	√

UNIT-I: [10 Hrs]
Fundamentals:
Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identitites on sets, pigeonhole principle. Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation. Function: Definition and types of function, composition of functions, recursively defined functions.

UNIT-II: [8 Hrs]
Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

UNIT-III: [8 Hrs]
Combinatories: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations, generating function

UNIT-IV: [8 Hrs]
Relations and digraphs:
Relations and digraphs, binary relations, equivalence relations, ordering relations, lattices, paths and closures, directed graphs, adjacency matrices.

UNIT-V: [8 Hrs]
Graphs:
Graphs, Isomorphism, Trees, Spanning trees, Binary trees, Walk, Trail, Path, Cycle, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Vertex coloring, Edge coloring, Chromatic Polynomials.

Suggested Books:

1. Kenneth H. Rosen: "Discrete Mathematics and its Applications", McGraw Hill, 2002.
2. J.P.Tremblay& R. Manohar: "Discrete Mathematical Structure with Applications to Computer Science",Mc.Graw Hill, 1975.
3. V. Krishnamurthy: "Combinatories:Theory and Applications", East-West Press.
4. Seymour Lipschutz, M.LiPOn: "Discrete Mathemataics", Tata McGraw Hill, 2005.
5. Kolman, Busby Ross: "Discrete Matheamatical Structures", Prentice Hall International.
6. N Deo: "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall.

Indian Constitution

Code: UCCUGMC03
Contacts: 2L
Credits: 0

Data Structures Lab

Code: CSEUGPC03
Contacts: 3P
Credits: 1.5

Course Objectives:

- Design and analyze linear and nonlinear data structures.
- Acquire programming skills to implement sorting and searching techniques.
- Identify and apply the suitable data structure for the given real world problem.

Course Outcomes:

CO 1: Implement insert, delete, search, sort and traverse operations using arrays and linked lists.
CO 2: Develop applications on stacks and queues.
CO 3: Understand nonlinear data structures to solve computing problems.
CO 4: Implement optimized sorting techniques for a given data set.
CO 5: Implement hashing techniques to perform dictionary operations and binary search trees.
CO 6: Develop applications on linked lists.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√		√							
CO2		√	√		√							
CO3		√	√		√						√	
CO4		√	√	√	√							
CO5				√	√						√	
CO6			√		√						√	

Experiments should include but not limited to:

1. Implementation of various sorting algorithms such as Bubble sort, Insertion sort, Selection sort, Merge sort, Quick sort, Shell sort, Heap sort, Radix sort, Bucket sorting.
2. Implementation of Linear and Binary Search.
3. Implementation of stacks and queues using arrays.
4. Implementation of stacks and queues using linked lists.
5. Applications of linked lists: polynomial arithmetic, set operations, etc.
6. Sparse Matrices: Multiplication, addition.
7. Implementation of Binary Trees, Binary Search Trees, B-Trees, B+-Trees.
8. Implementation of Hash tables.

Reference Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed:"Fundamentals of Data Structures in C", Second Edition, Universal Press. 2007.
2. M. A. Weiss:"Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2002.

3. A. V. Aho, J. E. Hopcroft and J. D. Ullman:"Data Structures and Algorithms", First Edition, Pearson Education, 2002.
4. R. K. Kruse, Bruce P. Leung:"Data Structures and Program Design", Prentice Hall, 2006.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein:"Introduction to Algorithms", Third Edition, PHI Learning Pvt. Ltd, 2010.
6. Y. Langsam, J. M. Augenstein, M. A. Tenenbaum:"Data Structures using C and C++", Second Edition, Pearson Education. 2015.

Digital Logic Lab

Code: CSEUGPC04
Contacts: 3P
Credits: 1.5

Course Objectives:

- To provide the basic concept logic family.
- To explain the concepts of Combinational circuits.
- To explain the concepts of flip-flops, registers and counters

Course outcomes:

CO 1: Implementation of the basic logic gates using diodes.
CO 2: Realize the characteristics of logic family.
CO 3: Design the combinational circuits.
CO 4: Implementthe various Boolean functions.
CO 5: Design the basic sequential circuits.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1												
CO2												
CO3												
CO4												
CO5												

1. **Logic family:** Implementation of OR and AND gates using diodes, Study on characteristics of DTL and TTL inverters using discrete components, Study on characteristics of TTL and CMOS gates.

2. **Combinational logic circuits:** Design and implementation of combinational circuits such as, Adders, comparators, parity generator and checker. Implementation of Boolean functions using multiplexer and decoder/de-multiplexer.

3. **Sequential circuits:** Study of latch and flip-flop, design of counters.

Suggested Books:

1. Floyed and Jain: Digital Fundamentals, Pearson Education.
2. Morries Mano: Digital Logic Design, PHI.

3. Leach & Malvino: Digital Principles & Application, 5/e, Tata McGraw Hill.
4. Kharate: Digital Electronics, Oxford.
5. Bigmell and R.Donovan: Digital Electronics - Logic & Systems; Cambridge Learning.
6. D.J.Comer: Digital Logic and State Machine Design, 3/e. OUP.
7. P.Raja: Digital Electronics, Scitech Publications.
8. R.P.Jain: Modern Digital Electronics, 2/e, Tata McGraw Hill.
9. H.Taub and D.Shilling: Digital Integrated Electronics, Tata McGraw Hill.
10. D.Ray Chaudhuri: Digital Circuits, vol I & II, 2/e, Platinum Publishers.

Semester IV:

Object Oriented Programming Systems

Code: CSEUGPC05
Contacts: 3L
Credits: 3

Course Objectives:

- To introduce basic concepts of object oriented design techniques.
- To emphasis the benefits of object oriented concepts.
- To give a thorough understanding of Java language.
- To provide basic exposure to the basics of packages, multithreading etc.
- To enable the students to solve the real time applications using object oriented programming features.

Course Outcomes:

CO 1: Apply object oriented principles in software design process.
CO 2: Choice of appropriate concepts in structured /object oriented programming paradigm to design a solution for real time applications and complex problems.
CO 3: Understand and apply various object oriented features like inheritance, encapsulation and polymorphism to solve various real-world computing problems using Java language.
CO 4: Discuss basic code reusability concept with respect to inheritance, packages and interface.
CO 5: Develop packages, multithreaded programs, exception handling in Java.
CO 6: Develop and deploy Applet in Java.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√			√	√				√	
CO2	√	√	√			√	√		√		√	
CO3	√	√	√			√	√		√		√	
CO4			√			√	√	√	√		√	
CO5		√	√	√	√			√	√			√
CO6		√				√	√			√	√	

UNIT I: Object Oriented Thinking [3 Hrs]
Need for OOP Paradigm, Principles of Object Oriented Languages, Benefits of OOP, Applications of OOP.

UNIT II: Java Basics [6 Hrs]
History of Java, Java Buzzwords, Java Virtual Machine, Platform Independence, Data Types, Variables, Scope and Life time of variables, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program.

UNIT III: Classes and Objects [5 Hrs]
Concepts of Classes, Objects, methods,constructors, this keyword, garbage collection, Compile time polymorphism: overloading methods and constructors, parameter passing, command line arguments,Recursion, nested and inner classes, Exploring String, StringBuffer classes, Arrays.

UNIT III: Inheritance [4 Hrs]
Hierarchical abstractions, Base class object, subclass, subtype, forms of inheritance, benefits of inheritance, Member access rules, Usage of super, staticand final with inheritance, Run time polymorphism: method overriding, abstract classes, the Object class.

UNIT IV: Packages and Interfaces [3 Hrs]
Defining, Creating and Accessing a Package, Understanding CLASSPATH, access control, differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.

UNIT V: Exception Handling [5 Hrs]
Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception classes: throw and throws.

UNIT VI: Multithreading [6 Hrs]
Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads.

UNIT VII: Applet Programming [4 Hrs]

Applet & Application, Applet Architecture, Parameters to Applet, Embedding Applets in Web page, Applet Security Policies

Suggested Books:

1. E Balagurusamy: “Programming with Java”, McGraw Hill Education
2. Herbert Schildt:“Java: The Complete Reference”,McGraw Hill Education
3. Sachin Malhotra and Saurabh Choudhary:“Programming in Java”, Oxford University Press
4. Y. Daniel Liang:“Introduction to Java Programming, Brief Version”, Pearson Education
5. Y. Daniel Liang:“Introduction to Java Programming, Comprehensive Version”, Pearson Education
6. Cay S. Horstmann: “Core Java - Vol. I, Vol. II and Vol. II”, Pearson Education
7. E. Balagurusamy: “Object-Oriented Programming with C++”, McGraw Hill Education
8. Bjarne Stroustrup: “The C++ Programming Language”, Pearson Education
9. R. Lafore: “Object Oriented Programming in C++”, Pearson Education
10. Debasish Jana: “C++ and Object-Oriented Programming Paradigm”, PHI Learning

Computer Organization& Architecture

Code: CSEUGPC06
Contacts: 3L+1T
Credits: 4

Course Objectives:

- To know the evolution of Computer Systems & its basic Structure.
- To learn the basics of stored program concepts and different arithmetic and control unit operation.
- To know how I/O devices are being accessed and its principles etc.
- To learn the principles of pipelining.
- To learn memory hierarchy and mechanism of data storage.
- To distinguish between the concepts of serial, parallel, pipeline architecture.

Course Outcomes:

CO 1: Understand how whole and fractions are stored in computers.
CO 2: Understand the designing of arithmetic, logic and control units and their operation.
CO 3: Learn about memory hierarchy and mapping techniques and capable of solving related problems.
CO 4: Understand the different data transfer techniques and working principles of I/O devices.
CO 5: Familiar with pipelining concepts with a prior knowledge of stored program methods.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√	√		√							
CO2	√				√							
CO3		√			√					√		
CO4			√		√	√	√				√	
CO5		√		√		√	√				√	

UNIT I
Introduction: [2 Hrs]
History of computing, von Neumann machine, Instruction and data, fixed-point and floating point numbers, errors, IEEE standards

UNIT II
Processor design: [7 Hrs]
Instruction Set Architecture-Instruction format, opcode optimization; operand addressing; Instruction implementation-data movement, branch control, logical, Input/output and debugging instructions; arithmetic instruction implementation–addition and subtraction, multiplication-division, 2's complement multiplication; Booth's algorithm–theory and examples; bit-pair algorithm; high performance arithmetic

UNIT III
Control unit design: [8 Hrs]
Hardwired control, micro-programmed control design – micro-instruction formats, control optimization;

UNIT IV

Memory subsystem: [9 Hrs]
Memory technology, memory interfacing, Memory hierarchy–introduction to virtual memory system; Cache memory – performance, address mapping, content addressable memory (CAM), FloppyDisks.

UNIT V
Peripherals: [7 Hrs]
Basic properties, bus architectures, interfacing of I/O devices, data transfer schemes –programmed I/O, DMA, mass storage, RAID

UNIT VI
Pipelining: [3 Hrs]
Pipelining datapath and instructions, speed up, CPI, latency; linear / non-linear pipeline–reservation table, MAL; super-pipelined and super-scalar processors.

Suggested Books:

1. Mano, M.M., "Computer System Architecture", PHI.
2. BehroozParhami: "Computer Architecture", Oxford University Press
3. Hayes J. P.: "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher: "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan: "Microprocessors and Microcontrollers" OUP.
6. Chaudhuri P. Pal: "Computer Organisation & Design", PHI.
7. P N Basu: "Computer Organization & Architecture", Vikas Publishing.
8. J. L. Hennessy and D. A. Patterson:"Computer Architecture: A Quantitative Approach", 3rd & 4th ed, Elsevier.
9. Kai Hwang:"Advanced Computer Architecture: Parallelism, Scalability, Programmability", TMH.

Probability & Statistics

Code: MATUGBS05
Contacts: 3L
Credits: 3

Course Objectives:

- To provide a basic exposure to the fundamental concepts of basics of probability.
- To familiarize with various kinds of probability distributions and their properties.
- To familiarize with correlation & regression computation between multiple random variables.
- To familiarize with sampling distributions & parameter estimation.
- To provide a thorough understanding about Testing of hypothesis.
- To offer a basic knowledge about Queuing theory & stochastic processes.

Course Outcomes:

CO 1: Students will be able to understand the fundamental concepts of basics of probability such as mean, variance, standard deviation, etc.

CO 2: Students will be able to familiarize with various kinds of probability distributions and their properties.

CO 3: Students will be able to acquaint with correlation & regression computation between multiple random variables.

CO 4: Students will be able to learn about sampling distributions & parameter estimation.

CO 5: Students will be able to analyze the statistical data and apply various sample tests for testing the hypothesis.

CO 6: Students will be able to learn about Queuing theory & stochastic processes.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√		√		√	√	√		√	√	
CO2	√	√		√		√	√	√		√	√	
CO3	√	√		√		√	√	√		√	√	
CO4	√	√	√	√		√	√	√	√	√	√	√
CO5	√	√	√	√		√	√	√	√	√	√	√
CO6			√									

UNIT-I: [5 Hrs]

Mathematical Theory of Probability: Basic concepts, Classical and axiomatic approaches, Sample space and events, Properties of probability functions, Conditional probability and independent events.

UNIT-II: [8 Hrs]

Single Random variables & probability distributions: Random variables - Discrete and continuous. Probability distributions, mass function/ density function of probability distribution. Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.Binomial, Poisson & normal distributions and their properties.Moment generating functions of the above three distributions, and hence finding the mean and variance.

UNIT-III: [7 Hrs]

Multiple Random variables, Correlation & Regression: Joint probability distributions-Joint probability mass/ density function, Marginal probability mass & density functions, Covariance of two random variables, Correlation Coefficient of correlation, Regression Coefficient, Central limit theorem.

UNIT-IV: [7 Hrs]

Sampling Distributions & Parameter estimation: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of mean and sampling distribution of variance, likelihood estimate, interval estimations.

UNIT-V: [6 Hrs]

Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors - critical region, confidence interval, Level of significance, Once sided test, Two sided test, Student t-distribution, F-distribution, Chi-square test of goodness of fit.

UNIT-VI: [7 Hrs]

Queuing Theory&Stochastic processes: Structure of a queuing system, Operating characteristics of queuing system, Introduction to Stochastic Processes - Classification of Random processes, Methods of description of random processes, Stationary and non-stationary random process, Markov process, Markov chain.

Suggested Books:

1. Seymour Lipschutz and John J. Schiller: "Introduction to Probability and Statistics",
2. S. K. Mapa: "Higher Algebra (Abstract & Linear)",
3. A. Banerjee, S. K. De and S. Sen: "Mathematical Probability",
4. C.W.Helstrom: "Probability and Stochastic Processes for Engineers",
5. K.B.Datta and M.S.Sriniva: "Mathematics for Engineers", Cengage Publications.
6. T.K.V.lyengar&B.Krishna Gandhi Et: "Probability and Statistics",
7. S C Gupta and V.K.Kapoor: "Fundamentals of Mathematical Statistics",
8. Jay I.Devore: "Probability and Statistics for Engineers and Scientists",

Biology for Engineers

Code: BIOUGBS01
Contracts: 2L
Credits: 2

Module No.	Content of the module	Allotted hour
1	Diversity of Life-prokaryotes and eukaryotes, non chordates and chordates; Origin of life and Darwinian Evolution, Synthetic theory of evolution	5
2	Cell and Cell theory, Cellular structure and function, central dogma of molecular Biology, Concept of Gene and Allele, Genetic disorder, Genetic code, Understanding inheritance patterns through pedigree	5
3	Organismal physiology, Bioenergetics, Exothermic and endothermic vs. Exergonic and endergonic reaction (include Glycolysis, Krebs cycle and photosynthesis)	4
4	Biomolecules, monomers and polymers, Nucleotides and DNA/RNA, Amino acids and proteins, carbohydrates and lipids, hierarchy of protein structure, structure function correlation , enzymes and their mode of action	5
5	Immunology- Self vs. Non Self, pathogens, human immune system , antigen-antibody reactions, Vaccines, Nervous system- impulse transmission	4
6	Biosafety, bioresources, Drug design principle	2
7	Engineering designs inspired by examples in biology (compare eye and camera, bird flight and aircraft	3
8	Engineering aspects of some Nobel Prizes in physiology and Medicine	2

Environmental Science

Code: UCCUGMC02
Contacts: 2L
Credits: 0

UNIT I [4 Hrs]
Basic ideas of environment, basic concepts related to environmental perspective, man, society andenvironment, their inter relationship.
Mathematics of population growth and associated problems, definition of resource, types of resource: renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth,pollutant and contaminant. Environmental impact assessment.
Environmental degradation:Acid rain, toxic element, particulates, noise pollution, air pollution, effect of pollution on man.
Overall methods for pollution prevention, components of environment, environmental problems and sustainable development

UNIT II [3 Hrs]
Elements of Ecology:System, open system, closed system, definition of ecology, species, population, community, Ecosystem, biotic and abiotic components.
Ecological balance and consequence of change:Effect of abiotic factor on population, flow chart of different cycles with only elementary reaction [oxygen,nitrogen, phosphate, sulphur], food chain

UNIT III [10 Hrs]
Overview of Air Pollution and Control
Atmospheric Composition: Troposphere, stratosphere, mesosphere, thermosphere, tropopause, stratopauseand mesopause.
Energy Balance:Conductive and convective heat transfer, radiation heat transfer, simple global temperature model [Earth asa black body, earth albedo]), problems.
Green-house effects, Climate, weather:Difference between climate and weather, Global warming and its consequence, Atmospheric dispersion, Source and effect of pollutants, Primary and secondary pollutants:Emission standard, Depletion Ozone layer, Standards and control measures.

UNIT IV [7 Hrs]
Different Other Types of Pollutions and Way to their Control, Water Pollution: Natural water, Lake, Arsenic pollution.Land Pollution: Lithosphere, Waste and Waste management, Land filling. Noise Pollution: Causes and Effects.

Suggested Books:

1. Masters, G.M.: “Introduction to Enviromental Engineering”, Pearson Education India.
2. N NBasak: “Environmental Engineering”, McGraw Hill Education.
3. Richard T. Wright, Dorothy F. Boorse: “Environmental Science: Toward a Sustainable Future”, Pearson Education.
4. Eugene Odum.: “Fundamentals of Ecology”,Cengage Learning.
5. Smith:“Elements of Ecology”, Pearson Education India.
6. M. Dash, S. Dash: “Fundamentals Of Ecology”, McGraw Hill Education.
7. N.K. Uberoi:“Environmental Management”, Excel Books.
8. Anil Kumar De and Arnab Kumar De:“Environmental Studies”, New Age International.

9. Mahua Basu and Xavier Savarimuthu SJ: "Fundamentals of Environmental Studies", Cambridge University Press.
10. Ajith Sankar: "Environmental Management", Oxford University Press.
11. R. Rajagopalan:"Environmental Studies", Oxford University Press.
12. Sindhu P.S.:"Environmental Chemistry", New Age International.
13. C.K. Varshney: "Water Pollution and Management", New Age International.
14. Goel P.K.: "Water Pollution: Causes, Effects & Control", New Age International.
15. Rao C.S.: "Environmental Pollution Control Engineering", New Age International.

Object Oriented Programming Lab

Code: CSEUGPC07
Contacts: 3P
Credits: 1.5

Course Objectives:

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Be able to use the Java SDK environment to create, debug and run simple Java programs.
- To have a thorough understanding of Java language and principles of software development.
- Have the ability to write a computer program to solve real-world problems.

Course Outcomes:

CO 1: Implement the process of object orientation in Java with the help of class – object – constructor relationship in Object Oriented Programming Paradigm.

CO 2: Implement basic knowledge of code reusability with the help of Java in Object Oriented Programming.

CO 3: Analyze the significance of various keywords with respect to encapsulation and polymorphism technique in OOPS.

CO 4: Discuss basic data abstraction concept with respect to inheritance, package and interface.

CO 5: Discuss the concept of handling arrays, matrices, Strings and wrapper classes.

CO 6: Implement exception handling, multithreading and applet programming concept in Java.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√			√	√				√	
CO2	√	√	√			√	√		√		√	
CO3	√	√	√			√	√		√		√	
CO4			√			√	√	√	√		√	
CO5	√	√				√	√				√	
CO6	√	√	√	√	√	√	√		√	√	√	√

1. Assignments on class, constructor, overloading, inheritance, overriding,
2. Assignments on abstract classes, String handling
3. Assignments on wrapper class, arrays
4. Assignments on developing interfaces- multiple inheritance, extending interfaces
5. Assignments on creating and accessing packages
6. Assignments on Exception handling
7. Assignments on multithreaded programming
8. Assignments on applet programming

Suggested Books:

1. E Balagurusamy: "Programming with Java", McGraw Hill Education
2. Herbert Schildt:"Java: The Complete Reference", McGraw Hill Education
3. Sachin Malhotra and Saurabh Choudhary: "Programming in Java", Oxford University Press
4. Y. Daniel Liang: "Introduction to Java Programming, Brief Version", Pearson Education
5. Y. Daniel Liang:"Introduction to Java Programming, Comprehensive Version", Pearson Education
6. Cay S. Horstmann: "Core Java - Vol. I, Vol. II and Vol. II", Pearson Education
7. E. Balagurusamy: "Object-Oriented Programming with C++", McGraw Hill Education
8. Bjarne Stroustrup: "The C++ Programming Language", Pearson Education
9. R. Lafore: "Object Oriented Programming in C++", Pearson Education
10. Debasish Jana: "C++ and Object-Oriented Programming Paradigm", PHI Learning

Computer Organization &ArchitectureLab

Code: CSEUGPC08
Contacts: 3P
Credits: 1.5

Course Objectives:

- Introduce with simulation Software.
- To explain the designing of different category adders and memory functioning.
- Realize the Bus implementation and communication through bus.

Course Outcomes:

CO 1: Knowledge of implementation of different adders.
CO 2: Designing memory module and control unit.
CO 3: Understand the data transfer techniques among Registers, Main Memory and IO.
CO 4: Familiarization with different ICs.
CO 5: Implementation of simple arithmetic unit and logic unit.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√			√							
CO2	√		√			√	√				√	
CO3			√		√							

CO4		√			√	√	√				√	
CO5			√	√		√	√				√	

1. Design of adders.
2. Memory module design.
3. Implementation of simple memory test logic (such as March test).
4. Realization of data transfer among CPU registers, Main memory and External sources.
5. Swapping of registers' contents.
6. Control design.
7.Familiarity with IC chips, e.g.
   a) Multiplexer , b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data book.
8. Design a BCD adder.
9. Design of a 'Carry Look Ahead' Adder circuit.
10. Use a multiplexer unit to design a composite ALU.
11. Use ALU chip for multibit arithmetic operation.

Suggested Books:

1. Mano, M.M., "Computer System Architecture", PHI.
2. BehroozParhami: "Computer Architecture", Oxford University Press
3. Hayes J. P.: "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher: "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan: "Microprocessors and Microcontrollers" OUP.
6. Chaudhuri P. Pal: "Computer Organisation & Design", PHI.
7. P N Basu: "Computer Organization & Architecture", Vikas Publishing.
8. J. L. Hennessy and D. A. Patterson:"Computer Architecture: A Quantitative Approach", 3rd & 4th ed, Elsevier.
9. Kai Hwang:"Advanced Computer Architecture: Parallelism, Scalability, Programmability", TMH.

Scripting Lab

Code: CSEUGPC09
Contacts: 1T+3P
Credits: 2.5

Course Objectives:

- To give an outlineof the essentialof python language.
- To provide an overview of types, operators and expressions.
- To acquainted with different kinds of data structures.
- To understand how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.
- To develop object oriented aptitudes in Python.
- To acquainted with testing skills.

Course Outcomes:

CO 1: Students will be capable to understand the needs of python programming and becomecomfortable with how to write python programs.
CO 2: Students will be competent to acquaint with different kinds of types, operators and expressions.
CO 3: Students will be proficient to acquaint with diverse sorts of data structures.
CO 4: Students will be capable to learn how to write functions and pass arguments in Python.
CO 5: Students will be competent to learn how to build and package Python modules for reusability.
CO 6: Students will be proficient to achieve object oriented skills in Python.
CO 7: Students will be capable to familiar with different types of standard libraries.
CO 8: Students will be competent to familiar with various kinds of testing skills.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√	√	√	√	√		√	√	√	√
CO2	√	√	√	√	√	√	√		√	√	√	√
CO3	√	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√	√	√	√	√	√	√	√	√
CO5	√	√	√	√	√			√	√	√		√
CO6	√	√	√	√	√			√	√	√		√
CO7	√	√	√	√	√	√	√	√	√	√	√	√

The lab experiments for this course have to ensure that the following concepts of PYTHON LANGUAGE are covered during lab classes:

Introduction: Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

Types, Operators and Expressions: Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences.Comprehensions.

Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions(Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. **Modules:** Creating modules, import statement, from. Import statement, name spacing, **Python packages** Introduction to PIP, Installing Packages via PIP, Using Python Packages

Object Oriented Programming OOP in Python: Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding,
Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions

Brief Tour of the Standard Library - Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics

Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Scripting Languages like Shell, Perl, Java Script; Database Driven Web Site: PHP and MySQL;

Suggested Books:

1. Vamsi Kurama:"Python Programming: A Modern Approach", Pearson.
2. Mark Lutz:"Learning Python",O'Rielly
3. W.Chun: "Core Python Programming", Pearson.
4. Introduction to Python, Kenneth A. Lambert, Cengage
5. S. Das:"Unix System V.4 Concepts and Applications", 3rd Ed., Tata Mcgraw-Hill, 2013.
6. D. Flanagan:"Javascript: The Definitive Guide", 5th Ed., O'Reilly, 2006.
7. D. Gosselin:"PHP Programming with MySQL", Course Technology, 2006.

Semester V:

Operating Systems

Code: CSEUGPC10
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the main components and services provided by an operating system.
- To understand what a process is and how processes are synchronized and scheduled.
- To compare and illustrate various process scheduling algorithms.
- To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC
- To understand different approaches to memory management.
- To summarize the principles of Virtual memory as applied to paging & caching techniques.
- To demonstrate internal file system structure with device drivers and file operations using system calls.
- To study the need for special purpose operating system with the advent of new emerging technologies

Course Outcomes:

CO 1: Understanding the working process of an operating system, its components and differentiate them.
CO 2: Describe process management methods and analyze the synchronization procedures.
CO 3: Identify the working methodology of multithreaded applications and distinguish different scheduling algorithms.
CO 4: Evaluate the requirement for process synchronization and coordination handled by operating system. Also understand different synchronization methods.
CO 5: Identify the reasons of deadlocks, and their remedial measures in an operating system.
CO 6: Understand different memory management techniques used in operating systems.
CO 7: Classify different file systems and apply the knowledge earned into various operating systems.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√			√							
CO2	√	√	√		√							
CO3	√	√	√	√	√							
CO4	√		√	√		√	√				√	
CO5		√			√	√	√				√	
CO6	√	√		√	√							

CO7	√			√	√	√	√				√	

Module-1: [12 Hrs]
Introduction to OS: Introduction to Operating System: Operating system functions, Concept of batch-processing, multi-programmed, time-sharing, real-time, distributed system. Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, and system calls.
Processes: Concept of processes, state diagram, process control block, scheduling of processes, operations on processes, co-operating processes, inter-process communication.
Threads: overview, benefits of threads, user and kernel threads.

CPU scheduling: scheduling criteria, preemptive& non-preemptive scheduling, scheduling algorithms like FCFS, SJF, RR, Selfish-RR, Priority, Highest Response ratio Next (HRN), and algorithm evaluation, multi-processor scheduling.

Module-2: [12 Hrs]
Process Synchronization: background, critical section problem, critical region, synchronization hardware, semaphores, discussion of synchronization problems like producer-consumer, readers-writers, dining philosophers, sleeping-barber etc.

Deadlocks: conditions, resource allocation graph, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Memory Management: background, logical vs. physical address space, address translation, swapping, static partitioning, dynamic partitioning, paging, segmentation, segmentation with paging.

Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FIFO, LRU, Optimal page replacement), allocation of frames, thrashing.

Module-3: [12 Hrs]
File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, and indexed), and free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks, concept of RAID etc.

Protection and Security: Concepts of domain, Access matrix and its implementation, access control, Security of systems- concepts, threats- Trojan horse, virus, worms etc, introduction to cryptography as security tool, user authentication. Case Studies

Suggested Books:

1. A. Silberschatz, P. Galvin and G. Gagne:"Operating Systems Concepts", Wiley India.
2. Gary Nutt, N. Chaki and S. Neogy: "Operating Systems Concepts", Pearson Education.
3. W. Stallings: "Operating Systems", Pearson Education.
4. D. M. Dhamdhere: "Operating Systems: A Concept-based Approach", Tata McGraw-Hill.

Database Management Systems

Code: CSEUGPC11
Contacts: 3L
Credits: 3

Course Objectives:

- The objective of this course is
- Students should be exposed to the fundamental concepts of Data Base Management Systems
- Students should be able to model, design and implement Data Base Management Systems
- Students should be able to manipulate a database using Structured Query Language (SQL)
- Students should be able to master techniques for Database Normalization, Transaction Management and database security and recovery management.

Course Outcomes:

CO 1: Understanding functional components and architecture of DBMS and its role in Information System.
CO 2: Mastering SQL queries with background understanding of Relational Algebra and Relational Calculus.
CO 3: Applying E-R model and Relational model for designing and implementation of DBMS.
CO 4: Understanding Integrity Constraint, Functional Dependency and Normalization Rules.
CO 5: Understanding Transaction Processing & Concurrency control.
CO 6: Performing Query Optimization and Evaluation.
CO 7: Understanding indexing, storage structure and recovery management

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√							√	√			
CO2	√	√			√	√	√					√
CO3		√	√							√		
CO4	√	√	√									
CO5		√			√							
CO6	√		√	√		√	√					
CO7		√				√	√					√

Introduction [4 Hrs]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema Architecture of DBMS.

Entity-Relationship Model [4 Hrs]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [5 Hrs]
Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views,Modifications of the Database.

SQL and Integrity Constraints [5 Hrs]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, ReferentialIntegrity Constraints, assertions, Views, Nested Subqueries, Database security application development using SQL, Stored Procedures and Triggers.

Relational Database Design [7 Hrs]
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, 2NF, 3NF,Boyce-Codd Normal Form, Normalization using multi-valued dependencies, 4NF, 5NF, Lossless Decomposition
Internals of RDBMS [6 Hrs]
Physical data structures, Query optimization: join algorithm, statistics and cost based optimization. Transaction Processing,Concurrency Control and Recovery Management, Serializability, Lock based protocols, Two Phase Locking.

File Organization & Index Structures [5 Hrs]
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary,secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Suggested Books:

1. Abraham Silberschatz, Henry F. Korth and S Sudarshan: "Database System Concepts", McGraw Hill Education.
2. ElmasriRamez and NovatheShamkant: "Fundamentals of Database Systems", Pearson Education.
3. Raghu Ramakrishnan and Johannes Gehrke:"Database Management Systems", McGraw Hill Education
4. Jim Gray and Andreas Reuter:"Transaction Processing: Concepts and Techniques", Moragan Kauffman Publishers.
5. C.J. Date:"An Introduction to Database Systems", Pearson Education
6. R. Panneerselvam: "Database Management Systems", PHI Learning
7. Alexis Leon and Mathews Leon: "Fundamentals of Database Management Systems", McGraw Hill Education.
8. Ullman JD.: "Principles of Database Systems", Galgotia Publications.

Design & Analysis of Algorithms

Code: CSEUGPC12
Contacts: 3L+1T
Credits: 4

Course Objectives:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

Course Outcomes:

CO 1: Student will be able to analyze and compare running times of algorithms using asymptotic analysis.

CO 2: Student will be able to demonstrate understanding of algorithmic design paradigms such as divide-and-conquer, dynamic-programming, greedy, backtracking etc. Student will be able to explain suitability of the type of algorithmic design principle needed for a specific problem.

CO 3: Student will be able to employ appropriate data structures like stack /tree /graphs to model engineering problems.

CO 4: Student will be able to understand the notion of computational complexity of problems & advanced concepts

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√										
CO2		√	√	√		√	√				√	
CO3				√	√	√	√				√	
CO4		√	√	√	√							

Module-1 [12 Hrs]

Models of computation:RAM,TM etc. time and space complexity

Asymptotic Notation: Big-O, omega, theta etc.; finding time complexity of well known algorithms like heap sort, search algorithm etc.

Algorithm design techniques:. Recursion: use, limitations, examples.

Divide and Conquer: basic concept, use, examples (Merge sort, Quick Sort, Binary Search).

Module-2 [12 Hrs]

Dynamic Programming: basic concept, use, examples (matrix-chain multiplication, all-pair shortest paths, single-source shortest path, travelling salesman problem).

Branch and Bound: basic concept, use, examples (15-puzzle problem).

Backtracking: basic concept, use, examples (Eight queens problem, graph coloring problem, Hamiltonian problem).

Greedy Method: basic concept, use, examples (Knapsack problem, Job sequencing with deadlines, minimum spanning tree).

Lower Bound Theory: Bounds on sorting and sorting techniques using partial and total orders.

Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by rank, Path compression.

Module-3 [12 Hrs]

Properties of graphs and graph traversal algorithms: BFS and DFS.

Matrix manipulation algorithms: Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes.

Notion of NP-completeness: P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem.

Approximation algorithms: Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem.

Suggested Books:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: "Introduction to Algorithms", The MIT Press.
2. E. Horowitz, S. Sahni, S. Rajasekaran: "Fundamentals to Computer Algorithms", Springer.
3. C.H. Papadimitriou, E. Steiglitz:"Combinatorial Optimization Algorithms and Complexity", Dover Publications Inc.

Formal Language & Automata Theory

Code: CSEUGPC13
Contacts: 3L+1T
Credits: 4

Course Objectives:

- 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.
- The course should in addition clarify the practical view towards the applications of these ideas in computer science.

Course Outcomes:

CO 1: Understand different models and compare them.
CO 2: Analyse different computational models using combinatorial methods.
CO 3: Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO 4: Construct algorithms for different problems and argue formally about correctness on different restricted machine models of computation.
CO 5: Understand limitations of some computational models and possible methods of proving them.
CO 6: Have an overview of how the theoretical study in this course is applicable to and application like designing the compilers.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√		√							
CO2	√	√			√							
CO3			√	√		√	√				√	
CO4			√	√	√	√	√				√	

CO5			√	√	√							
CO6		√		√	√							

Module-1 [12 Hrs]

Introduction: Alphabet, Languages, Grammars, Productions, Derivation, Chomsky hierarchy of languages, Regular Expressions and Languages. [3L]

Finite Automata (FA): Deterministic finite automata (DFA), Non-deterministic finite automata (NFA), Deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, Minimization of Finite Automata. [6L]

Regular Languages: Regular Sets and Languages, Properties of Regular Languages, Pumping Lemma for Regular Languages. [3L]

Module-2 [12 Hrs]

Context-Free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. [8L]

Context-Sensitive Languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. [4L]

Module-3 [12 Hrs]

Turing machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, Variants of Turing machines, Nondeterministic TMs and equivalence with deterministic TMs, Universal TMs, Halting Problem, Recursive Functions and Sets, Recursively Enumerable Sets, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. [8L]

Undecidability: Church-Turing Thesis, Universal Turing Machine, The Universal And Diagonalization Languages, Reduction Between Languages And Rice's Theorem, Undecidable Problems About Languages. [4L]

Suggested Books:

1. John Martin: “Introduction to Languages and Theory of Computation”,Tata McGraw Hill.
2. J. E. Hopcroft and J. D. Ullman:“Introduction to Automata Theory, Languages and Computation”, Pearson Education.
3. H. R. Lewis and C. H. Papadimitriou:“Elements of the Theory of Computation”, Second Edition, Pearson Education.
4. Peter Linz:“An Introduction to Formal Languages and Automata”, Narosa.
5. Michael Sipser:“Introduction to the Theory of Computation”, Thomson Press.
6. Dexter C. Kozenm:“Automata and Computability”, Springer.

Operating Systems Lab

Code: CSEUGPC14
Contacts: 3P
Credits: 1.5

Course Objectives:

- To discuss basic unix commands.
- To write and demonstrate Shell programming.
- To understand process creation, execution, deletion and different types of processes in the system.
- To write semaphore and threads programming.
- To understand inter-process communication.

Course Outcomes:

CO 1: Understand basic Unix commands.
CO 2: Understand to write and develop Shell programming.
CO 3: Illustrate process creation, execution, deletion and get knowledge about different types of processes in the system.
CO 4: Able to write semaphore and threads programming.
CO 5: Understand and develop inter-process communication.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√	√									
CO2	√		√		√							
CO3	√	√		√	√							
CO4	√		√		√							
CO5		√	√		√							
CO6												

1. **Shell programming:** creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).
2. **Process:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal:** signal handling, sending signals, signal interface, signal sets.
4. **Semaphore:** programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads:** programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication:** pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO)

Suggested Books:

1. UNIX concepts and Applications, Sumitabha Das, 4th Edition, Tata McGraw-Hill

2. Introduction to UNIX SHELL Programming, M.G. Venkateshmurthy, Pearson Education
3. UNIX and SHELL Programming, B.M. Harwani, Oxford Higher Education

Database Management Lab

Code: CSEUGPC15
Contacts: 3P
Credits: 1.5

Course Objectives:

- Students should be able to model, design and implement Data Base Management Systems
- Students should be able to manipulate a database using Structured Query Language (SQL)
- Students should be able to master techniques for Transaction Management, database security and recovery management.

Course Outcome:

CO 1: Design and Implement a database schema
CO 2: Devise queries using DDL, DML, DCL and TCL commands.
CO 3: Applications using PL/SQL
CO 4: Design and implement a project using SQL and Programming Language.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√		√				√			
CO2	√	√			√	√	√				√	√
CO3		√	√		√	√	√				√	
CO4	√	√	√	√	√				√			

Overview of Structured Query Language

1. **Creating Database**
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes

2. **Table and Record Handling**
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements

3. **Retrieving Data from a Database**
   - The SELECT statement

- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

4. **Clauses**
   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Subqueries

5. **Database Management**
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users
   - Using GRANT and REVOKE

6. **Cursors in Oracle PL / SQL**

7. **Writing Oracle PL / SQL Stored Procedures**

References:

1. Oracle PL/SQL by example, by Rosenzweig, Pearson Publication
2. Practical Oracle SQL, by Kim Berg Hansen, Oreilly Publication

Design & Analysis of Algorithms Lab

Code: CSEUGPC16
Contacts: 3P
Credits: 1.5

Course Objective:

- To analyze worst-case running time of algorithms and understand fundamental algorithmic problems.
- To understand how asymptotic notation is used to provide a rough classification of algorithms, how a number of algorithms for fundamental problems in computer science and engineering work and compare with one another.
- To introduce the methods of designing and analyzing algorithms
- To study about various designing paradigms of algorithms for solving real world problems.

Course Outcome:

CO 1: To analyze the complexities of various problems in different domains.
CO 2: To prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
CO 3: To understand methods for analyzing the efficiency and correctness of algorithms (such as exchange arguments, recurrence, induction, and average case analysis).
CO 4: To design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy.

CO 5: To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√										
CO2		√	√	√		√	√				√	
CO3				√	√	√	√				√	
CO4		√	√		√	√	√				√	
CO5			√	√					√			√

1. Implement Binary Search using Divide and Conquer approach
2. Implement Merge Sort using Divide and Conquer approach
3. Sort a given set of elements using the Heap sort method and determine the time taken to sort the elements
4. Sort a given set of elements using Selection sort and hence find the time required to sort elements.
5. Implement Quick Sort using Divide and Conquer approach
6. Find Maximum and Minimum element from an array of integer using Divide and Conquer approach
7. Obtain the Topological ordering of vertices in a given digraph
8. Find the minimum number of scalar multiplication needed for chain of matrix
9. Implement all pair of shortest path for a graph (Floyed- Warshall Algorithm)
10. Implement Traveling Salesman Problem
11. Implement Single Source shortest Path for a graph (Dijkstra, Bellman Ford Algorithm)
12. Implement 15 Puzzle Problem
13. Implement 8 Queen problem
14. Minimum Cost Spanning Tree by Prim's Algorithm >Minimum Cost Spanning Tree by Kruskal's Algorithm
15. Implement Breadth First Search (BFS) >Implement Depth First Search (DFS)

Suggested Books:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: "Introduction to Algorithms", The MIT Press.
2. E. Horowitz, S. Sahni, S. Rajasekaran: "Fundamentals to Computer Algorithms", Springer.
3. C.H. Papadimitriou, E. Steiglitz: "Combinatorial Optimization Algorithms and Complexity", Dover Publications Inc.

Semester VI:

Software Engineering

Code: CSEUGPC17
Contacts: 3L
Credits: 3

Course Objectives:

- Will get the basic concept of Structural Modeling, Advance Structural Modeling, Basic Behavioural Modeling, Advance Behavioural Modeling.
- Will get the basic concept of Architectural Modeling, UML Notation, UML Stranded Elements, Designing Test cases, Test Suits, Rational Unified Process etc.
- To understand the best practices in software engineering.
- To develop the necessary skills to handle software projects in a principled way

Course Outcomes:

CO 1: Basic knowledge and understanding of the analysis and design of complex systems.
CO 2: Ability to apply software engineering principles and techniques.
CO 3: Ability to develop, maintain and evaluate large-scale software systems.
CO 4: To produce efficient, reliable, robust and cost-effective software solutions.
CO 5: Ability to perform independent research and analysis.
CO 6: Ability to work as an effective member or leader of software engineering teams.
CO 7: Ability to understand and meet ethical standards and legal responsibilities.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√						√				
CO2		√	√									
CO3	√		√									
CO4			√		√	√	√				√	√
CO5		√	√							√		
CO6				√		√	√				√	√
CO7										√		

Module 1:[12 Hrs]
Software as an engineering product, Software vs. Program, Software engineering vsconventional engineering, Goals of software engineering, Issues and challenges.
Software development process models, Waterfall, Prototyping, Spiral, Incremental, RAD and Component based development model; Comparative analysis.

Requirement Engineering - Tools for requirement elicitation and analysis, Analysis issues,System Requirement Specification, Formal techniques– Z Spec, Analysis Models forStructured approach &Object Oriented approach, Requirement Traceability.

Module 2:[12 Hrs]

Software Design &Modelling - Problem partitioning, Top-Down And Bottom-Up design,Structured charts, coupling,cohesion, Modular Design and Structured Programming. Data design, User Interface design.

Coding & Documentation: Coding Standards and Guidelines, Code review & walkthrough,Structured Programming, OO Programming, Information Hiding, Code reuse, System Documentation.

Software testing objectives and principles, Verification vs. Validation, Types of testing,Cyclomatic complexity, Test Case Generation, Test tools & Models, Object-orientedTesting, Model Based testing, Test automation, Regression.

Module 3:[12 Hrs]

Software Project Management: Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Qualityfactors, Quality standards – TQM, ISO, SEI CMM, PCMM, Six sigma, Reliability;Project Monitoring; Software Project Estimation - Estimation Metrics- Size Oriented andFunction Point Oriented; Cost Estimation - Algorithmic Cost Modeling, COCOMO, advanced COCOMO, Personnel Productivity &team structure.

Overview of models in software development – UML, DFD, ERD, Modeling concurrent& distributed systems - PetriNets, High Level Petri Nets;

CASE tools: Concepts, use and application.

Suggested Books:

1. C. Ghezzi, M. Jazayeri, D. Mandrioli: "Fundamentals of Software Engineering",Pearson.
2. Sommerville: "Software Engineering", Pearson.
3. Martin L. Shooman: "Software Engineering", TMH.
4. Roger Pressman: "Software Engineering - A practitioner's approach", Mcgraw-Hill Companies, Inc.
5. Rajib Mall: "Software Engineering", PHI.

Compiler Design

Code: CSEUGPC18
Contacts: 3L
Credits: 3

Course Objectives:

- Learn about the various phases during compilation; brief understanding about various types of translators, linkers, loaders and their roles during program compilation and execution.
- Detail understanding about lexical and syntax analysis, categories of syntax analyzers (parsers), learning different types of top-down and bottom-up parsing algorithms in details.
- Learning the brief overview of semantic analysis procedure, generation of intermediate codes, type checking procedure, roles of symbol table management, machine independent code optimization, code generation techniques, and scheduling of instructions.

Course Outcomes:

CO 1: Understand the fundamental concepts about compilers and the roles of various phases of a compiler.

CO 2: Clear understanding about the theoretical background to create a simple compiler using C programming languages along with various automated tools like LEX, YACC.

CO 3: Learn the roles of finite automata, context free grammars in designing compilers.

CO 4: Learn in detail about the different algorithms to perform syntax, semantic analysis, and intermediate code generation, machine independent code optimization, and code generations.

CO 5: Understand the similarities and differences among various parsing and grammar transformation techniques.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√	√					√			
CO2	√	√	√	√								
CO3	√	√	√									
CO4	√	√	√						√			√
CO5	√	√	√									

Module-1 [8 Hrs]

Introduction to Compiling [2L]

Compilers, Analysis-synthesis model, The phases of the compiler, Cousins of the compiler.

Lexical Analysis [6L]

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of tokens, Recognition of tokens, Finite automata, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Module-2 [10 Hrs]

Syntax Analysis [6L]

The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Syntax directed translation [4L]

Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.

Module-3 [8 Hrs]

Type checking [3L]

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions, Overloading of functions and operators.

Run time environments [5L]

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Module-4 [10 Hrs]

Intermediate code generation [3L]

Intermediate languages - Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples), Declarations, Assignment statements, Boolean expressions.

Code generations [4L]

Issues in the design of code generator, The target machine, Run-time storage management, Basic blocks and flow graphs, A simple code generator, Register allocation and assignment, The DAG representation of basic blocks, Peephole optimization.

Code optimization [3L]

Introduction, The principle sources of optimization, Optimization of basic blocks, Loops in flow graphs.

Suggested Books:

1. Aho, Sethi, Ullman: "Compiler Principles, Techniques and Tools", Pearson Education.
2. K. V. N. Sunitha: "Compiler Construction", Pearson Education.
3. O.G. Kakde: "Compiler Design", Laxmi Publications.
4. Holub: "Compiler Design in C", PHI.
5. Tremblay and Sorenson: "Compiler Writing", McGrawHill International.
6. Chattopadhyay: "Compiler Design", PHI.

Computer Networks

Code: CSEUGPC19
Contacts: 3L
Credits: 3

Course Objectives:

- Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.
- Read the fundamentals and basics of Physical layer, and will apply them in real time applications
- Study data link layer concepts, design issues, and protocols.
- Gain core knowledge of Network layer routing protocols and IP addressing.
- Study Transport layer services and protocols.
- Acquire knowledge of Application layer and Presentation layer paradigms and protocols.

Course Outcomes:

CO 1: Understand basic concepts of computer networking and its terminologies.
CO 2: Describe the basic functionalities of each layer in OSI and TCP/IP model.
CO 3: Explain the types of transmission media with real time applications
CO 4: Describe the functions of data link layer and explain the protocols.
CO 5: Classify the routing protocols and analyze how to assign the IP addresses for the given networks.
CO 6: Describe the functions of Transport layer and explain the protocols.
CO 7: Explain the functions of Application layer.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√	√	√							
CO2	√	√	√		√							
CO3	√	√		√	√							
CO4	√	√		√	√							
CO5		√	√		√							
CO6		√	√		√							
CO7			√		√							

Module-1: [12 Hrs]
Introduction: Data communications concepts, direction of data flow (simplex, half duplex, full duplex). Networks: physical structure (type of connection, topology), categories of network (LAN, MAN, WAN). Internet: brief history, internet today. Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical level: Overview of data (analog & digital), review of signal (analog & digital), transmission (analog & digital) & transmission media (guided & non-guided). TDM, FDM, WDM. Circuit switching and packet switching concepts

Data link layer: Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC.

Module-2: [12 Hrs]
Medium access sub layer: Point to point protocol, token bus, token ring. Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD. Traditional Ethernet, Fast Ethernet.

Network layer: Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router. Addressing: Internet address, classful and classless addressing, subnetting.
Routing: techniques, static vs. dynamic routing, routing table for classful address.
Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing. Protocols: ARP, RARP, IP, ICMP, IPV6. Unicast and multicast routing protocols.

Module-3: [12 Hrs]
Transport layer: Process to process delivery, UDP, TCP, Congestion control algorithms. Quality of service, techniques to improve QoS.

Application layer:DNS, SMTP, SNMP, FTP, HTTP & WWW.
Security: cryptography, user authentication, security protocols in internet, Firewalls.

Wireless LAN: IEEE 802.11; Introduction to Bluetooth, VLAN's, Cellular telephony & Satellite network.

Suggested Books:

1. B. A. Forouzan: "Data Communications and Networking (3rd Ed.)", TMH.

2. A. S. Tanenbaum: "Computer Networks (4th Ed.)", Pearson Education/PHI.
3. W. Stallings: "Data and Computer Communications (5th Ed.)", PHI/ Pearson Education.
4. Zheng& Akhtar:"Network for Computer Scientists & Engineers", OUP.
5. Black, Data & Computer Communication", PHI.
6. Miller: "Data Communication & Network", Vikas.
7. Miller:"Digital & Data Communication", Jaico.
8. Shay:"Understanding Data Communication & Network", Vikas.

Computer Graphics

Code: CSEUGPC20
Contacts: 3L
Credits: 3

Course Objectives:

- To provide comprehensive introduction about computer graphics system, design algorithms and two dimensional transformations.
- To make the students familiar with techniques of clipping, three dimensional graphics and three dimensional transformations.
- To prepare students for activities involving design, development and testing of modeling, rendering and shading.

Course Outcomes:

CO 1: Knowledge about the foundations of computer graphics.
CO 2: Concepts about geometric/mathematical transforms and other algorithms necessary for programming computer graphics.
CO 3: Understanding of object representation and viewing in display devices.
CO 4: Knowledge about illumination, ray tracing, animation, etc.
CO 5: Familiarity with different aspects and components about recent applications of computer graphics and insights into upcoming prospective graphics-powered applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√		√		√	√	√		√		√	
CO2	√	√	√	√	√	√	√		√		√	√
CO3	√	√	√	√	√	√	√		√		√	√
CO4	√	√	√	√	√	√	√		√		√	√
CO5	√	√	√	√	√	√	√		√		√	√

Unit I. Introduction to Computer Graphics & Graphics Systems [5 Hrs]
Overview of computer graphics, graphical display devices, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics softwares; Character generation

Unit II. Scan Conversion [6 Hrs]
Points and lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon fill algorithm, boundary fill algorithm, flood fill algorithm.

Unit III. 2D Transformation [4 Hrs]
Basic transformations - translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection, shear, Transformation of points, lines, parallel lines, intersecting lines.

Unit IV. Viewing in 2D [4 Hrs]
Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, Cohen Sutherland Algorithm, clipping circles, polygons & ellipse, Sutherland Hodgeman algorithm.

Unit V. 3D Transformation and Viewing [4 Hrs]
Translation, rotation, scaling & other transformations, Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Unit VI. Curves and Surfaces [5 Hrs]
Object representation; Curve and surface designs, Bezier curves, Continuity conditions; B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Unit VII. Hidden Surfaces [4 Hrs]
Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Unit VIII. ColorandShadingModels [4 Hrs]
Light andcolor model; interpolative shading model; Texture; Ray tracing; Animation

Suggested Books:

1. D. Hearn and M.P. Baker: "Computer Graphics C version", Pearson Education.
2. Samit Bhattacharya: "Computer Graphics", Oxford University Press.
3. David F.Rogers: "Procedural Elements for Computer Graphics", TMHpublication.
4. David F. Rogers and J. A.Adams: "Mathematical Elements for Computer Graphics", TMH publication.
5. J.D. Foley, A. van Dam, S.K.Feiner and F. H. John: "Computer Graphics Principles &Practice in C", Pearson.
6. S. Harrington: "Computer Graphics – A Programming Approach", TMHpublication.
7. A.N. Sinha and A.D. Udai: "Computer Graphics", TMH publication.

Embedded Systems

Code: CSEUGPC21
Contacts: 3L
Credits: 3

Course Objectives:

- To introduce the technologies behind embedded computing systems.
- To introduce and discuss various software components involved in embedded system design and development.
- To expose students to the recent trends in embedded system design.

Course Outcomes:

CO 1: Demonstrate the role of individual components involved in a typical embedded system.
CO 2: Analyze the characteristics of different computing elements and select the most appropriate one for an embedded system.
CO 3: Model the operation of a given embedded system.
CO 4: Substantiate the role of different software modules in the development of an embedded system.
CO 5: Develop simple tasks to run on an RTOS.
CO 6: Examine the latest trends prevalent in embedded system design.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√		√		√							
CO2	√	√			√	√	√				√	
CO3	√		√		√	√	√				√	
CO4			√	√		√	√				√	
CO5			√		√	√	√				√	
CO6	√	√		√								

UNIT -I: [6 Hrs]

Introduction to Embedded Systems:
Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II:[8 Hrs]

Typical Embedded System:
Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III:[5 Hrs]

Embedded Firmware:
Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV:[6 Hrs]

RTOS Based Embedded System Design:

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT -V:[5 Hrs]

Task Communication:
Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

UNIT –VI:[6 Hrs]

8051, AVR, PIC, ARM Microcontroller Interfacings with:
LEDs and LCD,DC Motor and Stepper Motor, Switches and Relays ,HEX Keypad,ADC CENTRE

Suggested Books:

1. Shibu K.V: "Introduction to Embedded Systems", Mc Graw Hill.
2. Raj Kamal: "Embedded Systems", TMH.
3. Frank Vahid, Tony Givargis,: "Embedded System Design", Wiley.
4. Lyla: "Embedded Systems", Pearson, 2013.
5. David E. Simon: "An Embedded Software Primer", Pearson Education.

ELECTIVE – I

Bioinformatics

Code:CSEUGPE01
Contacts: 3L
Credits: 3

Course Objectives:

- To give students an introduction to the basic practical techniques of bioinformatics.
- Emphasis will be given to the practical application of bioinformatics and biological databases to achieve problem solving skills in real research problems.

Course Outcomes:

CO 1: To learn basic concepts of Bioinformatics and its significance in Biological data analysis.
CO 2: Describe the preliminary and related concepts, scope and importance of Bioinformatics.
CO 3: Explain different algorithms and methods to characterize and explain different types of Biological data.
CO 4: Use of machine learning to classify different types of Biological Databases.

CO 5: Introduce the basics concept of sequences and its uses in alignment and analysis.
CO 6: Overview about biological macromolecular structures and structure prediction methods.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√		√								
CO2	√	√			√	√	√				√	√
CO3		√	√			√	√			√	√	
CO4	√			√		√	√				√	
CO5		√			√							
CO6		√	√	√		√	√				√	

Module-1 [12 Hrs]

Background: Why computational biology, biological information, challenges in computational biology.

Sequence Assembly: Fragment assembly, Sequencing by hybridization, Overlap-layout-consensus

Sequence Alignment: Introduction to biological sequences, DNA sequence, dynamic programming methods for global and local alignment, gap penalty functions, heuristics in alignment, BLAST, pairwise sequence alignment, multiple sequence alignment

Module-2 [12 Hrs]:

Biological Database and its Types: Introduction to data types and Source. Population and sample, Classification and Presentation of Data.Quality of data, private and public data sources.General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

Phylogenetic Trees: Distance, parsimony, and probabilistic methods of phylogenetic tree construction, models of sequence evolution

Module-3 [12 Hrs]
Clustering approaches to biological datasets: High-throughput technologies, clustering algorithms, evaluation of clusters.

Gene Expression analysis: Representation of patterns and relationship General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS. Introduction to Regular Expression, Hierarchies, and Graphical models (including Marcov chain and Bayes notes).Genetic variability and connections to clinical data**.**

Modelling and analysis of biological networks: Biological networks, computational problems in network biology, Bayesian networks, module networks, parameter and structure learning, regression-based network inference, network applications.

Machine Learning algorithms and its usage in modelling biological data.

Suggested Books:

1. JIN XIONG: "Essential Bioinformatics", Cambridge University Press.
2. Joachim Selbig and Stefanie Hartmann: "Introductory Bioinformatics: Fourth Edition",
3. Jonathan Pevsner: "Bioinformatics and Functional Genomics", Wiley- Blackwell.
4. S.C. Rastogi, N Mendiratta, P Rastogi: "Bioinformatics: Methods & Applications", PHI.
5. Stanley I. Letovsky: "Bioinformatics: Databases and Systems", Springer.
6. Sorin Draghici: "Bioinformatics Databases: Design, Implementation, and Usage (Chapman & Hall/ CRC Mathematical Biology & Medicine)",
7. Arthur M.Lesk: "Data base annotation in molecular biology, Principles and Practices", Wiley.
8. Tao, Jiang, Ying Xu, Michael Q. Zang: "Current topics in computational molecular biology", Ane Books Pvt. Ltd (2004).

Data Science & Big Data

Code: CSEUGPE02
Contacts: 3L
Credits: 3

Course Objectives:

- To enable the student to understand basic data science concepts.
- To learn to detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization.
- To make aware of how to address advanced statistical situations, Modeling and Machine Learning.

Course Outcomes:

CO 1: Students should be able to understand the problem.
CO 2: Able to comprehend the problem.
CO 3: Able to define suitable statistical method to be adopted.
CO 4: Able to apply different Data Analysis Techniques.
CO 5: Able to apply different Supervised Learning Methods.
CO 6: Understand different business scenarios and able to do visualization.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√	√		√	√	√				√	
CO2	√		√		√				√	√		
CO3		√				√	√			√	√	√
CO4		√				√	√	√		√	√	

CO5		√				√	√			√	√	√
CO6	√	√		√	√				√			√

Unit I. Data Definitions and Analysis Techniques [6 hrs]
Elements, Variables, and Data categorization; Levels of Measurement; Data management and indexing; Introduction to statistical learning and R-Programming

Unit II. Descriptive Statistics and Basic AnalysisTechniques[8 Hrs]
Measures of central tendency; Measures of location of dispersions; Practice and analysis with R; Statistical hypothesis generation and testing; Chi-Square test; t-Test; Analysis of variance; Correlation analysis; Maximum likelihood test; Practice and analysis with R

Unit III. Data Analysis Techniques [10 Hrs]
Relation analysis; Regression analysis; Classification techniques; Clustering; Association rules analysis; Practice and analysis with R

Unit IV. Big Data Processing [8 Hrs]
Big data concepts; Introduction to Hadoop; Hadoop Distributed File System; Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Typesand Formats, Map Reduce Features; Hadoop EcoSystem

Unit V. Case Studies and Projects [4 Hrs]
Understanding business scenarios; Feature engineering and visualization; Scalable and parallel computing with Hadoop and Map-Reduce; Sensitivity Analysis

Suggested Books:

1. Joel Grus: “Data Science from Scratch”, O’Reilly Publisher.
2. R. Myers and R. Walpole: “Probability and Statistics for Engineers and Scientists”, Pearson.
3. Seema Acharya and SubhasiniChellappan: “Big Data Analytics”, Wiley Publisher.
4. Tom White: “Hadoop: The Definitive Guide”, O’Reilly Publisher.

Image Processing

Code: CSEUGPE03
Contacts: 3L
Credits: 3

Course Objectives:

- To learn the fundamentals of image acquisition, representation and analysis.
- To learn about image enhancement in spatial domain.
- To comprehend the frequency domain and various image transformation in it.
- To learn the analytical tools and methods applied to image information for variousaspects of practical applications.
- To learn image compression and segmentation techniques.

Course Outcomes:

CO 1: Knowledge of basic operators and preprocessing techniques in monochrome, gray and color images.

CO 2: Skills in image enhancement like linear and non-linear spatial and frequency domain filters using python libraries.

CO 3: Familiarity to morphological image processing and segmentation techniques.

CO 4: Knowledge of image representation, feature extraction, object recognition and basics of image compression.

CO 5: To understand the concepts and techniques of image processing projects using different methods.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√										
CO2	√	√	√		√	√	√				√	
CO3	√	√	√	√	√							√
CO4		√	√	√	√	√	√				√	
CO5	√	√	√	√	√	√	√		√		√	

Module - 1 [3 Hrs]

Image formation: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems.

Module - 2 [4 Hrs]

Introduction: Overview of Image Processing System, Image Digitization (Sampling and Quantization), Digital Image, Fundamentals of Color image, Color Models (RGB, YCbCr, HIS), Image File Format.

Module - 3 [3 Hrs]

Spatial Domain Image Enhancement: Contrast Intensification (linear and non-linear stretching), Histogram Equalization, Spatial Domain Smoothing and Sharpening Filters, Correlation and Convolution.

Module - 4 [4 Hrs]

Frequency Domain Image Enhancement: Fourier Transform (1-D and 2-D), Frequency Domain image, Image smoothing, Image sharpening, Correlation and Convolution, Discrete Cosine Transform, Discrete Wavelet Transform.

Module - 5 [3 Hrs]

Morphological Image Processing: Dilation and Erosion, Opening and Closing, Some Basic Morphological Algorithms, Extensions to Gray-Scale Images.

Module - 6 [5 Hrs]

Image Segmentation: Point Detection, Line Detection, Edge Detection,Edge Linking and Edge Following by Local Processing, Hough Transform, Thresholding, Region segmentation

Module - 7 [9 Hrs]

Image Representation, Feature Extraction & Object Recognition: Boundary Representation by Chain Codes, Polygonal Approximation, Skeletons Component Labeling and Counting Geometrical, Texture Analysis, Geometric Moments Texture Descriptor, Gray-level Co Occurrence Matrix, some object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition, Texture Description, Pattern & Pattern Classes, Template Matching.

Module - 8 [5 Hrs]

Image Compression: Fundamentals, Compression Models, Error-Free compression, Lossy Compression.

Suggested Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing".
2. B. Chanda and D. Dutta Majumder, "Digital Image Processing and Analysis".
3. D. Forsyth and J. Ponce , "Computer Vision - A modern approach", Prentice Hall.

VLSI Design

Code: CSEUGPE04
Contacts: 3L
Credits: 3

Course objectives:

- To introduce the concepts and techniques of modern integrated circuit design and testing (CMOS VLSI).
- Be able to design static CMOS combinational and sequential logic at the transistor level, including mask layout.
- Describe the general steps required for processing of CMOS integrated circuits.
- Estimate and optimize combinational circuit delay using RC delay models and logical effort.
- Estimate and optimize interconnect delay and noise.
- Design for higher performance or lower area using alternative circuit families
- Describe and avoid common CMOS circuit pitfalls and reliability problems
- Compare the trade-offs of sequencing elements including flip-flops, transparent latches, and pulsed latches
- Design functional units including adders, multipliers, ROMs, SRAMs, and PLAs

Course Outcomes:

CO 1: Express the Layout of simple MOS circuit using Lambda based design rules.
CO 2: Apply the Lambda based design rules for subsystem design.
CO 3: Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnection.
CO 4: Be able to create models of moderately sized CMOS circuits that realize specified digital functions.
CO 5: Be able to apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and effects.
CO 6: Have an understanding of the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√		√									
CO2	√			√	√							
CO3	√	√			√					√		
CO4			√		√				√			
CO5				√								√
CO6		√		√								√

UNIT –I:
MOS, CMOS, BiCMOS Technology.
Basic Electrical Properties of MOS, CMOS & BiCMOS Circuits: Ids – Vds relationships, Threshold Voltage VT, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

UNIT –II:
Layout Design and Tools:
Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools.

Logic Gates & Layouts:
Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

UNIT –III:
Combinational Logic Networks:
Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing.

UNIT –IV:
Sequential Systems:
Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing

UNIT –V:
Floor Planning:
Floor planning methods, Global Interconnect, Floor Plan Design, Off-chip connections.

Suggested Books:

1. Essentials of VLSI Circuits and Systems, K. Eshraghian Eshraghian. D, A. Pucknell, 2005, PHI
2. Modern VLSI Design – Wayne Wolf, 3rd Ed., 1997, Pearson Education.
3. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC press
4. Principals of CMOS VLSI Design – N.H.E Weste, K. Eshraghian, 2nd Ed., Addison Wesley

Web Technologies

Code: CSEUGPE05
Contacts: 3L
Credits: 3

Course Objectives:

- To get the basics knowledge on web page design.
- Learn about HTML5 documents and create static and dynamic web pages.
- Learn JavaScript and use the JS in WebPages to make the page more dynamic and also for client side validation.
- Get knowledge on XML schema and transformation.
- Create dynamic web pages using PHP and JSP.

Course Outcomes:

CO 1: To learn the basics of HTML and can apply CSS on web pages.
CO 2: Create static and dynamic web pages and make a website also.
CO 3: Prepare XML documents and schemas to store and transport data.
CO 4: Write programs in PHP.
CO 5: Write a server side java application called Servlet to catch form data sent from client, process it and store it on database.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√				√	√	√	√			√	
CO2	√				√							√
CO3			√		√	√	√	√			√	√
CO4					√	√	√				√	
CO5			√	√	√	√	√				√	

Static Web Pages [3 Hrs]

HTML:Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout,

Dynamic Web Pages [3Hrs]

The need of dynamic web pages; an overview of DHTML, Cascading Style Sheet (CSS), comparative studies of different technologies of dynamic page creation

Active Web Pages [3Hrs]

Need of active web pages;Java Applets:Container Class, Components, Applet Life Cycle, Update method; Parameter passing Applet, Applications.

Java Script [4Hrs]

Data types, variables, operators, conditional statements, Array object, Date object, String object, Function, Errors, Validation.

Extensible Markup Language (XML) [3 Hrs]

Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.

Cookies & Sessions [3 Hrs]

Definition of cookies; Create and Store a cookie with example; Sessions.

Java Servlet [3Hrs]

Servlet environment and role, HTML support, Servlet API, The Servlet life cycle, Servlet Programs.

JSP [10Hrs]

JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

PHP & MySQL [4Hrs]

Overview ofPHP, Basics web programming usingPHP, Introducing MySQL, Database connectivity using PHP.

Suggested Books:

1. Uttam K. Roy: “Web Technologies”, Oxford University Press.
2. Ivan Bayross, Sharanam Shah, Cynthia Bayross, Vaishali Shah: “Java Server Programming for Professionals”, Shroff Publishers and Distributors.
3. C. Xavier: “Web Technology and Design”, New Age.
4. Kogent Learning Solutions Inc.: “Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book”, Dreamtech Press.
5. N.P. Gopalan and J. Akilandeswari:“Web Technology: A Developer's Perspective”, PHI.
6. Luke Welling, Laura Thomson:“PHP and MySQL Web Development”, Pearson Education.
7. Mike McGrath: “PHP and MySQL”, McGraw Hill Education.
8. Meloni J C: “Sams Teach Yourself PHP MY SQL and Apache”, Pearson Education.
9. Jain & Siddiqui with NIIT: “J2EE Professional Projects”, PHI.
10. UttamK. Roy: “Advanced Java Programming”, Oxford University Press.

Seminar and Presentation Skills

Code: CSEUGPR01
Contacts: 3P
Credits: 0

English language and verbal skills; Skills related to seminar and presentation; Selection of (preferably) technical topic; Practice sessions on seminar presentation; Do's and don'ts in seminar and technical presentation; Listening pre-recorded matters produced by British Council, Universities of Oxford, and University of Cambridge, etc. Preparing final presentation and facing question answer session at the end of presentation; boosting confidence in communication in social as well as professional lives.

Reference Books:

1. SM Gupta:"Current English Grammar and Usage",
2. Sashi Kumar: "Spoken English (with Cassette)" , TMH.
3. Ishita Bhown:"Improve Your Presentation Skills (with CD)", V&S Publishers.
4. R. Sharma and Krishna Mohan:"Business Correspondence & Report Writing", McGraw Hill.

Compiler Design Lab

Code: CSEUGPC22
Contacts: 3P
Credits: 1.5

Course Objectives:

- This course is intended to provide a comprehensive knowledge about designing a compiler.
- Learn compiler translates High Level Languages to Machine Language.
- To learn different phases of a compiler and implementing them by writing programs and automated tools like LEX, YACC, etc.
- To learn generating efficient machine codesusing code optimization.

Course Outcomes:

CO 1: Learn fundamental of a compiler and its various phases during compilation.
CO 2: Learn in detail about the Lexical Analysis process and implementation using LEX.
CO 3: Understands various types of parsing techniques, e.g., LL, LR, SLR, etc.
CO 4: Learn to design a parser through YACC.
CO 5: Learn the overview of syntax directed translation, symbol table management.
CO 6: Learn how to generate intermediate codes and perform code optimization during compilation.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√	√					√			

CO2	√	√	√	√	√							
CO3	√	√	√	√	√							
CO4	√	√		√								
CO5	√	√	√	√	√							

Syllabus

1. Design of a tiny lexical analyzer for lexical analysis using C programs.
2. Implement the lexical analyzer using lexical analyzer generating tools (LEX).
3. Program to check whether a grammar is left recursive or not, if it is remove left recursion.
4. Program for computation of FIRST AND FOLLOW of non-terminals.
5. Design of a predictive parser/LALR bottom up parser for a given language.
6. Conversion of BNF rules into YACC form
7. Write code for generating abstract syntax tree.

Reference Books:

1. A. V. Aho and J. D. Ullman: Principles of Compiler Design; Narosa Pub.
2. Holub: Compiler Design in C, PHI.
3. J. P. Tremblay and P. G. Sorenson: The Theory and Practice of Compiler Writing; McGraw Hill.
4. S. S. Muchnick: Advanced Compiler Design & Implementation; Narosa.
5. J. R. Levine, T. Mason and D. Brown: Lex and Yacc; O'Reilly.

Computer Networks lab

Code: CSEUGPC23
Contacts: 3P
Credits: 1.5

Course Objectives:

- To familiar with network cables, different connectors, connecting devices like hubs, switches.
- To write, execute and debug c programs which use Socket API.
- To understand the use of client/server architecture in application development.
- To understand how to use TCP and UDP based sockets and their differences
- To write and implement data link layer protocols.

Course Outcomes:

CO 1: Demonstrate the networking cables, different connectors and connecting devices.
CO 2: Understand the socket programming using TCP & UDP sockets.
CO 3: Develop and design client/server applications.
CO 4: Develop and simulate the code for different Data link layer protocols.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√	√		√							
CO2	√		√		√							
CO3	√	√				√	√				√	
CO4	√		√			√	√			√	√	

1. **Familiarization with**
   - Networking cables (CAT5, UTP)
   - Connectors (RJ45, T-connector)
   - NIC Installation & Configuration (Windows/Linux)
   - Hubs, Switches
2. **TCP/UDP Socket Programming**
3. **Implementation/Simulation of**
   - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
   - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
   - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

Reference Books:

1. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4 th Ed.)" – Pearson Education/PHI
2. Unix Network Programming: The Sockets Networking Api, W. Richard Stevens, Bill Fenner, Andrew M. Rudoff
3. Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code, Lewis Van Winkle

ELECTIVE – I Lab

Bioinformatics Lab

Code: CSEUGPE06
Contacts: 3P
Credits: 1.5

Course Objectives:

- This course is designed to provide a comprehensive knowledge of Biological Data Analysis.
- To learn how to construct biological complex networks and performing analysis.
- To implements several real life tools used for sequence analysis, complex network analysis using several programming languages such as python, R and Matlab.

Course Outcomes:

CO 1: Understands python for implementation of various bioinformatics tool.
CO 2: Understands the biological data analysis part using R and python.
CO 3: Understands several Bioconductor package of R.
CO 4: Implement several bioinformatics tools using biopython.
CO 5: Understands microarray, single cell technology and use R to analysis them.
CO 6: Understands visualization of complex biological datasets, implements several visualization tasks using R and python software.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√			√	√				√	
CO2	√	√	√			√	√		√		√	
CO3	√	√	√			√	√		√		√	
CO4		√	√			√	√	√	√		√	
CO5	√	√				√	√		√		√	
CO6	√	√	√	√	√	√	√		√		√	

1. Explore machine learning tool "R" and python language.
2. Perform biological data pre-processing tasks using R package.
3. Demonstrate performing classification and clustering on microarray expression data sets.
4. Demonstrate performing sequence alignment task using BLAST and FASTA.
5. Demonstrate the complex biological network analysis.
6. Design several research problem related to the gene expression and sequencing data.

Reference Books:

[1] M. Lesk, "Introduction to Bio Informatics," Oxford University Press
[2] Hooman Rashidi, Lukas K. Buehler, "Bioinformatics Basics: Applications in Biological Science andMedicine," CRC Press/Taylor & Francis Group, 2nd edition, May 2005
[3] Stephen A. Krawetz, David D. Womble, "Introduction to Bioinformatics: A Theoretical and PracticalApproach," Humana Press
[5] Bryan Bergeron, "Bioinformatics Computing," Prentice Hall PTR .

Data Science Lab

Code: CSEUGPE07
Contacts: 3P
Credits: 1.5

Course Objectives:

After learning the course the students should be able

- To learn the fundamentals of data analytics.

- To learn the data science pipeline.
- To learn about various statistical distributions.

Course Outcomes:

CO 1: Learn how to scope the resources required for a data science project.
CO 2: Apply statistical methods, regression techniques, and machine learning algorithms to make sense out of data sets both large and small.
CO 3: Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
CO 4: Apply principles of Data Science to the analysis of business problems.
CO 5: Apply data mining software to solve real-world problems.
CO 6: Apply algorithms to build machine intelligence.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√		√							
CO2	√				√	√	√				√	
CO3	√	√		√	√				√			
CO4	√		√		√			√	√			
CO5	√	√								√		√
CO6	√		√							√		√

- Practice and assignments on elementary operations on data, statistical measures, distributions, hypothesis testing, correlation analysis, etc.
- Practice and assignments on relation analysis, regression, data classification and clustering techniques, association rules analysis, etc.
- Exercise and assignments on big data processing exercises in Hadoop, Sparc or related platform(s). eg.

  - Write a program to plot Chi square distribution
  - Write a program to plot Normal distribution
  - Write a program to plot Poisson distribution
  - Write a program to plot T distribution
  - Write a program to plot Binomial Distribution
  - Write a program to plot Central limit theorem
  - Write a program to plot Uniform distribution
  - For the given data , perform Hypothesis Testing (two weeks)
  - For the given data perform ANOVA and tell the difference of variance between groups
  - For the data given , find the line of Linear regression and plot it
  - For the data given , find the regression coefficients for multiple regression
  - Calculate K-nearest neighbors for the data and classify
  - Using in-built function calculate Multinomial logistic regression

- Using built-in function perform Support Vector machine algorithm

Suggested Softwares: Matlab ,Python,Excel.

Reference Books:

1. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010
3. Bekkerman et al. Scaling up Machine Learning
4. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5. Vincent Granville, Developing Analytic Talent: Becoming a Data Scientist, wiley, 2014.

Image Processing Lab

Code: CSEUGPE08
Contacts: 3P
Credits: 1.5

Course Objectives:

- To familiarize with image processing tools and libraries.
- Learn to operate on them.
- Implement image processing techniques and algorithms on them.
- Develop projects/applications of practical importance/usefulness.

Course Outcomes:

CO 1: Knowledge about image processing tools along with their scope and applicability.
CO 2: Ability to operate on images with various techniques (such as smoothing, sharpening, histogram processing, filtering in spatial as well as frequency domain, morphological operators, etc.)
CO 3: Application, visualization and comprehension of various types of features on different kinds of images.
CO 4: Ability to apply basic image compression techniques and analyze them.
CO 5: Develop project/application of practical relevance involving preprocessing, segmentation and object recognition, etc.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1					√							√
CO2	√	√			√							
CO3	√	√	√	√	√	√	√		√		√	√
CO4	√	√	√	√	√	√	√		√		√	√
CO5	√	√	√	√	√	√	√		√	√	√	√

Images and digital images, File Sizes, Image perception, Greyscale images, RGB Images, Data types and conversions, Spatial Resolution.

Point Processing, Arithmetic operations, Addition/subtraction/multiplication of images, Linear and non-linear transformations in intensity space, histograms processing,

Spatial Domain filtering, Smoothing & their variants, Sharpening & their variants; Frequency domain filtering, Smoothing & their variants, Sharpening & their variants

Thresholding, component labelling, point/line/edge segmentation, morphological operations, feature extraction; Image compression with multiple techniques.

Suggested Books and References:

1. R. Gonzalez, R. Woods and S. Eddins, "Digital Image Processing Using MATLAB", McGraw Hill
2. A. Pajankar "Python 3 Image Processing", BPB publication.
3. S. Dey, "Hands-On Image Processing with Python", Packt publication.

VLSI Design Lab

Code: CSEUGPE09
Contacts: 3P
Credits: 105

Course Objectives:

- To learn Hardware Descriptive Language (Verilog/VHDL).
- To learn the fundamental principles of VLSI circuit design in digital and analog domain.
- To familiarize fusing of logical modules on FPGAs.
- To provide hands on design experience with professional design (EDA) platforms.

Course Outcomes:

CO 1: Have knowledge about sequential & combinational digital system designs.
CO 2: Write HDL code for basic as well as advanced digital integrated circuits.
CO 3: Import the logic modules into FPGA Boards.
CO 4: Design a microcontroller based systems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√									
CO2		√	√	√	√					√		
CO3					√							
CO4			√						√	√		√

i. Familiarization with analog and digital CAD tools.
ii. Implementation of MOS inverter circuits using CAD tools and verification of different characteristics of an inverter.
iii. Implementation MOS current mirrors and current sources.
iv. Implementation of NAND and NOR gates using CMOS logic and observation of their static and dynamic behaviors.
v. Design of flip-flop circuits and study of its transient behavior.
vi. Mask layout of an inverter, application of design verification rules, RC extraction, pre and post layout comparison of characteristics

Reference Books :

1. Baker, R.J., Lee, H. W. and Boyce, D. E., CMOS Circuit Design, Layout and Simulation, Wiley - IEEE Press (2004) 2nd ed.
2. Weste, N.H.E., Harris, D. and Banerjee, A., CMOS VLSI Design, Dorling Kindersley (2006) 3rd ed.
3. Rabaey, J.M., Chandrakasen, A.P. and Nikolic, B., Digital Integrated Circuits – A Design perspective, Pearson Education (2007) 2nd ed.

Web Technologies Lab

Code: CSEUGPE10
Contacts: 3P
Credits: 1.5

Course Objectives:

- To acquire knowledge and Skills for creation of Web Site considering both client- and server-side Programming.
- To create Web application using HTML, CSS.
- To learn the Java Script, JSP.
- To Demonstrate Google or Gmail mash up.
- To be well versed with XML and web services Technologies.

Course Outcomes:

CO 1: Creating web page using the knowledge of HTML and CSS.
CO 2: Implement dynamic web pages with validation using JavaScript objects by applying different event handling mechanism.
CO 3: Learning about SQL, JAVA and database connectivity.
CO 4: Demonstrate simple web application using JSP, XML.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√				√	√	√	√			√	
CO2												
CO3			√		√	√	√	√			√	√
CO4					√	√	√				√	

1. Web Page Design using HTML
2. Use of CSS in Designing Web Pages
3. Applet Design
4. Application of JavaScript in Web Page Development
5. Usage of Cookies & XML
6. Server Side Programming through Servlets
7. Application of Java Server Pages in Server Side programming
8. Application of Java Database Connectivity
9. Web design using PHP and MySQL

Suggested Books:

1. Uttam K. Roy: "Web Technologies", Oxford University Press.
2. Ivan Bayross, Sharanam Shah, Cynthia Bayross, Vaishali Shah: "Java Server Programming for Professionals", Shroff Publishers and Distributors.
3. C. Xavier: "Web Technology and Design", New Age.
4. Kogent Learning Solutions Inc.: "Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book", Dreamtech Press.

Semester VII:

Machine Learning & Soft Computing

Code: CSEUGPC24
Contacts: 3L
Credits: 3

Module-1 [12 Hrs]:

Fuzzy Logic and Approximate Reasoning: Conventional and fuzzy sets, Basic concepts of fuzzy logic, Fuzzy expressions: Basic principles of fuzzy logic and fuzzy inference rules, fuzzy relations, fuzzy operators, realization of fuzzy systems using fuzzy relations , application of fuzzy logic in vision, pattern recognition, robotics and linguistics.

Approximate reasoning in Experts Systems, Fuzzy sets in approximate reasoning, Fuzzy propositions in approximate reasoning.Transition Modifier rules, Basic principles of approximate reasoning and rules of inference.

Module-2 [12 Hrs]

Genetic Algorithms (GAs) : Introduction to GAs, Binary encodings of candidate solutions, Schema Theorem and Building Block Hypothesis, Genetic operators – crossover and mutation, parameters for GAs, Reproduction mechanism for producing Offspring, Darwinian Principle in evaluating objective function. Convergence Analysis: Simple GA schemes, Stochastic models: GA approaches to optimization problems

Module-3 [12 Hrs]

Machine learning foundations – probabilistic framework, algorithms.

Classification and Predictions:What is Classification & Prediction, Issues regarding Classification and prediction, k-NN, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm.

Suggested Books:

1. J. S. R. Jang C. T. Sun and E. Mizutani: "Neuro- Fuzzy and Soft Computing : A Computational Approach to Learning and Machine Intelligence", Pearson.
2. T. J. Ross:"Fuzzy Logic with Engineering Applications", Wiley.
3. B. Kosko:"Neural Network and Fuzzy Systems : A Dynamical Systems Approach to Machine Intelligence", PHI, 1992.
4. G. J. Klir, B. Yuan: "Fuzzy sets and Fuzzy logic: Theory and Applications", PHI, 1995.
5. David E. Goldberg: "Genetic Algorithms in Search, Optimization and Machine Learning", Addision Wesley, MA, 1989.
6. S. Haykin: "Neural Networks - A Comprehensive Foundation", Macmillan College Publishing Company, New York, 1994.

Industrial Economics & Management

Code: MBAUGHU01
Contacts: 4L
Credits: 4

Module no	Content of the module	Allotted hours
1	**Economics:** Introduction and Basic Economics Terms: Nature and Significance of Economics, Role of Economics in Engineering and Technology, Basic Economic: Utility, Saving, Investment, Equilibrium, Micro and Macro Economics, Liberalization, Privatization, Globalisation. Demand Analysis, Elasticity of Demand, Demand Forecasting, Factors of Production. Money Banking and Trade: Functions of money, supply & demand for money, money price level & inflation, black money, meaning, magnitude & consequences. Banking system in India, Functions of Commercial banks, Function of RBI, Sources of public revenue, principles of taxation, direct and indirect taxes, balance of trade and payment.	10
2	**Organizational Behavior:** Basic concepts of management, objectives, classification and hierarchy,	5

	Different Schools of Management Thought, Motivation: Concept, Different Theories (Maslow, ERG, Herzberg) Communication: Purpose, process, Barriers to effective communication, Guidelines to make communication effective. Perception: Process, Importance, Factors influencing perception, Shortcuts for judging people- Halo effect, Stereotyping, Projection.	
3	**Human Resource Management:** Recruitment and selection, Training, Performance appraisal, Industrial Relations, Trade Union, Collective Bargaining	5
4	**Quality Management**: Concept, Dimensions for goods and services, Cost of Quality, Statistical Quality Control, Control Charts, Acceptance Sampling (single). Quality circle. Total Quality Management: Concept, benefits, Criticism. New Quality Tools: Kaizen, Six Sigma, Quality Circles.	5
5	**Productions Management:** Concept, Difference from Operations Management, Types of Production (Mass, Batch, Project), Functions of Production Management. Productivity: Concept, Different Inputs and Productivity Measures, Efficiency and Effectiveness, Measures to increase Productivity.	6
6	**Marketing Management:** Basic Concepts of Marketing, Difference between Selling and Marketing, Elements of Marketing Mix- the 4 P's., STP. Marketing Research: Definition, Process, Importance, SWOT Analysis, BCG Matrix, GE Matrix.	6
7	**Financial Management:** Use of management science for the efficient administration of economic units, cost benefit analysis, present work and breakeven analysis, budgetary control.	6
8	**Materials Management:** Concept, Functions, EOQ Models, Selective Inventory Control—ABC, VED, FSN analysis	5

Suggested Books:

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1. L. C. Jhamb:"A Text Book of Industrial Engineering (Vol.1)",Publisher: Everest Publishing House.
2. Anil Bhat & Arya Kumar: "Management: Principles, Processes and Practices", Publisher: OUP.
3. Martand T. Telsang: "Industrial & Business Management", Publisher: S. Chand.
4. RajanMisra: " (2009) Engineering Economics", University Science Press, An imprint of Laxmi PubliactionsPvt. Ltd., New Delhi.

ELECTIVE – II

Natural Language Processing

Code:CSEUGPE11
Contacts: 3L
Credits: 3

Course Objectives:

- Student should understand the theoretical concepts of natural language processing in Linguistics and Formal Language theory
- Enable students to be capable to syntactic, semantic and pragmatic processing of Natural Languages
- Student should be able to analyze NLP models and algorithms using both the traditional and the statistical approaches

Course Outcome:

CO 1: Understanding fundamentals of syntax, semantics and rules in NLP and Automata Theory
CO 2: Mastering Text Processing Operations
CO 3: Learning Language modeling techniques
CO 4: Understanding Information Retrieval Techniques
CO 5: Ability to Perform Text Classification using Machine Learning
CO 6: Understanding Context Free Grammars and Probabilistic Context Free Grammars

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√										
CO2			√		√							
CO3			√		√							
CO4				√	√							
CO5				√		√	√			√	√	√
CO6	√				√	√	√				√	

Unit I. Regular Expressions and Automata [2 Hrs]
Introduction to NLP, Regular Expression, Finite State Automata

Unit II. Basic Text Processing [6 Hrs]
Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition,Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance; Morphology – Inflectional and Derivational Morphology, Finite State MorphologicalParsing, The Lexicon and Morphotactics, Morphological Parsing with Finite StateTransducers, Orthographic Rules and Finite State Transducers, Porter Stemmer

Unit III. Language Modeling [8 Hrs]
Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-BellDiscounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models; Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part ofSpeech Tagging – Rule based and Machine Learning based approaches, Evaluation

Unit IV. Text Classification [6 Hrs]

Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis –Opinion Mining and Emotion Analysis, Resources and Techniques

Unit V. CFG and Lexical Semantics [6 Hrs]
Context Free Grammar and Constituency, Some common CFG phenomena for English,Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, DependencyParsing; Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus –WordNet, Computational Lexical Semantics – Thesaurus based and Distributional WordSimilarity

Unit VI. Information Retrieval [8 Hrs]
Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization,Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequencybased ranking, Zone Indexing, Query term proximity, Cosine ranking, Combiningdifferent features for ranking, Search Engine Evaluation, Relevance Feedback

Suggested Books:

1. Jurafsky and Martin: "Speech and Language Processing", Pearson Education.
2. Manning and Schutze: "Foundation of Statistical Natural Language Processing", MIT.

Internet of Things

Code: CSEUGPE12
Contacts: 3L
Credits: 3

Course Objectives:

- To explore the Machine-to-Machine communications in the digital world.
- To understand characteristic features of Internet of Things and its various domains.
- To design and build IoT systems.

Course Outcomes:

CO 1: Understand the application areas of IoT.
CO 2: Realize the revolution of Internet in Mobile devices, Cloud and Sensor Networks.
CO 3: Learn about the building blocks of Internet of Things and its characteristics.
CO 4: Define the infrastructure for supporting IoT deployments.
CO 5: Design and program IoT devices.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√			√	√	√			√	√	
CO2	√				√							
CO3			√							√		√
CO4		√		√	√				√			
CO5	√	√		√		√	√	√	√	√	√	

Module 1: [12 Hrs]

Introduction to IoT: Sensing, Actuation, Basics of Networking.
Basics of Networking, Communication Protocols, Sensor Networks.
Machine-to-Machine Communications

Module 2: [12 Hrs]

Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.

Cloud Computing.

Module 3: [12 Hrs]

Fog Computing, Smart Cities and Smart Homes.
Connected Vehicles, Smart Grid, Industrial IoT.
Case Study: Agriculture, Healthcare, Activity Monitoring.

Suggested Books:

1. Pethuru Raj and Anupama C. Raman:"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.
2. ArshdeepBahga and Vijay Madisetti:"Internet of Things: A Hands-on Approach", Universities Press.

Advanced Java Programming

Code: CSEUGPE13
Contacts: 3L
Credits: 3

Course Objectives:

- To recapitulate the basic terms and concepts of Object Oriented Programming.
- To understand the concepts of how a client's request is generated and tracking a user using Java servlet.
- To be familiar with the process of connection of databases with an application.
- To be able to demonstrate the application of AWT class and be familiar with the event handling methods.
- To understand the basic concepts of Java Swing and network programming.

Course Outcomes:

CO 1: Demonstrate the basic principles of Object Oriented Programming.

CO 2: Demonstrate the concepts of Java servlet on how to generate a client request as well as tracking them.
CO 3: Establish connection with different kinds of database from any application.
CO 4: Create an application using AWT and the event handling methods.
CO 5: Demonstrate the concepts of Java Swing and network programming.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1					√			√		√		
CO2	√				√							√
CO3		√	√									
CO4				√		√	√				√	
CO5						√	√		√		√	√

UNIT I: Introduction [6 Hrs]

Recapitulation of Basic Concepts in Java: Objects, Classes, Encapsulation, Inheritance, Polymorphism, Packages, Access Protection, Interfaces, Arrays, Applets, Exception Handling, Multithreading, String Handling.

UNIT II: Networking [6 Hrs]

Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagrams.

UNIT III: Java Database Connectivity (JDBC) [6 Hrs]

Introduction, Database driver,Different approaches to connect an application to a database server, Establishing a database connection and executing SQL statements, JDBC Prepared statements, JDBC data sources.

UNIT IV: Event Handling [6 Hrs]

Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

UNIT V: Java Servlet [5 Hours]

Servlet as an improved CGI, Servlet Fundamentals / API, What is a Web-Container, Servlet Life Cycle / Architecture, HTTP GET and POST Request Method, Processing Html Forms, What is Name-Value pair, Content Types and MIME.

UNIT VI: Java Swing [7 Hrs]
Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing-JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees and Tables.

Suggested Books:

1. E Balagurusamy: ―Programming with Java‖, McGraw Hill Education.
2. Herbert Schildt:―Java: The Complete Reference,McGraw Hill Education.
3. Sachin Malhotra and Saurabh Choudhary:―Programming in Java, Oxford University Press.
4. Y. Daniel Liang:―Introduction to Java Programming, Brief Version, Pearson Education.
5. Y. Daniel Liang:―Introduction to Java Programming, Comprehensive Version‖, Pearson Education.
6. Cay S. Horstmann: ―Core Java - Vol. I, Vol. II and Vol. II, Pearson Education.
7. Paul J. Deitel and H. Deitel: ―Java 9 for Programmers, Pearson Education India.
8. Harold Elliotte Rusty: ―Java Network Programming, Shroff Publishers & Distributers.
9. George Reese: ―Java Database Best Practices: Persistence Models and Techniques for Java Database Programming, O'Reilly.
10. Uttam K. Roy: ―Advanced Java Programming, Oxford University Press.

Computational Geometry

Code: CSEUGPE14
Contacts: 3L
Credits: 3

Course Objectives:

- Knowledge learned without implementation (content covered in the lecture component of contact sessions).
- The basic objective is to give students an introduction to the basic theory and techniques of computational geometry. Emphasis will be given to the theoretical aspects of computational geometry and application of it to problem solving in real research problems.

Course Outcomes:

CO 1: To get introduce the basic concepts of computational geometry and its significance.
CO 2: Describe the history, scope and importance of computational geometry.
CO 3: Grasp the fundamental algorithms and techniques in computational geometry.
CO 4: Strengthen students' ability of algorithms design and analysis technique.
CO 5: Understand how to model problems in a geometric fashion.
CO 6: Training students to use geometric structures and techniques to solve simple or moderately difficult problems

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√		√								

CO2	√	√			√	√	√				√	√
CO3		√	√			√	√			√	√	
CO4	√			√		√	√				√	
CO5		√	√	√								
CO6		√			√							
		√	√	√		√	√				√	

Unit I [6 Hrs]
Introduction, historical perspective, geometric preliminaries. Convex hulls algorithms in 2d and 3d, lower bounds. Triangulations: polygon triangulations, representations, point-set triangulations.

Unit II [8 Hrs]
Voronoi diagrams: algorithms, closest pair problems. Delaunay triangulations: algorithms (divide-and-conquer, flip, incremental), duality of Voronoi diagrams, properties (min-max angle).

Unit III [6 Hrs]
Geometric searching: point-location, 2d linear programming with prune and search. Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems.

Unit IV [8 Hrs]
Arrangements of lines: 2d arrangements, zone theorem, many-faces complexity, algorithms. Sweep techniques: plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, topological sweep for line arrangements.

Unit V[8L]
Combinatorial geometry: Ham-sandwich cuts, Helly's theorems, k-sets. Rectilinear geometry: intersection and union of rectangles, rectangle searching. Robust geometric computing.Applications of computational geometry.

Reference Books

1. Berg, Cheong,Kreveld and Overmars:"Computational Geometry – Algorithms and Applications" 3e, Springer.
2. Preparata and Shamos:"Computational Geometry – An Introduction", Springer.
3. Joseph O'Rourke: "Computational Geometry in C, 2e", Cambridge University Press.
4. David Mount: "Lecture Notes".

ELECTIVE – III

Computer Vision

Code: CSEUGPE15
Contacts: 3L
Credits: 3

Course Objectives:

- To introduce students the fundamentals of image formation.
- To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition.
- To develop an appreciation for various issues in the design of computer vision and object recognition systems.
- To provide the student with programming experience from implementing computer vision and object recognition applications

Course Outcomes:

CO 1: Students demonstrate a thorough understanding of fundamental concepts in computer vision (camera and projection models, image formation, image features, and calibration, stereo).

CO 2: Students must be able to design and conduct experimental validation for a computational approach to a computer vision problem, and interpret the results to assess the performance (accuracy, efficiency, robustness) of the method.

CO 3: Students are familiar with methods used in various vision-based applications – image feature detection, camera calibration, 3-D reconstruction, segmentation.

CO 4: Students are better prepared to analyze a problem and assess the strengths and weaknesses of different methods and techniques for solving it.

CO 5: Students should demonstrate the ability to present and discuss a body of research work in computer vision.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√			√			√				√
CO2	√	√			√			√				√
CO3	√	√	√		√							√
CO4	√	√			√							√
CO5	√	√			√							√
	√	√	√	√	√	√	√	√	√	√	√	√

Module - 1 [3 Hrs]

Image formation: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems.

Module - 2 [7 Hrs]

Processing & Analysis: Overview of Image Processing System, Image Digitization (Sampling and Quantization), Digital Image, Fundamentals of Color image, Color Models (RGB, YCbCr, HIS), Image File Format, Spatial & Frequency Domain Image analysis (Filtering, Correlation, Convolution), Morphological Image Processing&Morphological Algorithms.

Module - 3 [6 Hrs]

Segmentation: Point Detection, Line Detection, Edge Detection **,** Edge Linking and Edge Following by Local Processing, Hough Transform, Thresholding, Region segmentation, Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods.

Module - 4 [9 Hrs]

Representation & Feature Extraction: Boundary Representation by Chain Codes, Polygonal Approximation, Skeletons Component Labeling and Counting Geometrical, Texture Analysis, Geometric Moments Texture Descriptor, Gray-level Co Occurrence Matrix, some object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition, Texture Description.

Module - 5 [5 Hrs]

Motion Structure & Estimation:

Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion, Translational alignment, Parametric motion, Spline-based motion, Optical flow, Layered motion.

Module - 6 [6 Hrs]

Recognition:

Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding, Recognition databases and test sets.

Suggested Books:

4. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
5. Shapiro, L. & Stockman, G., "Computer Vision". Prentice Hall, 2001.
6. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", Prentice Hall.
7. E. Trucco and A. Verri, "Introductory Techniques for 3D Computer Vision", Publisher: Prentice Hall.
8. Haralick R M and Shapiro L G, "Computer & Robot Vision", Vo: I and II Addison Wesley, 1993.
9. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing".
10. B. Chanda and D. Dutta Majumder, "Digital Image Processing and Analysis".
11. The Computer Vision Homepage" (Carnegie Mellon University): http://www-2.cs.cmu.edu/_cil/vision.html.

Mobile Computing

Code: CSEUGPE16
Contacts: 3L
Credits: 3

Course Objectives:

- Understand the fundamental concepts in mobile wireless systems and mobile computing standards issues including wireless LANs, mobile IP, ad-hoc networks and Bluetooth.
- To learn about the concepts and principles of mobile computing;
- To understand mobile technologies like GSM and CDMA.
- To be able to evaluate and explain the important issues and concerns on security and privacy.

Course Outcomes:

CO 1: Understand and identify the GSM, GPRS and Bluetooth software model for mobile computing.
CO 2: The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.
CO 3: Know modern multiple access schemes, the concept of frequency reuse, channel assignment strategies and estimate trucking and GOS.
CO 4: Describe the possible future of mobile computing technologies and applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√	√								√
CO2		√	√		√	√	√		√		√	√
CO3	√				√				√	√		√
CO4				√		√	√	√		√	√	√

Module-1: [12 Hrs]
Introduction to wireless networking and characteristics of mobile computing; Fundamentals of wireless transmission - Medium Access Control Protocols FDMA, TDMA, CDMA; Overview of Wireless LAN (IEEE 802.11); Overview of Bluetooth architecture

Module-2: [12 Hrs]
Introduction to Mobile Adhoc Network and routing protocols- DSDV, WRP, CGSR, FSR, AODV, DSR, ABR, TORA etc.; Mobile Networking protocol (Mobile IP); Mobile transport layer - Effects of mobility on Reliable Transport Protocols; Mechanisms for improving TCP performances on wireless links

Module-3: [12 Hrs]
Energy / Power Management; Wireless application Environments Wireless Application Protocol, WML, Push Architecture, Push/Pull Services; Overview of Security in mobile environments; Overview of fault tolerance in mobile computing systems.

Suggested Books:

1. C. Siva Ram Murthy and B. S. Manoj: "Ad Hoc Wireless Networks: Architectures and Protocols", Pearson.
2. Charles Perkins: "Adhoc Networking", Pearson Education.
3. W. Stallings:"Wireless Communication", Pearson.

Visual Programming & Multimedia

Code: CSEUGPE17
Contacts: 3L
Credits: 3

Course Objectives:

- Explore Visual Basic's Integrated Development Environment (IDE).
- Discuss variables, data types and syntax rules used in program development.
- Learn to apply the decision structures, loop structures and functions to create applications.
- Learn in details about the technical aspects of multimedia databases and architectures and the different evolving technologies.
- Discuss the technical details of common multimedia data formats and protocols.
- Learn about the technical details of different families of multimedia standard.
- Discuss about the various storage management and retrieval technologies used in multimedia applications.

Course Outcomes:

CO 1: Design, create, build, and debug Visual Basic applications.
CO 2: Implement syntax rules in Visual Basic programs and apply arithmetic operations for displaying numeric output.
CO 3: Write and apply decision structures for determining different operations.
CO 4: Write and apply loop structures to perform repetitive tasks and procedures, sub-procedures, and functions to create manageable code.
CO 5: Identify the different media; representations of different multimedia data and data formats.
CO 6: Analyze various compression techniques.
CO 7: Compare various audio and video file formats.
CO 8: Apply different coding technique for solving real world problems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√	√									
CO2	√	√			√							
CO3	√				√							
CO4		√	√		√	√	√				√	
CO5		√			√							
CO6		√			√							
CO7				√	√							
CO8				√		√	√				√	

Module 1: [12 Hrs]

WINDOWS PROGRAMMING:

Windows environment – a simple windows program – windows and messages – creating the window – displaying the window – message loop – the window procedure –
message processing – text output – painting and repainting – introduction to GDI – device context – basic drawing – child window controls

VISUAL C++ PROGRAMMING – INTRODUCTION:

Application Framework – MFC library – Visual C++ Components – Event Handling – Mapping modes – colors – fonts – modal and modeless dialog – windows common controls – bitmaps

THE DOCUMENT AND VIEW ARCHITECTURE:

Menus – Keyboard accelerators – rich edit control – toolbars – status bars – reusable frame window base class – separating document from its view – reading and writing SDI and MDI documents – splitter window and multiple views – creating DLLs – dialog based applications

Module 2: [12 Hrs]

ACTIVEX AND OBJECT LINKING AND EMBEDDING (OLE):

ActiveX controls Vs. Ordinary Windows Controls – Installing ActiveX controls – Calendar Control – ActiveX control container programming – create ActiveX control at runtime – Component Object Model (COM) – containment and aggregation Vs. inheritance – OLE drag and drop – OLE embedded component and containers – sample applications

ADVANCED CONCEPTS:

Database Management with Microsoft ODBC – Structured Query Language – MFC ODBC classes – sample database applications – filter and sort strings – DAO concepts – displaying database records in scrolling view – Threading – VC++ Networking issues – Winsock – WinInet – building a web client – Internet Information Server – ISAPI server extension – chat application – playing and multimedia (sound and video) files

Module 3: [14 Hrs]

Multimedia

Introduction:

Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications

Text and Audio:

Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI

Image and Video:

Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.

Synchronization:

Temporal relationships, synchronization accuracy specification factors, quality of service

Storage models and Access Techniques:

Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, and CCD

Image and Video Database:

Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing

Document Architecture and Content Management:

Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications

Suggested Books:

1. Charles Petzold: "Windows Programming", Microsoft Press, 1998.
2. David J. Kruglinski, George Shepherd, Scot Wingo: "Programming Microsoft
3. Visual C++", Microsoft Press, 2006.
4. Kate Gregory: 'Using Visual C++", Prentice Hall of India Pvt., Ltd., 1999.
5. Buford J. K.: "Multimedia Systems" – Pearson Education.
6. Andleigh&Thakrar: "Multimedia", PHI
7. Balagurusamy E: "Programming in C#", Tata McGraw Hill, 2010.

Information and Coding Theory

Code: CSEUGPE18
Contacts: 3L
Credits: 3

Course Objectives:

- To provide an introduction to the basic terminology of information theory.
- To familiarize with the various types of error controlling codes such as like linear block codes, convolution codes, cyclic codes, etc.
- To explain the various types of combinatorial designs in coding theory.
- To provide a basic exposure to the fundamental concepts of network coding and explain various types of networking coding.

Course Outcomes:

CO 1: Students will be able to understand the basic terminology of information theory.
CO 2: Students will be able to understand various types of block codes for error detection and correction.
CO 3: Students will be able to understand various types of combinatorial designs for error detection and correction.
CO 4: Students will be able to understand various types of networking coding.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√											√
CO2	√	√	√	√	√	√	√				√	√
CO3	√	√	√	√	√	√	√				√	√
CO4	√	√	√	√	√	√	√				√	√

Module-1: [12 Hrs]
Information Theory: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

Module- 2: [12 Hrs]
Source Coding: Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels.
Fundamental Limits on Performance: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity.
Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

Module-3: [12 Hrs]
Introduction to Error Control Coding: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding. Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation.BCH codes. RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes. Convolution Codes, Time domain approach. Transform domain approach.

Suggested Books:

1. K. Sam Shanmugam: "Digital and analog communication systems", John Wiley, 1996.
2. Simon Haykin: "Digital Communication", John Wiley, 2003.
3. Ranjan Bose: "ITC and Cryptography", TMH, II edition, 2007.
1. Glover and Grant: "Digital Communications", Pearson Ed. 2nd Ed 2008.

E- Commerce and ERP

Code: CSEUGPE19
Contacts: 3L
Credits: 3

Course Objectives:

- To understand strategic IT planning for industries.
- To develop enterprise IT architecture for Information technology.
- To integrate various resources for optimization in the industry as well as for strategic utilization of IT enabled services and functions.
- To develop competence in global sourcing: strategy and management to gain a perspective on the global services sourcing landscape: past, present, and future

Course Outcomes:

CO 1: Describe the importance of IT enabled services and challenges.

CO 2: Identify strategic IT planning for software development.
CO 3: Recognize enterprise IT architecture for Information technology.
CO 4: Use of information Technology so as to enable them for job in sunrise industries.
CO 5: Illustrate various IT web services for betterment of knowledge.
CO 6: Use their skills to find out various current IT trends in ITES.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1						√	√			√	√	
CO2		√		√								
CO3		√		√								
CO4	√				√				√			√
CO5		√		√		√	√			√	√	
CO6					√	√	√		√		√	

Module 1: [12 Hrs]
E – Commerce

Electronic Commerce : Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws.

Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking For E – Commerce, Internet, Intranet & Extranet, EDI Systems

Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce.

Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.

E – strategy: Overview, Strategic Methods for developing E – commerce.

Four C's : (Convergence, Collaborative Computing, Content Management & Call Center).

Convergence: Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce.

Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security.

Module 2: [12 Hrs]

Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management; Content Marketing.

Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).

Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.

E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. E – Marketing:. Home –shopping, E-Marketing, Tele-marketing

Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA).

Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.

Module 3: [14 Hrs]

Introduction to ERP: Common ERP myths, Evolution of ERP, Advantages, Characteristics, Process integration with ERP system, Implementation costs, Roadmap for successful ERP implementation.

ERP Market and Vendors: ERP market, ERP vendors, Service oriented architecture, ERP package features.

Extended ERP services: Defining Extended ERP, Supply chain Management (SCM) and ERP, ERP and Business Intelligence (BI), ERP and E-commerce.

Business Process Re-engineering (BPR) and ERP: Defining BPR, BPR Vs TQM, BPR and change management, approaches in BPR implementation, Methodologies for BPR implementation, BPR success/failure factors.

Planning for ERP: Planning for ERP implementation, understanding organizational requirement, Economic and strategic justification, Project scope, Determining resources, organizational commitment to change, budget for ERP, select right ERP package.

Implementation of ERP: Designs of ERP system, ERP implementation approach, ERP implementation life cycle, different phases of ERP implementation

Managing ERP projects: Risk/Failure factors in ERP implementation, Example of ERP failure, Critical success factors, Complexities of ERP projects, Evaluating ERP projects.

ERP: Going Live and post implementation: Preparing to go live, Strategies for migration to new ERP system, Managing ERP after Go Live, Maintenance of ERP system.

ERP, Internet and WWW – ERP II: The internet explosion, ERP, Internet and WWW, ERP to ERP II, Best practices of ERP II.

Future directions and Trends in ERP: New markets, New channels, Easier communication tools, Business models, Need based applications, Expenditures, Reduction in implementation time, Market snap shots, Shifting revenue models

Suggested Books:

1. David Whitley:"E-Commerce-Strategy, Technologies & Applications", TMH.
2. Kamlesh K. Bajaj:"E-Commerce- The cutting edge of business", TMH.

3. W Clarke: "E-Commerce through ASP", BPB.
4. Mathew Reynolds, Wrox:"Beginning E-Commerce with VB, ASP, SQL Server 7.0 & MTS",WROX Press Ltd.
5. J. Christopher Westland and Theodore H. K Clark:"Global Electronic Commerce- Theory and Case Studies", University Press.
6. Enterprise Resource Planning, Ashim Raj Singla, Cengage Learning India Pvt. Ltd., New Delhi, 2008.
7. Alexis Leon: "Enterprise Resource Planning", 2nd edition, Tata Mcgraw Hill Education Pvt. Ltd., NewDelhi, 2008.
8. Grant Norris, James R. Hurley, Kenneth M.Hartley, John R. Dunleavy, John D. Balls: "E-Business and ERP: Transforming the Enterprise",John Wiley and Sons, 2000.
9. V.K. Garg: "Enterprise Resource Planning: Concepts and Practice", Wiley.

Project – I

Code: CSEUGPC24
Contacts: 8P
Credits: 4

Summer Internship ***

Code: CSEUGPC24
Contacts: 0
Credits: 2

Machine Learning & Soft Computing Lab

Code: CSEUGPC24
Contacts: 3P
Credits: 1.5

In this laboratory students need to perform programming in Matlab and R.

A sample assignment list is given below:

Fuzzy set: Matlab program to implement the different Fuzzy Membership functions, Fuzzy set operations and its properties, composition of Fuzzy and Crisp Relations, Fuzzy Information System (using GUI based Fuzzy toolbox)

Neural network: Write Matlab code to implement McCulloh-Pitts neural network for generate AND, OR functions, Perceptron learning for particular, OR function with bipolar inputs and targets using Adaline network, XOR function with bipolar inputs and targets using Madaline, McCulloh-Pitts model to generate AND, OR functions.

Genetic Algorithm : Write a Matlab code for implementing Genetic Algorithm and solve several optimization problems. Perform GA to implement TSP problem.

Clustering: Write R code to implement different clustering algorithm such as k-means, hierarchical, density based. R code to validate clustering algorithms (clustering validity index such as DB index, Dunn index, XB index etc).

R code to implement **Principal Component Analysis (PCA)** and applied it to reduce high dimensional data.

Classification: R code to implement different classification technique such as SVM, K-nn, Tree based classifier, Naïve-baye's etc. Implement R code to classify different dataset and plot ROC curve and accuracy.

Soft Skills

Code: MBAUGHU03
Contacts: 3P
Credits: 0

Basic Communications Skills: Verbal and non-verbal communications, Correct Pronunciations, Listening skills, Intonations
Mock Interview Session: Three Vs of interview, SWOT Analysis, STAR Techniques, Five Ts principle of Life
Personality Development, Confidence building, Body Language-Positive and Negative body language, Postures,Gestures, Appearance and Presentation skills. Presentation abilities, Nature vs. NurtureIndividual Counseling& Feedback
Time Management: Managing your time effectively, Setting things on priorities
Team management and team dynamics, Team Work, Role Plays, Game Planning, Co-ordination Etiquettes, Business Etiquettes, Email Etiquettes, Resume Writing

Suggested Books:

1. E. Suresh Kumar:"Communication Skills and Soft Skills", Pearson.
2. John Sonmez:"Soft Skills: The software developer's life manual", Manning Publications.
3. Prof. M.S. Rao: "Soft Skills for Young Managers", Dreamtech Press.
4. Emma-Sue Prince:"The Advantage: The 7 soft skills you need to stay one step ahead", Pearson.

Semester VIII:

Cryptography and Network Security

Code: CSEUGPC26
Contacts: 3L
Credits: 3

Course Objectives:

- To introduce the concepts of finite fields and number theory.
- To discuss the classical encryption algorithms and explore the working principles and the effectiveness of various cryptographic algorithms, including symmetric key cryptography, public key cryptography, hashes and message digests.
- To explore the design issues and working principles of various authentication protocols and PKI standards.
- To discuss the various internet security protocols and communication standards, including Kerberos, IPsec, SSL/TLS and S/MIME.
- To learn the various authentication mechanisms like password authentication, authentication tokens, certificate-based authentication and biometrics.
- To explore the concepts of network layer security, including firewalls, VPN and NAT.
- To develop the ability to use existing cryptographic utilities and authentication mechanisms to build programs for secure communication.

Course Outcomes:

CO 1: Identify the information security goals and the internal and external threats to an organization.
CO 2: Understand, compare and apply the different encryption and decryption techniques to solve problems related to confidentiality and authentication.
CO 3: Apply the knowledge of cryptographic checksum and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CO 4: Apply different digital signature algorithms to achieve authentication and create secure applications.
CO 5: Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
CO 6: Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1			√		√	√	√				√	
CO2	√	√			√	√	√				√	
CO3	√	√	√			√	√				√	

CO4			√	√		√	√				√	
CO5	√	√		√	√							
CO6	√		√									

Module 1: [14 Hrs]
Introduction and Mathematical Foundations: Introduction, Overview on Modern Cryptography, Number Theory Probability and Information Theory, Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.
Cryptography: Concepts & Techniques. Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size

Module 2 [14 hrs]
Symmetric Key Algorithm: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5 (Rivest Cipher 5) algorithm.
Asymmetric Key Algorithm: Digital Signature and RSA: Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).

Module 3 [10 hrs]
Internet Security Protocols, User Authentication: Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.
Electronic Mail Security: Basics of mail security, Pretty Good Privacy, S/MIME.
Firewall: Introduction, Types of firewall, Firewall Configurations, DMZ Network

Suggested Books:

1. William Stallings: "Cryptography and Network Security",6th Edition, Pearson Education, 2013.
2. MerikeKaeo: "Designing Network Security", 2nd Edition, Pearson Books.
3. Wade Trappe, Lawrence C Washington: "Introduction to Cryptography with coding theory", 2nd Ed, Pearson, 2007.
4. William Stallings: "Network Security Essentials: Applications and Standards", Pearson Education.
5. Behrouz A. Ferouzan: "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
6. Man Young Rhee: "Internet Security: Cryptographic Principles, Algorithms and Protocols", Wiley Publications, 2003.
7. Douglas R Simson: "Cryptography – Theory and practice", First Edition, CRC Press, 1995.

Professional Values and Ethics

Code: MBAUGHU02
Contacts: 2L
Credits: 2

Unit 1 – Human Values [5 Hrs]
Objectives , Morals ,Values , Ethics , Integrity, Work ethics, Service learning , Virtues, Respect for others , Living peacefully, Caring , Sharing, Honesty, Courage, Valuing time , Cooperation , Commitment , Empathy, Self-confidence, Challenges in the work place ,Spirituality.

Unit 2 – Engineering Ethics [5 Hrs]
Overview, Senses of engineering ethics , Variety of moral issues , Types of inquiries , Moral dilemma , Moral autonomy , Moral development (theories) , Profession , Models of professional roles ,Theories about right action (Ethical theories)

Unit 3 – Engineering as Social Experimentation [4 Hrs]
Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, Industrial standards.

Unit 4 – Safety, Responsibilities and Rights [5 Hrs]
Safety definition, Safety and risk, Risk analysis, Assessment of safety and risk, Conflict of interests, Occupational crime, Human rights, Employee rights, Whistle blowing, Intellectual property rights.

Unit 5 – Global Issues [5 Hrs]
Globalization, Multinational corporations, Environmental ethics, Computer ethics, Engineers as managers, Engineers as advisors in planning and policy making, Moral leadership, Codes of ethics.

Suggested Books:

1. R.S. Naagarazan:"A Textbook of Professional Ethics and Human Values", New Age International Publishers.
2. Dr.Subir Chowdhury:"Blending the best of the East & West", EXCEL.
3. Ghosh, VIKAS: "Ethics & Mgmt. & Indian Ethos",
4. Pherwani:"Business Ethics",EPH.
5. Balachandran, Raja, Nair:"Ethics, Indian Ethos & Mgmt.", Shroff Publishers.
6. Velasquez:"Business Ethics: concept and cases", Pearson.

ELECTIVE – IV

CAD for VLSI

Code: CSEUGPE20
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the concepts of VLSI and CAD.
- To understand how the tools themselves work, at the level of their fundamental algorithms and data structures.
- To analyze different algorithms used as routing and for testing.
- To solve problems with electronic circuits using CAD.

Course Outcomes:

CO 1: Recognize different electronic circuits like Transistor, Registers, MOS.
CO 2: Distinguish between different partitioning algorithms.
CO 3: Apply the basic knowledge of CAD to design VLSI circuits.
CO 4: Testing of all patterns generated.
CO 5: Create a new design, starting from formulation of a problem to implementations.
CO 6: Solving problems and observing the nature of any VLSI circuit.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1					`					√		√
CO2		√								√		
CO3	√		√		√							
CO4		√		√	√							
CO5	√		√			√	√		√		√	√
CO6				√		√	√				√	

MODULE - I
Introduction [5L]
VLSI technology, MOS Transistor & Switches, Layout of basic devices- Inverter, NAND, NOR, Compound gates, Multiplexer, Memory-Latches & Register.

MODULE - II
Overview of VLSI Design cycle [4L]
System specification; Design- Functional, Logic, Circuit, Physical; Fabrication, Design methodologies, Packaging; Design styles- Full custom, Standard cell, Gate arrays FPGA;

Partitioning [4L]
Problem formulation, Approximation of hyper graphs with graphs, Kerninghan-Lin & Fiduccia-Mattheyses heuristic algorithm, Ratio cut.

Placement [4L]

Cost function, Force directed methods, Partitioning placement, Resistive network, Regular & linear placement.

Floorplanning [4L]
Problem formulation, Hierarchical approach, Rectangular dualization, Floorplan sizing.

MODULE - III
Routing [8L]
Global- Problem formulation; Fundamentals- Maze running, Line searching, Steiner trees; Lee & line probe algorithm, Hierarchical approach,Randomized routing; Detailed- Problem formulation, Channel routing & Switchbox routing, Hierarchical approach, Greedy algorithm; Single layer-General river routing algorithm; Two layer- Left edge algorithm (Basic & Dogleg); Constraint graph- Yoshimura &Kuh algorithm.

Module-IV
Testing [7L]
Need for testing- Functionality & Manufacturing test; Manufacturing test principles- Stuck At, short & open circuit, Observability, controllability, Fault coverage; Automatic test pattern generation, Design strategies for test- Scan based, Self test.

Suggested Books:

1. Naved A. Sherwani: "Algorithms ForVLSI Physical Design Automation", Kulwer Academic.
2. M Sarafzadeh&C.K.Wong: "An Introduction to VLSI Physical Design",TMH.
3. Sujata Pandey& Manoj Pandey:"VLSI Design", DhanpatiRai& Co.
4. Bhasker: "A VHDL Primer", PE.Publisher.
5. Douglas L. Pery: "VHDL Programming by Example", TMH.
6. B. Abrhamkhi: "Digital Testing",
7. S.H. Gerez:"Algorithms for VLSI Design Automation", Wiley-India, 1999.

Distributed Systems

Code: CSEUGPE21
Contacts: 3L
Credits: 3

Course Objectives:

- Provide an introduction to the fundamentals of distributed computer systems.
- Study different distributed algorithms
- Cover distributed operating system in detail, including communication process, file system and memory management synchronization and so on but this time in the context of distributed systems.
- Understand the basic concepts of protection and security of distributed system.

Course Outcomes:

CO 1: Knowledge and understanding the potential benefits of distributed systems.
CO 2: Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security.

CO 3: Apply standard design principles in the construction of these systems.
CO 4: Learn and apply the different distributed algorithms in the real scenario.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√	√		√							
CO2	√		√	√	√							
CO3	√		√			√	√				√	
CO4	√	√	√		√	√	√				√	

Module 1 [12 hrs]
Introduction to Distributed System
Introduction, Examples of distributed system, Resource sharing, Challenges

Operating System Structures:
Review of structures: monolithic kernel, layered systems, virtual machines. Process based models and client server architecture; The micro-kernel based client-server approach.

Communication :
Inter-process communication, Remote Procedure Call, Remote Object Invocation, Tasks and Threads. Examples from LINUX, Solaris 2 and Windows NT.

Theoretical Foundations:
Introduction.Inherent Limitations of distributed Systems.Lamport's Logical clock. Global State

Module 2 [12 Hrs]
Distributed Mutual Exclusion:
Classification of distributed mutual exclusion algorithm. Non Token based Algorithm: Lamport's algorithm, Ricart-Agrawala algorithm. Token based Algorithm: Suzuki-Kasami's broadcast algorithm.

Distributed Deadlock Detection:
Deadlock handling strategies in distributed systems. Control organizations for distributed deadlock detection. Centralized and Distributed deadlock detection algorithms: Completely Centralized algorithms, path pushing, and edge chasing, global state detection algorithm.

Protection and Security:
Requirements for protection and security regimes.The access matrix model of protection. System and user modes, rings of protection, access lists, capabilities. User authentication, passwords and signatures.Use of single key and public key encryption.

Module 3 [12 Hrs]
Distributed file systems:
Issues in the design of distributed file systems: naming, transparency, update semantics and fault resilience. Use of the Virtual File System layer. Examples of distributed systems including Sun NFS, the Andrew file store, CODA file system and OSF DCE

Distributed Shared Memory:
Architecture and motivations.Algorithms for implementing DSM. Memory Coherence

CORBA:
The Common Object Request Broker Architecture model and software and its relationship to Operating Systems

Suggested Books:

1. George Coulouris, Jean Dollimore, Tim Kindberg: "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education.
2. A.S. Tanenbaum and M. V. Steen: "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall.
3. M.L. Liu: “Distributed Computing Principles and Applications”, Pearson Addison Wesley.
4. Mukesh Singhal: “Advanced Concepts In Operating Systems”, McGrawHill Series in Computer Science.
5. Nancy A. Lynch: "Distributed Algorithms", The Morgan Kaufmann Series in Data Management System, Morgan Kaufmann Publishers.

Operations Research

Code: CSEUGPE22
Contacts: 3L
Credits: 3

Course Objectives:

- To understand basic concepts of linear programming, game theory and various models.
- To develop models and then analyze the model using the techniques of Operations Research.
- To grow decision making ability under uncertainty and risk.
- To apply the principles of different Methods/Model of Operations Research to solve practical problems.

Course Outcomes:

CO 1: Define and formulate linear programming problems and appreciate their limitations.
CO 2: Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
CO 3: Achieve expertise in strategy making by solving various games.
CO 4: Develop mathematical skills to analyze and solve integer programming and network models arising from a wide range of applications.
CO 5: Effectively communicate ideas, explain procedures and interpret results and solutions in written and electronic forms to different audiences.
CO 6: Recall the distinctive characteristics of different types of decision-making problem to formulate and solve a real-world problem a prototype of mathematical problem.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√										√
CO2	√	√										

CO3				√								
CO4	√		√						√			
CO5			√	√						√		
CO6	√					√	√				√	√

UNIT-I: [2 Hrs]
Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation.

UNIT-II: [10 Hrs]
Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples. Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory.Transportation Problems and Assignment Problems.

UINT-III: [6 Hrs]
Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

UNIT-IV: [8 Hrs]
Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).

UNIT-V: [8 Hrs]
Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic; Safety Stock; Buffer Stock.

UNIT-VI: [8 Hrs]
Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.

Suggested Books:

1. H. A. Taha: "Operations Research", Pearson.
2. P. M. Karak: "Linear Programming and Theory of Games", ABS Publishing House.
3. Ghosh and Chakraborty: "Linear Programming and Theory of Games", Central Book Agency.
4. Ravindran, Philips and Solberg: "Operations Research", WILEY INDIA.
5. Kanti Swaroop: "Operations Research", Sultan Chand & Sons.

High Performance Computer Architecture

Code: CSEUGPE23
Contacts: 3L
Credits: 3

Course Objectives:

Course Outcomes:

CO 1: To acquire the knowledge of parallelism and pipelining.
CO 2: To develop knowledge of parallel processing.
CO 3: To combine the concept and design techniques of interconnection network.
CO 4: To acquire the knowledge of shared memory architecture.
CO 5: To describe the fundamentals of embedded system architecture

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√			√							
CO2		√	√		√							
CO3					√							
CO4	√		√	√		√	√				√	
CO5	√	√			√							

UNIT I [3 Hrs]
Introduction:
Review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance.

UNIT II [2 Hrs]
CISC and RISC processors.

UNIT III [10 Hrs]
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards.Exception handling.Pipeline optimization techniques.

Compiler techniques for improving performance. Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses;

UNIT IV [4 Hrs]
Virtual memory organization, mapping and management techniques, memory replacement policies.

UNIT V [6 Hrs]
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures. Array and vector processors.

UNIT VI [6 Hrs]
Multiprocessor architecture: taxonomy of parallel architectures. Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks.

UNIT VII [5 Hrs]

Distributed shared-memory architecture. Cluster computers. Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

Suggested Books:

1. John L. Hennessy and David A. Patterson:"Computer Architecture: A Quantitative Approach", Morgan Kaufmann.
2. John Paul Shen and Mikko H. Lipasti:"Modern Processor Design: Fundamentals of Superscalar Processors", Tata McGraw-Hill.
3. M. J. Flynn:"Computer Architecture: Pipelined and Parallel Processor Design", Narosa Publishing House.
4. Kai Hwang:"Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw-Hill.
5. John Hennessy and David Patterson: "Computer Architecture: A Quantitative Approach", 4th Edition,Morgan Kaufmann.

Real Time Systems

Code: CSEUGPE24
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the basic concepts of Real Time systems.
- To know the concepts of programming in real time environment along with its tools.
- To know the concepts of real time databases.
- Understand the concepts of real time communications and fault tolerance.

Course Outcomes:

CO 1: Demonstrate concepts of Real-Time systems and scheduling.
CO 2: Analyse the programming languages and tools of a real time operational system.
CO 3: Demonstrate the different concepts related to databases in a real time operating system environment.
CO 4: Evaluate the reliability and fault tolerance of a real time model.
CO 5: Understand the concepts of real time communications and fault tolerance.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1					√					√		
CO2	√	√							√	√		
CO3					√			√				√
CO4		√		√		√	√				√	
CO5			√	√	√							

Module-1 [8 Hrs]
Introduction:

Introduction - Issues in Real Time Computing, Structure of a Real Time System. Task Classes, Performance Measures for Real Time Systems, Estimating Program Run times. Task Assignment and Scheduling - Classical Uniprocessor scheduling algorithms, UniProcessor scheduling of IRIS Tasks, Task Assignment, Mode Changes, and Fault Tolerant Scheduling.

Module-2 [7 Hrs]

Programming languages and tools:

Programming Language and Tools – Desired Language characteristics, Data Typing, Control structures, Facilitating Hierarchical Decomposition, Packages, Run-time (Exception) Error handling, Overloading and Generics, Multitasking, Low Level programming, Task scheduling, Timing Specifications, Programming Environments, Run-time Support.

Module-3 [7 Hrs]

Real time databases:

Real time Databases - Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency Control Issues, Disk Scheduling Algorithms, Two-phase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time systems.

Module-4 [7 Hrs]

Communication:

Real-Time Communication - Communications Media, Network Topologies Protocols, Fault Tolerant Routing. Fault Tolerance Techniques - Fault Types, Fault Detection. Fault Error containment Redundancy, Data Diversity, Reversal Checks, Integrated Failure handling.

Module-5 [7 Hrs]

Evaluation techniques:

Reliability Evaluation Techniques - Obtaining Parameter Values, Reliability Models for Hardware Redundancy, Software Error models. Clock Synchronization - Clock, A Nonfault-Tolerant Synchronization Algorithm, Impact of Faults, Fault Tolerant Synchronization in Hardware, Fault Tolerant Synchronization in Software

Suggested Books:

1. C.M. Krishna, Kang G. Shin: “Real-Time Systems”, McGraw-Hill International Editions, 1997.
2. Stuart Bennett: “Real Time Computer Control-An Introduction”,Second edition Perntice Hall PTR, 1994.
3. Peter D. Lawrence: “Real time Micro Computer System Design – An Introduction”, McGraw Hill, 1988.
4. S.T. Allworth and R.N. Zobel: “Introduction to real time software design”, Macmillan, II Edition, 1987.
5. R.J.A Buhur, D.L. Bailey: “An Introduction to Real-Time Systems”, Prentice-Hall International, 1999.
6. Philip.A.Laplante: “Real Time System Design and Analysis”, PHI, III Edition, April 2004.

Digital Topology

Code: CSEUGPE25

Contacts: 3L
Credits: 3

Module I (8 Hours)
Introduction, basic ingredients, concept of 2D/3D digital space, continuity, contour tracing, chain code, topology preserving operations – skeletonization and adjacency tree, Euler characteristics, connected component labelling, adjacency graph construction

Module II (6 Hours)
Metric space, neighborhood concepts in 2D/3D, digital path, fuzzy path-definition and notations, path lengths, digital straightness concepts, polygonal approximation

Module III (8 Hours)
Distance Transform, Medial Axis Transform, Shrinking binary images, Skeletonization Algorithm, Skeletons of planar patterns, Boundaries in digital space, Connected, oriented, closed boundaries in digital space, Computation of normal at boundary points, Computation of cross-sections of 3D objects

Module IV (8 Hours)
Homotopic tree, Voronoi neighborhood, Surface voxelization, Topological transformation and topological equivalence, simple point, characteristics of simple points in 3D, local topological numbers

Module V (6 Hours)
Topological Approaches to Image Segmentation: Region Growing, Watershed, and Minimal Path; Dam construction, Watershed transform

Suggested Books and References:

1. Topological algorithms for digital image processing by T. Y. Kong and A. Rosenfeld, Elsevier
2. Topology of Digital Images by J. F. Peters, Springer
3. Digital Geometry in Image Processing by J. Mukhopadhyay, P. P. Das, S. Chattopadhyay, P. Bhowmick, B. N. Chatterji, CRC Press

ELECTIVE – V

Adhoc& Sensor Networks

Code: CSEUGPE26
Contacts: 3L
Credits: 3

Course objectives:

- Explain the basic concepts of wireless networks and challenges of adhoc and sensor networks
- Classify the design issues and different architectures of WSN.

- Explain the various adhoc routing protocols and transport layer mechanisms.
- Discuss the sensor characteristics and wsn layer protocols.
- Illustrate the issues of routing in WSN and QoS related performance measurements.

Course Outcomes:

CO 1: To describe an adhoc network and analyze various technologies associated with it.
CO 2: To analyze various architectures of WSN protocols and analyze various protocols associated with it.
CO 3: Students will apply this knowledge to analyze adhoc & sensor based networks and compute various parameters associated with it.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	√	√		√		√	√				√	√
CO2		√	√		√	√	√				√	√
CO3	√		√	√		√	√		√	√	√	

Module-1: Introduction and Overview: [12 Hrs]
Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hocNetworks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.

Module-2: Architectures & Communication Protocols [12 Hrs]
Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes, operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design principles forWSNs, service interfaces for WSNs.

Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, routing protocols- classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing,data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.

Module-3: Infrastructure Establishment & Sensor Network Platforms and Tools [12 Hrs]
Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services,sensor tasking and control.

Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.

Suggested Books:

1. Holger Karl & Andreas Willig: “Protocols and Architectures for Wireless Sensor Networks”, John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas: “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. KazemSohraby, Daniel Minoli, &TaiebZnati: “Wireless Sensor Networks- Technology, Protocols, and Applications”, John Wiley, 2007.
4. Anna Hac: “Wireless Sensor Network Designs”, John Wiley, 2003.
5. Thomas Haenselmann: "Sensor Networks", available online for free, 2008.
6. Edgar Callaway: "Wireless Sensor Networks: Architectures and Protocols", Auerbach, 2003.

Cloud Computing

Code: CSEUGPE27
Contacts: 3L
Credits: 3

Course Objectives:

- Identify the technical foundations of cloud systems architectures.
- Analyze the problems and solutions to cloud application problems.
- Apply principles of best practice in cloud application design and management.
- Identify and define technical challenges for cloud applications and assess their importance.

Course Outcomes:

CO 1: Understand the fundamental principles of distributed computing.
CO 2: Understand how the distributed computing environments known as Grids can be built from lower level services.
CO 3: Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
CO 4: Analyze the performance of Cloud Computing.
CO 5: Understand the concept of Cloud Security.
CO 6: Learn the Concept of Cloud Infrastructure Model.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√			√				√			
CO2		√	√		√	√	√				√	
CO3	√	√	√									
CO4		√				√	√				√	√
CO5		√			√							
CO6		√		√	√							

Module-1: [12 Hrs]
Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/

service providers, Cloud Reference model, Characteristics of Cloud Computing – Benefits and advantages of Cloud Computing.

Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients.

Services and Applications by Type: IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations; PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)

Module-2: [12 Hrs]

Concepts of Abstraction and Virtualization: Virtualization technologies: Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D); Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Mention of The Google Cloud as an example of use of load balancing; Hypervisors: Virtual machine technology and types.

Use of Google Web Services: Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.

Use of Amazon Web Services: Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service

Module-3: [12 Hrs]

Use of Microsoft Cloud Services: Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services.

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs.

Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service, attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs.

Cloud-based Storage: Cloud storage definition – Manned and Unmanned.

Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.

Suggested Books:

1. Barrie Sosinsky: "Cloud Computing Bible", Wiley India Pvt. Ltd, 2013.
2. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi: "Mastering Cloud Computing", McGraw Hill Education (India) Private Limited, 2013.
3. Anthony T. Velte: "Cloud computing: A practical approach", Tata Mcgraw-Hill.

4. Miller: “Cloud Computing”, Pearson.
5. Moyer: “Building applications in cloud: Concept, Patterns and Projects”, Pearson.
6. Dr. Kumar Saurabh:“Cloud Computing – Second Edition”, Wiley India.

Data Warehousing and Data Mining

Code: CSEUGPE28
Contacts: 3L
Credits: 3

Course Objectives:

- To identify the scope and essentiality of Data Warehousing and Mining.
- To analyze data, choose relevant models and algorithms for respective applications.
- To study spatial and web data mining.
- To develop research interest towards advances in data mining.

Course Outcomes:

CO 1: Understand Data mining and warehouse fundamentals.
CO 2: Design data warehouse with dimensional modelling and apply OLAP operations.
CO 3: To get familiar with different data mining algorithms to solve real world problems
CO 4: Compare and evaluate different data mining algorithms and techniques like classification, prediction, clustering and association rule mining.
CO 5: Describe complex data types with respect to spatial and web mining.
CO 6: Benefit the user experiences towards research, innovation and integration.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√			√				√			
CO2		√	√		√	√	√				√	
CO3	√	√	√									
CO4		√				√	√				√	√
CO5		√			√							
CO6		√		√	√							

Module-1 [12 Hrs]
Introduction to Data Mining
Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities,
Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data,(Binning,Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integrationand Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction

Association Rule Mining:
Mining Association Rules in Large Databases, Association rule mining,mining Single-Dimensional Boolean Association rules from Transactional Databases– AprioriAlgorithm, Mining Multilevel

Association rules from Transaction Databases and Mining MultiDimensionalAssociation rules from Relational Databases.

Module-2 [12 Hrs]
Classification and Predictions:
What is Classification & Prediction, Issues regarding Classification and prediction, Decisiontree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forwardNeural Network, Back propagation Algorithm, Classification methods K-nearest neighbour classifiers, Genetic Algorithm.

Dimensionality Reduction
Introduction Principal Components Analysis, Singular Value Decomposition, Multidimensional Scaling

Module-3 [12 Hrs]
Cluster Analysis:
Data types in cluster analysis, Categories of clustering methods, Partitioning methods.
Hierarchical Clustering- CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS,
Grid Based Methods- STING, CLIQUE, Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

Data Warehousing:
Overview, Definition, Delivery Process, Difference between DatabaseSystem and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes,Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.
Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers,ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, TuningData Warehouse, Testing Data Warehouse.

Suggested Books:

1. P. Tan, M. Steinbach and V. Kumar: “Introduction to Data Mining”, Addison Wesley, 2006.
2. J. Han and M. Kamber: “Data Mining: Concepts and Techniques”, 2nd Edition, Morgan Kaufmann, 2006.
3. Arun K. Pujari: “Data Mining Techniques”, Universities Press.

GIS & Remote Sensing

Code: CSEUGPE29
Contacts: 3L
Credits: 3

Course Objectives:

- To understand the principles, applications, trends, and pertinent issues of geographical information systems and sciences.
- To develop technical skills and competence in data and information acquisition, extraction, management and analysis; spatial and statistical modeling; mapping and visualization.

- To perform image enhancement on remotely sensed imagery and extract information.
- To apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate remote sensing data and processing methods.

Course Outcomes:

CO 1: Retrieve the information content of remotely sensed data.
CO 2: Analyze the energy interactions in the atmosphere and earth surface features.
CO 3: Interpret the images for preparation of thematic maps.
CO 4: Apply problem specific remote sensing data for engineering applications.
CO 5: Analyze spatial and attribute data for solving spatial problems.
CO 6: Create GIS and cartographic outputs for presentation.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		√		√					√	√		
CO2	√	√										
CO3	√											
CO4		√	√	√					√			√
CO5	√	√		√								
CO6			√			√	√			√	√	

Module 1 [12 Hrs]
Fundamentals of remote sensing; Principles of electromagnetic radiation and EM spectrum.Sensors and platforms; remote sensing satellites, multispectral, hyper spectral and thermal sensors; RS data acquisition systems.Image processing; Image enhancement and visualization; Image interpretation and classification.Microwave thermal remote sensing; Radar & laser altimetry.

Module 2 [12 Hrs]
Applications of Remote Sensing; Integration of remote sensing and GIS.Basic concepts of GIS; cartographic principles, map projections and coordinate systems.Geographic information and spatial data types; Hardware and software; Steps of spatial data handling; Database management systems; Spatial referencing.

Module 3 [12 Hrs]
Data quality, measures of location errors on maps. Spatial data input, data preparation; Point data transformation.Analytical GIS capabilities, retrieval and classification, overlay functions.
Neighbourhood operations, network analysis, error propagation; Data visualization.

Suggested Books:

1. Burrough PA:“Principles of Geographic Information System for Land Resources Assessment”, Oxford Univ. Press.
2. Curran PJ:“Principles of Remote Sensing”, Longman.
3. Jensen JR:“Introductory Digital Image Processing”, Prentice Hall.
4. Lillesand TM & Kiefer RW:“Remote Sensing and Image”, Wiley.

Parallel Computing Techniques

Code: CSEUGPE30
Contacts: 3L
Credits: 3

MODULE –I[4 Hrs]
Introduction:
Hardware and software paradigms, Shared infrastructure

MODULE – II [6 Hrs]
Parallel Programming Paradigms,Parallel Architecture,Parallel Program Design

MODULE – III [8 Hrs]
Message-Passing Computing and Programming,Multithread Programming,Open Programming,Open MP&PRAM Model of Computation,PRAM.

MODULE – IV [7 Hrs]
Embarrassingly Parallel Computations,Partitioning and Divide-and-Conquer Strategies,Pipelined Computations,Synchronous Computations,Load Balancing and Termination Detection.

MODULE – V [5 Hrs]
Shared Memory & Message Passing,MPI,Algorithmic Techniques,CUDA.

MODULE – VI [6 Hrs]
Sorting Algorithms,Numeric Algorithms,Image Processing Algorithm

Suggested Books:

1. M J Quinn: "Parallel Programming in C with MPI and OpenMP",
2. Ananth Grama, George Karypis, Vipin Kumar, and Anshul Gupta:"Introduction to Parallel Computing", Pearson.
3. D. Kirk and W. Hwu: "Programming Massively Parallel Processors",Morgan Kaufman Publisher.
4. Michael Huth, Mark Ryan: "Logic in Computer Science Modelling and Reasoning about Systems", Cambridge University Press.