SEMESTER I

15Z101/15I101 CALCULUS AND ITS APPLICATIONS

3 2 0 4

DIFFERENTIAL CALCULUS: Basic concepts - Limits, continuity, differentiation, functions of several variables, partial derivatives. (6+4)

INTEGRAL CALCULUS: Double integrals - double integrals over rectangles, double integrals as volumes, Fubini's theorem (concept and statement only), double integrals in polar form, changing the order of integration, triple integrals in rectangular co-ordinates, triple integrals in spherical and cylindrical co-ordinates. (8+5)

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER: Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, Bernoulli equation, modelling – decay and growth problems. (8+5)

LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER: Homogeneous linear equations of second order, linearity principle, initial value problem, general solution, second order homogeneous equations with constant coefficients, Euler – Cauchy equation, solution by variation of parameters, modelling of electric circuits. (7+5)

VECTOR CALCULUS: Gradient of a scalar field, directional derivative, divergence of a vector field, curl of a vector field. Integration in vector field – line integrals, work, circulation and flux, path independence, conservative fields, surface integrals. Green's, Gauss divergence and Stoke's theorems (concepts and statements only), evaluation of line, surface and volume integrals. (16+11)

Total L: 45+T: 30=75

TEXT BOOKS:

REFERENCES:

15Z102/15B102/15D102/15I102/15L102 PHYSICS

3 0 0 3


Total L: 45

TEXT BOOKS:
REFERENCES:

15Z103/15E103/15I103/15L103/15R103/15U103 CHEMISTRY


ADVANCED MATERIALS: Carbon nanotubes and carbon fibres, graphene and polymer nano-composites-properties and applications – morphological studies by SEM and TEM. Solid oxide materials and polymer electrolytes –energy storing applications. Polymer blends and alloys, photo and electroluminescence materials, insulating materials, photopolymers and photoresists for electronics, polymer photovoltaics.


Total L: 45

TEXT BOOKS:

REFERENCES:

15Z104 ENGLISH LANGUAGE PROFICIENCY


WRITING PRACTICE

FOCUS ON SPOKEN ENGLISH: Task – based activities with graded levels of difficulty and with focus on language functions.

Level 1: Self – expression – Greetings in Conversation, Hobbies, Special interests, Daily routine.

Level 2: General Awareness – Expression of Concepts, Opinions, Social Issues, Description of a process / picture/chart, news presentation / review.
Level 3: Advanced Skills – Making Short Speeches and Participating in Role Plays.

LISTENING ACTIVITY: Task- based Activities using Language Lab.

Total L: 30+T: 30 =60

TEXTBOOK:
1. Monograph prepared by the Faculty, Department of English, 2015.

REFERENCES:

15Z105 PROBLEM SOLVING USING C

3 0 0 3


ARRAYS AND STRINGS: Single Dimensional Array, Strings, Two – Dimensional Arrays, Array of Strings, Multidimensional Array:Initialization, Unsized Array Initialization, Variable Length Arrays.


Simple programs based on the above concepts must be illustrated.

Total L: 45

TEXT BOOKS:

REFERENCES:

15Z106 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

3 0 0 3


ELECTROMAGNETISM AND MAGNETIC CIRCUITS: Magnetic field – magnetic circuits – Inductance and Mutual Inductance – Magnetic Materials – Ideal Transformers and Real Transformers
DC AND AC MACHINES: Overview of Motors – Principles of DC machines – Rotating DC machines – AC machines – Generation of three-phase e.m.fs – Three phase Induction motors – Single Phase Induction Motors - Stepper motors and Brushless DC motors


INTRODUCTION TO DIGITAL SYSTEM: Number Systems - Conversion Between Number System - 1's And 2's Complement - Logic Gates – Implementation of Logic Functions using Gates - De Morgan's Theorem – Truth Table and Boolean Expression – Sum of Products – Product of Sums – Karnaugh Map Minimization – Don’t Care Conditions

TEXT BOOKS:

REFERENCES:

15Z110 ENGINEERING PRACTICES

MODULE- I
1. Study of passive and active components (resistors, capacitors, inductors, diodes and transistor).
2. Study of equipments (CRO, Function generator and DC power supply).
5. Preparation of PCB layout and simulation of PCB (Printed circuit board).
6. Soldering of components on the PCB and testing of PCB.
7. Study of types of lamps (CFL lighting, LED lighting, filament lamps) – Measurement of power.

MODULE – II
1. Welding - Metal arc welding tools and equipment, exercises by Arc welding and TIG welding Processes.
2. Fitting - Tools, operations, exercises Make "T"-Joint and "L". Joint, types of joints.
5. Sheet metal work& Soldering - Tools, operations, exercises Make a Rectangular Tray in Galvanized Iron sheet

REFERENCES:
1. Laboratory Manual prepared by ECE Department, 2012.

15Z111 PHYSICS LABORATORY I

LIST OF EXPERIMENTS:
5. Study of Reverse Bias Characteristics of Germanium Diode and Determination of Band Gap of Ge.

DEMONSTRATION:
2. Ultrasonic Cleaning.
3. Thin Film Deposition using DC/RF Sputtering Technique.

REFERENCES:
1. Physics Practicals, Department of Physics, PSG College of Technology 2015.
15Z112 CHEMISTRY LABORATORY I

1. Estimation of strength of an acid by pH -metry.
2. Estimation of acids in a mixture by conductometry.
3. Anodizing of aluminium, determination of thickness of anodic film, sealing and dyeing of anodic film.
4. Determination of total, permanent, temporary, calcium and magnesium hardness of water by EDTA method.

REFERENCE:
1. Laboratory Manual Prepared by the Department.

Total P: 30

15Z113 C–PROGRAMMING LABORATORY

LIST OF EXPERIMENTS:
First ten programs must be done in Unix/Linux environment and the other programs may be done in an IDE in Windows environment. Modular programming and working with multiple files must be illustrated in the lab.
Programs illustrating the following statements/concepts:
1. Basic unix/linux commands.
2. Writing portable C code.
3. Formatted I/O statements.
5. Looping Statements: For, While, Do – while.
7. Multi dimensional array.
8. Operations on Strings.
9. Pass by value and pass by address.
10. Recursion.
11. Structures and nested structures.
12. String handling operations using pointers.
14. Passing data through command line arguments.
15. Operations on files.

REFERENCES:

Total P: 60

SEMESTER II

15Z201 COMPLEX VARIABLES AND TRANSFORMS

COMPLEX VARIABLES: Complex differentiation-Analytic function, Cauchy Riemann equations, harmonic functions. (6+4)

COMPLEX INTEGRATION: Cauchy’s integral theorem, Cauchy’s integral formula, Laurent series (concept and statement only), singularities and zeros, residue integration method (Residue integration of complex integrals only), linear fractional transformations. (8+5)

LAPLACE TRANSFORMS: Laplace transform, inverse transform, linearity, s-shifting, transforms of derivatives and integrals, unit step function, t- shifting , Dirac’s delta function, periodic functions, convolution, differentiation and integration of transforms, Method of solving differential equations and integral equations by using Laplace transform technique. (12+9)


Z-TRANSFORMS: Introduction of Z-transform, Inverse transform, difference equation – modelling, application of Z-transform to solve difference equations. (6+4)

Total L: 45+T: 30 = 75
REFERENCES:

15Z202 COMPUTER ARCHITECTURE I


PROCESSOR DESIGN: Stack Organization – Instruction Formats - Addressing Modes - Fixed Point Arithmetic: Addition, Subtraction, Multiplication (Booth’s Algorithm) and Division (Restoring and Non-Restoring Division Algorithm), Floating Point Arithmetic.


TOTAL L: 45

TEXT BOOKS:

REFERENCES:

15Z203 OBJECT ORIENTED PROGRAMMING IN C++


INHERITANCE: Derived and Base Class –protected access specifier – Derived class constructors - Overriding member functions - Single Inheritance- Protected Data With Private Inheritance- Multiple Inheritance- Multi Level Inheritance- Hierarchical Inheritance-Multipath Inheritance

VIRTUAL FUNCTIONS: Need For Virtual Function - Pointer to Derived Class Objects- - Array of Pointer to Base Class Objects- Pure Virtual Functions- Abstract Classes- Virtual Destructors – Virtual Dynamic Binding – Run Time Type Identification(RTTI)


TOTAL L: 45
**TEXT BOOKS:**

**REFERENCES:**

**15Z204 MATERIALS SCIENCE**


**(9)**


**(9)**


**(8)**

**PHYSICS OF SEMICONDUCTOR DEVICES:** P type and N type semiconductors-the effective mass-P-N junction, rectifier equation -Hall effect-Quantum tunneling. Bipolar transistor. The field effect transistor- Integrated circuits—Hetero junction-Quantum well, wire, dots- Optical properties of Semiconductors: LD, LED, Photo diode. Introduction to MEMS

**(10)**


**(9)**

**TEXTBOOKS:**

**REFERENCES:**

**15Z205 APPLIED ELECTROCHEMISTRY**


**(9)**

**METAL FINISHING IN ELECTRONIC INDUSTRY:** Production of Plated through hole PCB’s, electroforming - fabrication of CD stampers and wave guides. Electropolishing, electrochemical machining, electrochemical etching of Cu from PCBs , Electrophoretic painting, Electrochemical etching of semiconductors.

**(9)**

**BATTERIES AND FUEL CELLS:** Batteries- types - battery characteristics-fabrication and working of dry cell, lithium primary battery, lead- acid battery, Ni – Cd, Ni-metal-hyride and lithium ion batteries. Advanced batteries and supercapacitors.

Fuel cells: Classification, working principle, components, applications of hydrogen-oxygen, solid oxide, molten carbonate, direct methanol and proton exchange membrane fuel cells. Hydrogen as a fuel-production and storage.

**(9)**


**(9)**

TEXT BOOKS:

REFERENCES:

1Z210 ENGINEERING GRAPHICS

1 0 4 3

INTRODUCTION: Introduction to Engineering Drawing, BIS. Principles of dimensioning. (2+4)


PICTORIAL PROJECTIONS: Principles of pictorial views, isometric view of simple engineering components. Orthographic views from given pictorial views. Isometric views from given two or three views. Drawing isometric views of typical electronic components. (2+14)

SECTION OF SOLIDS: Section of regular solids, types of sections, selection of section views. Sectional views of simple engineering components. Drawing sectional views of assemblies like electric motor, mobile phone. (2+14)

DEVELOPMENT OF SURFACES: Development of lateral surfaces of regular solids and truncated solids. Preparing parts like tray, funnel, CPU housing using cardboard material. (2+14)

TEXT BOOKS:

REFERENCES:

1Z211 PHYSICS LABORATORY II

0 0 2 1

List of Experiments:
1. Study of I-V characteristics of a solar cell and determination of its efficiency
2. Determination of hysteresis loss of a ferromagnetic material
3. Determination of electrical resistivity of metal and alloy using Carey Foster Bridge
4. Determination of Temperature Coefficient of Resistance of metallic wire using post office box
5. Study the characteristics of a photo diode.

Demonstration:
1. UV Visible spectrophotometer
2. Laser micromachining.
3. Determination of Crystal structure by powder photograph method.
4. Thin film deposition using electron beam and thermal evaporation.
5. Crystal Growth System

REFERENCES:
1. Physics Practicals, Department of Physics, PSG College of Technology 2015.
15Z212 CHEMISTRY LABORATORY II

1. Potentiometric determination of ferrous iron.
2. Electroplating of nickel & copper and determination of cathode efficiency.
3. a. Determination of alkalinity and TDS of water.
   b. Photocolorimetric estimation of iron.
   b. Estimation of dichromate in corrosion inhibitor solution by iodometry.

REFERENCE:
1. Laboratory Manual Prepared by the Department.

Total P: 30

15Z213 C++ PROGRAMMING LABORATORY

LIST OF EXPERIMENTS:
1. Classes and Objects.
2. Function Overloading.
3. Call by value and Call by Reference.
4. Inline Function.
5. Static Data and Member Function.
6. Constant Functions
7. Friend function.
8. Objects as Arguments.
10. Static and Dynamic Objects.
11. Constructor and Destructor.
12. Operator Overloading
15. Virtual functions.
16. Sequential and Random Accessing of Files.
17. Template Functions and Template Class.

REFERENCE:

Total P: 30

SUMMER TERM COURSES

15Z215 PROFESSIONAL SKILLS
(4 weeks duration)


**DOCUMENT PREPARATION:** Creating and editing a document, checking spelling and grammar, enhancing a document with various formats, inserting graphics. Spreadsheet Creation: Entering text, numbers, and formulas; saving, closing and opening workbooks; specifying ranges, enhancing a worksheet. Creating a variety of charts and enhancing them. Database Handling: Creating a database, creating tables, entering and editing data, creating forms and reports. Presentation: Creating presentations, inserting slides, inserting graphics, enhancing a presentation, previewing. Project: Solving real world industrial / business / engineering problems using office automation methods.

Total: L: 24 + P: 36 = 60

**REFERENCES:**

**15Z216 IN-PLANT TRAINING & TECHNICAL SEMINAR**

**TECHNICAL SEMINAR**
The student will make a technical presentation on current topics related to the programme.

**INPLANT TRAINING**
Study tour / Industrial visit. Reports are to represent the observations of the students after the visits with their personal comments / suggestions.

Total: L: 24+P: 36 = 60

**SEMESTER III**

**15Z301 LINEAR ALGEBRA AND NUMERICAL ANALYSIS**

**VECTOR SPACE:** General Vector Spaces · Real Vector Spaces · Euclidean N-Space · Subspaces · Linear Independence · Basis and Dimension.

**ERRORS:** Errors in Numerical Procedures.

**SYSTEM OF LINEAR EQUATIONS:** Direct Methods · Naive Gauss Elimination Method · Gauss Jordan Method · Crout’s Method · Iterative Methods · Gauss-Jacobi Method · Gauss-Seidel Method · Convergence Criteria · Ill Conditioned Systems · Eigenvalues and Eigenvectors · Power Method · Jacobi Method.

**NONLINEAR EQUATIONS:** Bisection Method · False Position Method · Newton’s Method · Convergence Criteria · Bairstow’s Method · Graeffe’s Root Squaring Method.

**INTERPOLATION AND CURVE FITTING:** Lagrange’s Polynomials · Newton’s Divided Differences · Evenly Spaced Data · Chebyshev interpolation · Curve Fitting · Using Principle of Least Squares Approximation.

**DIFFERENTIATION AND INTEGRATION:** Numerical Differentiation · Numerical Integration · Newton-Cotes Formulae · Trapezoidal Rule · Simpson’s 1/3 Rule · Simpson’s 3/8 Rule · Gaussian Quadratures.

**ORDINARY DIFFERENTIAL EQUATIONS:** Numerical Methods for Initial Value Problem · Taylor-Series · Euler and Modified Euler Method · Runge-Kutta Methods · Adams Moulton Method · Solution of Second Order Boundary Value Problem by Finite Difference Method.

Total: L: 45+T: 30 = 75

**TEXT BOOKS:**

**REFERENCES:**
15Z302 DATA STRUCTURES

**INTRODUCTION:** Data Structures - Types of Data Structures - Abstract Data Types - Program Development Life Cycle - Algorithm - Characteristics - Complexity Analysis - Recurrence Relations - Asymptotic Notations.


**STACKS AND QUEUES:** Stack Representation - Operations - Applications - Expression Handling - Queue Representation - Operations - Types of Queues: Circular Queue - Deque - Priority Queue.


**GRAPHS:** Graph Terminologies - Types of Graphs - Representation - Operations - Traversal Techniques: Breadth First Search - Depth First Search. Applications: Topological Sort.

**HASHING:** Hash Table - Hash Functions - Resolving Collisions - Rehashing.

**TEXT BOOKS:**

**REFERENCES:**

Total L: 45

15Z303 MICROPROCESSORS AND INTERFACING


**ASSEMBLY LANGUAGE PROGRAMMING:** Assembly Language Program Development On The PC - The Instruction Set - Addressing Modes - Assembler Directives - Types Of Instructions: Data Transfer – Arithmetic – Logical - Shift And Rotate - Flag Control – Compare - Control Flow And Jump Instructions – Subroutine - Loop And String Handling Instructions.

**MEMORY INTERFACES:** Minimum and Maximum mode Memory interface signals - Hardware organization of the memory address space - Memory interface circuits.

**I/O INTERFACES:** Types of Input/Output - I/O Interface - I/O Data Transfers and Instructions - Core and Special Purpose I/O Interfaces - Parallel Interface - 8255 Programmable Peripheral Interface - Serial Interface - 8251 Programmable Communication Interface - Interfacing with DAC – ADC - Stepper Motor.

**INTERRUPT INTERFACING:** Interrupt Mechanism - Types and Priority - Interrupt Vector Table - Interrupt Instructions - Enabling and Disabling of Interrupts - Hardware Interrupts - Software Interrupts - Internal Interrupts.

**TRENDS IN MICROPROCESSOR TECHNOLOGY:** Overview of Pentium Processors - ARM Processors - Introduction to ARM Architecture.

**TEXT BOOKS:**

**REFERENCES:**

Total L: 45
15Z304 ENVIRONMENTAL SCIENCE AND ENGINEERING

3 0 0 3


Total L: 45

TEXT BOOKS:

REFERENCES:

15Z305 DISCRETE STRUCTURES

3 2 0 4

LOGIC AND PROOF: Logic - Propositional Equivalences - Predicates and Quantifiers - Nested Quantifiers - Rules of Inference - Proofs - Direct Proofs - Contraposition - Contradiction - Equivalence - Normal Forms - Program Correctness - Mathematical Induction. (13+10)

RELATIONS: Relations and their Properties - Representing Relations - Closures of Relations - Equivalence Relations - Partial Orderings. (5+3)

FUNCTIONS: Functions - Composition - Identity - Inverse and Characteristic Function - Hashing Function - Recursion. (5+2)

COUNTING: Permutation and Combination - Generalized Permutation and Combination - Advanced Counting Techniques - Recurrence Relation - Solving Linear Recurrence Relations using Characteristic Roots. (9+6)


Total L: 45+30 = 75

TEXT BOOKS:
REFERENCES:

15Z070 ECONOMICS FOR ENGINEERS

INTRODUCTION: Definition - Nature and Scope - Significance of Economics for Engineers.


TEXT BOOKS:

REFERENCES:

15Z310 MICROPROCESSORS AND INTERFACING LABORATORY

LIST OF EXPERIMENTS:

DIGITAL SYSTEMS
1. Design of Combinational circuit
2. Design of Sequential Circuit

MICROPROCESSOR
3. Arithmetic Operations
4. Recursion
5. Searching and Sorting
6. String Operations

INTERFACING
7. DAC/ADC Interface
8. Keyboard/Display Interface, Printer
9. Interfacing Stepper Motor to 8086
10. Traffic Light Controller

REFERENCES:

**15Z311 DATA STRUCTURES LABORATORY**

**LIST OF EXPERIMENTS:**
1. Solving Problems Using Arrays
2. Implementation of Linked List
3. Applications of Linked List
4. Implementation of Stack
5. Applications of Stack
6. Implementation of Queue
7. Operations on Binary Search Trees
8. Graphs - Depth First Search and Breadth First Search
9. Hashing and Collision Resolution
10. Sorting Algorithms

**REFERENCES:**

**SEMESTER IV**

**15Z401 PROBABILITY, STATISTICS AND RANDOM PROCESSES**

**PROBABILITY:** Probability Axioms - Conditional Probability - Law of Total Probability - Baye's Theorem – Independence. (4+4)


**STATISTICAL INFERENCE:** Estimation of a Random Variable - Linear Estimation of X given Y - MAP and ML Estimation - Simple Linear Regression and Multiple Linear Regression Model. (8+3)

**HYPOTHESIS TESTING:** Tests of statistical hypothesis, one-sided and two-sided hypothesis, confidence intervals, large and small sample tests, inference concerning means, variances and proportions - Chi-square test for goodness of fit and independence of attributes. (7+4)

**STOCHASTIC PROCESSES:** Types of Stochastic Processes – Poisson Process -Brownian Motion Process - Expected Value and Correlation - Stationary Processes - Wide Sense Stationary Stochastic Processes. (10+6)

**Total L: 45+T: 30=75**

**TEXT BOOKS:**

**REFERENCES:**
**15Z402 SOFTWARE ENGINEERING**


**REQUIREMENTS ENGINEERING:** Requirements Elicitation - Requirements Analysis and Negotiation - Requirements Validation - Requirements Management.


**SOFTWARE CONFIGURATION MANAGEMENT:** Baselines - Software Configuration Items - The SCM Process - Version Control - Change Control - Configuration Audit - SCM Standards.

**TEXT BOOKS:**

**REFERENCES:**

**15Z403 DESIGN AND ANALYSIS OF ALGORITHMS**

**DIVIDE AND CONQUER:** Methodology - Finding Maximum and Minimum Element - Quick sort - Merge sort - Matrix multiplication - Convex Hull.


**DYNAMIC PROGRAMMING:** Principle of Optimality - Knapsack Problem - All Pairs Shortest Path - Optimal Binary Search Tree - Multistage Graphs.

**BACKTRACKING:** State Space Tree - Knapsack Problem - The Eight Queens Problem - Sum of Subset Problem - Graph Coloring.

**BRANCH AND BOUND:** Bounding Functions - 0/1 Knapsack Problem - Traveling Sales Person Problem - Assignment Problem.


**TEXT BOOKS:**

**REFERENCES:**
15Z404 OPERATING SYSTEMS

INTRODUCTION: Functions - History - Operating System Concepts - System Calls - Services - User Operating System Interface - Design and Implementation - Introduction to Virtual Machines. (6)


MEMORY MANAGEMENT: Main Memory: Swapping - Contiguous Memory Allocation - Paging - Structure of Page Table - Segmentation - Examples. Virtual Memory: Demand Paging - Copy on Write - Page Replacement - Allocation of Frames - Thrashing - Memory Mapped Files - Allocating Kernel Memory - Memory Management Utilities. (10)


TEXT BOOKS:

REFERENCES:

15Z405 DATABASE MANAGEMENT SYSTEMS


LOGICAL DATABASE DESIGN: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization - Functional Dependencies - Anomaly - 1NF to 5NF - Domain Key Normal Form – Denormalization. (9)


INDEXING: Types of Single Level Ordered Indexes - Multilevel Indexes - Dynamic Multilevel Indexes. (6)


ADVANCED TOPICS: Overview: Parallel Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database. Data Warehouse - OLTP Vs OLAP - NoSQL Database. (6)

TEXT BOOKS:

REFERENCES:
15Z410 OPERATING SYSTEMS LABORATORY

LIST OF EXPERIMENTS:
1. Linux Commands
2. Shell Programming
4. Interprocess Communication using Pipes, Shared Memory and Message Queues
5. CPU Scheduling Algorithms
6. Banker’s Algorithm
7. Memory Management Schemes.
8. Page Replacement Algorithms
9. Mini File Manager – Open, Close, Read, Write, Seek, Delete
10. Disk Scheduling Algorithms

REFERENCES:

Total P: 30

15Z411 DATABASE MANAGEMENT SYSTEMS LABORATORY

LIST OF EXPERIMENTS:
1. Practice of SQL Commands (DDL,DML,DCL,TCL)
2. Practice of PL/SQL - (Cursors, Stored Procedures, Stored Function, Triggers, Packages).
3. Study of Open Source Databases
4. Mini Project (Application Development)

REFERENCES:

Total P: 30

15Z412 SOFTWARE PACKAGE DEVELOPMENT

CODING TECHNIQUES: Coding Standards and Code Reviews - Best practices.

PACKAGE DEVELOPMENT: Problem Identification - Algorithm Design - Coding - Testing and Documentation.

Total P: 60

TEXT BOOKS:

REFERENCES:

SEMESTER V

15Z501 THEORY OF COMPUTING

INTRODUCTION: Basic Mathematical Notation and Proof Techniques - Recursive Definitions- Chomsky’s hierarchy of Languages.
REGULAR EXPRESSIONS AND FA: Regular Expressions - Basic Definitions - DFA Construction - Converting Regular Expression to DFA - NFA: Introduction to NFA - Subset Construction - Epsilon Closure - NFA to DFA - Minimization of FA - Applications of Finite Automata - Properties of Regular Sets - Decision Algorithms. (9+6)


TURING MACHINES: Definitions of Turing Machines - Models - Computable Languages and Functions - Techniques for Turing Machine Construction - Variants of Turing Machines: Multi Head and Multi Tape Turing Machines - Universal Turing Machine - The Halting Problem - Partial Solvability. (9+6)

UNSOVABLE PROBLEMS: Unsolvable Problems - PCP - MPCP - Recursive and Recursively Enumerable Languages - Computable Functions: Primitive Recursive Functions - Godel Numbering - Rice Theorem. (9+6)

MEASURING AND CLASSIFYING COMPLEXITY: Tractable and Intractable Problems - Tractable and Possibly Intractable Problems - P and NP Completeness - Polynomial Time Reductions - Boolean Satisfiability Problem - Clique Problem. (5+2)

Total L: 45+T: 30=75

TEXT BOOKS:

REFERENCES:

15Z502 COMPUTER NETWORKS


PHYSICAL LAYER: Signal Characteristics - Data Transmission - Physical Links and Transmission Media - Signal Encoding Techniques - Channel Access Techniques - TDM - FDM. (7)

Total L: 45

TEXT BOOKS:
15Z503 OBJECT ORIENTED ANALYSIS AND DESIGN


STRUCTURAL DIAGRAMS: Notations and Construction of Class Diagram - Object Diagram - Package Diagram - Composite Structure Diagram - Component Diagram - Deployment Diagram - Design Patterns - Frameworks. (8+5)

CASE STUDIES: ATM - Library Management - E-Shopping (3+3)

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15Z504 COMPUTER ARCHITECTURE II


MEMORY MANAGEMENT: Introduction - Memory Technology and Optimizations - Cache Performance - Basic Cache Optimizations - Advanced Optimizations - Case study on Memory hierarchies of ARM cortex A8 - Virtual Memory and Virtual Machines. (10)


MULTIPROCESSORS AND THREAD LEVEL PARALLELISM: Symmetric Shared-Memory Architectures - Performance of Symmetric Shared-Memory Multiprocessors - Distributed Shared Memory - Directory-Based Coherence - Synchronization Challenges - Models of Memory Consistency – Multi core Processors and their Performance. (10)

Total L: 45

TEXT BOOKS:

REFERENCES:
15Z510 COMPUTER NETWORKS LABORATORY

LIST OF EXPERIMENTS:
1. Study of Network Components
2. Study of Basic Network Commands and Network Configuration Commands
3. The following experiments are to be implemented in ‘C’ language:
   i. Simple Chat Program using TCP Sockets
   ii. Sliding Window Protocol using TCP Sockets
   iii. DNS using UDP Sockets
4. Study of Wireshark Tool
5. Tracing of TCP and UDP Connection using Wireshark
6. Study of any Simulator Tool
7. Simulation of TCP Performance using Simulator Tool
8. Simulation of UDP Performance using Simulator Tool
9. Performance Comparison of Routing Protocols using Simulator Tool

REFERENCES:

Total P: 60

15Z511 JAVA PROGRAMMING LABORATORY

INTRODUCTION: Basic Concepts - Classes - Methods - Inheritance - Packages - Interfaces. (3+6)

EXCEPTION HANDLING: Exception Types – Try-Catch Block - Throw - Throws Clauses - Finally - User-Defined Exceptions (1+2)

STRING HANDLING: Immutability - Operations - Comparison - StringBuffer - StringTokenizer. (1+2)

COLLECTIONS: Overview - Generics - Interfaces - Classes - Accessing a Collection – Maps. (2+4)

APPLETS: Basics - Event Handling: Model - Sources - Classes - Interfaces - Fonts - AWT Controls - Layouts and Managers - Swing: Packages - Event Handling – Components. (4+8)

INPUT / OUTPUT: IO - Basics - Stream I/O - Text I/O - Serialization. (2+4)

JDBC: Connectivity to Database - Drivers - Select - Update - Record Sets. (2+4)

PROGRAMS:
1. Basics, Classes and Inheritance
2. Overloading and Overriding, Interfaces and Packages
3. Exception Handling
4. String Handling
5. Collections and Generics
6. Applet Development
7. Controls and Layouts
8. Applet Development using Swing
9. Input / Output
10. JDBC

Total L: 15+P: 30=45

REFERENCES:

SEMESTER VI

15Z601 EMBEDDED SYSTEMS


VALIDATION AND DEBUGGING: Host and Target Machines - Validation Types and Methods - Host Testing - Host-Based Testing Setup - Target Testing - Remote Debuggers and Debug Kernels - ROM Emulator - Logical Analyzer - Background Debug Mode - In-Circuit Emulator.


REFERENCES:

15Z602 COMPILER DESIGN

INTRODUCTION TO COMPILERS: Translators - Compilation and Interpretation - The Phases of Compiler - Errors Encountered in Different Phases - The Grouping of Phases - Compiler Construction Tools.


REFERENCES:
15Z603 DISTRIBUTED OPERATING SYSTEMS


SYNCHRONIZATION AND TRANSACTIONS: Clock Synchronization - Physical Clocks - Logical Clocks - Election Algorithms - Mutual Exclusion - Deadlocks - Detection and Avoidance - Transaction Model - Classification.


NAME SERVICES: Names - Identifiers and Addresses - Name Resolution - Name Space Implementation - System and Human Oriented Names - Object Location - Name Caches.

TEXT BOOKS:

REFERENCES:

15Z604 DATA MINING

INTRODUCTION: Motivation - Significance of Data Mining - Data Mining Functionalities - KDD Process – Architecture - Task Primitives - Issues.

DATA PREPARATION: Forms of Preprocessing - Data Cleaning - Data Integration and Transformation - Concept Hierarchy - Data Generalization - Attribute Oriented Induction.

ASSOCIATION ANALYSIS: Market Basket Analysis - Interestingness Measures - Closed Itemsets - Frequent Itemset Mining - The Apriori Algorithm - Compact Representation of Frequent Itemsets - Association Rule Generation - Correlation Analysis.

CLASSIFICATION: Decision Tree Classifier - Attribute Selection Measures - Overfitting and Pruning - Bayesian Classifier - Nearest Neighbour Classifier - Rule Classifier - Bayesian Belief Networks - Prediction.


APPLICATIONS: Trends and Social Impacts of Data Mining - Privacy Concerns - Web Mining - Social Network Analysis - Biological Data Analysis.

TEXT BOOKS:
1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann publisher, USA, 2012.

REFERENCES:
1. Ian Witten, Eibe Frank and Mark A Hall, "Data Mining - Practical Machine learning tools and techniques", Morgan Kaufmann publisher, USA, 2011.

15Z610 EMBEDDED SYSTEMS LABORATORY

LIST OF EXPERIMENTS:
1. Introduction to Development Tools and Environment
2. Programming - Basics of Embedded C
3. Interfacing Keyboard
4. Interfacing LCD Display
5. UART Serial Port Programming
6. Communication Interface using I2C and SPI
7. RTOS Programming Environment
8. RTOS - Creating Multiple Tasks
9. RTOS - Inter-Task Communication
10. RTOS - Task Synchronization

*Note: First seven experiments will be done in 8051 and ARM 7 and above.

REFERENCES:

15Z611 INNOVATION PRACTICES

This course involves preparing students to think innovatively and present possible solutions to an identified issue/problem.

15Z701 ARTIFICIAL INTELLIGENCE


NATURAL LANGUAGE PROCESSING: Phases - Syntactic Processing - Semantic Analysis - Discourse and Pragmatic Processing. (8)

TEXT BOOKS:

REFERENCES:

15Z702 DATA ANALYTICS

INTRODUCTION: Data Science and Analytics - Big Data - Relations: Data Scales - Set and Matrix Representations - Relations - Similarity Measures - Dissimilarity Measures - Sequence Relations. (9+6)

PREPROCESSING AND VISUALIZATION: Sampling and Quantization - Error Types - Error Handling - Filtering - Data Transformation - Data Merging - Diagrams - Principal Component Analysis - Multidimensional Scaling - Sammon Mapping - Autoassociator - Histograms - Spectral Analysis. (9+6)
CORRELATION, REGRESSION AND FORECASTING: Linear Correlation - Correlation and Causality - Chi-Square Test for Independence - Linear Regression - Non-Linear Substitution - Robust Regression - Neural Networks - Radial Basis Function Networks - Cross Validation - Feature Selection - Finite State Machines - Recurrent Models - Autoregressive Models. (9+6)


Total L: 45+T: 30=75

TEXT BOOKS:

REFERENCES:

15Z703 MOBILE SYSTEMS ENGINEERING 3 2 0 4


Total L: 45+T: 30=75

TEXT BOOKS:

REFERENCES:

15Z704 CRYPTOGRAPHY AND NETWORK SECURITY 2 2 0 3


SYMMETRIC CIPHERS: Classical Encryption Techniques: Block Ciphers and Stream Ciphers - Data Encryption Standard - Block Cipher Principles - Modes - The Origins AES. Basic Concepts in Number Theory: Prime Numbers - Fermat’s and Euler’s Theorems. (6+7)


**NETWORK AND INTERNET SECURITY PROTOCOLS:** Basic Concepts - Secure Sockets Layer (SSL) - Transport-Level Security - Secure Shell (SSH) - **Email Security:** Pretty Good Privacy (PGP) - Firewalls - Characteristics and Types - IP Security - IEEE - PKCS. (5+5)  

**TEXT BOOKS:**  

**REFERENCES:**  

15Z710 ARTIFICIAL INTELLIGENCE LABORATORY  

**LIST OF EXPERIMENTS:**  
1. Study of PROLOG / LISP  
2. List Operations in PROLOG / LISP  
3. Best First Search  
4. A* Algorithm  
5. AO* Algorithm  
6. Min-Max Search Trees and Alpha Beta Pruning  
7. Reasoning: Resolution and Probabilistic  
8. Planning  
9. Learning  
10. Developing a Simple AI Application  

**REFERENCES:**  

15Z720 PROJECT WORK I  

The project I involves the following:  
- Identification of Real World Problem  
- System Requirement Analysis and Specification  
- Developing a Model and Solution for the Identified Problem  
- Consolidated Report Preparation and Presentation  

Total P: 60  

15Z820 PROJECT WORK II  

The Project work II involves  
- Preparing a project - brief proposal including  
  - Problem Identification  
  - A statement of system / process specifications proposed to be developed  
  - List of possible solutions including alternatives and constraints  
  - Cost benefit analysis  
  - Time Line of activities  
- Presentation highlighting the  
  - Design based on functional requirements  
  - Implementation  

Total P: 60  

SEMESTER VIII
3 0 0 3

COMMUNICATION CONCEPTS: Process of Communication - Inter and Intrapersonal Communication - Essentials for Effectiveness. (4)


BUSINESS CORRESPONDENCE: Writing Emails - Preparing Resumes - Memos - Technical and Business Proposals. (7)

TECHNICAL COMMUNICATION: Seminars - Process Description and Group Discussions - Use of Visual Aids. (10)

TEXTBOOK:
1. Monograph prepared by the Faculty, Department of English, 2015.

REFERENCES:

15Z081 BASIC GERMAN 3 0 0 3

INTRODUCTION: German Culture - Tradition - Universities and Companies - Alphabets - Greetings - Countries - Nationalities and Languages. (3)

VOCABULARY: Context Related to School - University - Professions - Family - Supermarket - Food and Beverages - Entertainment - Celebrations - Weather. (4)


SYNTAX: Word Order and Sentence Formation - Practice with Mini Dialogues. (4)

COMMUNICATION SKILLS: Conversing in Formal and Informal Situations - Dialogue Writing - Letter Writing - Email Writing - Invitations and Telephone Conversations. (7)

PRACTICALS: Listening - Speaking - Reading and Writing. (6)

TEXTBOOK:
1. Monograph prepared by the Faculty, Department of English, 2015.

REFERENCES:

15Z082 BASIC FRENCH

INTRODUCTION

UNITÉ-1: Faire connaissance - inviter et répondre à une invitation - décrire les personnes- articles définis et indéfinis - genre et nombre des noms et des adjectifs - interrogation et négation - conjonction du present - Paris monuments et lieux publics - la vie de quatre parisiens de professions différentes. (T-R1) (10)

UNITÉ-2: Exprimer l'ordre et l'obligation demander et commander - évaluer et apprécier - féliciter et remercier - articles partitifs - adjectifs démonstratifs et possessifs prépositions et adverbes de quantité et de l'imperatif verbes pronominaux - une région de France la Bourgogne - vie quotidienne à la campagne. (T-R1) (11)

UNITÉ-3: Raconter et rapporter - donner son avis - se plaindre et réprimander - expliquer et justifier - pronoms compléments - futur proche - passé composé et imparfait - Plusieurs régions de France - différents univers sociaux.(T-R2) (11)


Total L:45

TEXT BOOK:

REFERENCES:

15Z083 BASIC JAPANESE

ORIENTATION SESSION: Geographic and Socio - Economic Perspective to Japan - Japanese People - Culture - Basic Greetings and Responses. (3)

BASIC SCRIPT: Method of Writing Hiragana and Katakana - Combination Sounds and Simple Words. (3)

TOPIC MARKER:"Wa" - Desu / Dewa Arimasen Cupolas - Interrogative Particle "Ka" - Grammar Particles "Mo" - "No" - "Introducing Someone: "Kochira Wa ~". Self Introductions: Hajimemashite". (3)

DEMONSTRATIVES: "Kore" - "Sore" - "Are" - Demonstrative: "Kono" - "Sono" - "Ano". Possessive Noun Particle "No" - Japanese Apartments: Greeting Your Neighbour. (2)


ASKING FOR AND TELLING THE TIME:Particle "Ni (At)" for Time - Kara (from) - Made (until) - Particle "To (and)" - Time Periods: Days of the Week - Months - Time of Day - Verbs (Present / Future And Past Tense). Telephone Enquiry: Asking for a Phone Number and Business Hours. (2)

DESTINATION PARTICLE: "E" - Particles "De (Mode Of Transportation)" - To (With) - Japanese Train Station: Asking for Fare and Track Number / Types of Trains. (2)

DIRECT OBJECT PARTICLE: "O" - Particle "De (Place Of Action)" - Verbs ("Masen Ka" - "Mashou") and "Ohanami" Cherry Blossom Viewing. (2)

PARTICLES: Particle "De (By Means Of)" - Particle "Ni (To)" - Aematsu (Give) - Moraimasu (Receive) - Visiting a Japanese House.(2)

ADJECTIVES: "I" and "Na" Type - Positive and Negative Usage-Particle "Ga (However - But)" - "Dore Which?)" - Leaving a Room - Thanking Someone for Hospitality. (2)

LIKES AND DISLIKES: Potential Verbs (Wakarimasu and Dekimasu) - "Kara (~ Because)" -Adverbs - Asking Someone out over the Phone. (2)

VERBS DENOTING PRESENCE: "Imasu" - "Arimasu" -Particle "Ni (In)" - "Dare (Who?)" - Adverbs ("Chikaku Ni ~") - Particle "Dare Mo (Negative ~ No One)" - Dare Ka (Anyone) - Dare Ga (Who) - Nani Ka (Anything) -Nani Ga (What) - ~Ya(And) ~ Nado (Etc.) - Asking for Directions. (2)

48
COUNTERS AND COUNTING SUFFIXES

INTRODUCTION TO ADJECTIVES: Na and Ii Type - Different Usages of Adjectives - Comparison - Likes and Dislikes - Going to a Trip.

NEED AND DESIRE: (Ga Hoshii) - Wanting to - (Tabeli Desu) - Going for a Certain Purpose (Mi ~Ni Ikimasu) - Choosing from a Menu.

VERB GROUPS: I - ii and iii - Exercises to Group Verbs.

PLEASE DO: (Te Kudasai) - Present Continuous Tenses (Te Imasu) - Shall I? (~ Mashou Ka) - Describing a Natural Phenomenon (It Is Raining).

PERMISSION: To Grant Permission (~Te Mo Ii Desu) - Asking for Permission (~ Te Mo li Desu Ka) - Should Not Do (~ Te Wa Ikemasen).

STATE AND ACTION: Describing a Continuing State - Describing a Habitual Action.

ROLEPLAYS IN JAPANESE

A DEMONSTRATION ON USAGE OF CHOPSTICKS AND JAPANESE TEA PARTY


OPEN ELECTIVES

MATHEMATICS

15OH01 ADVANCED LINEAR ALGEBRA

VECTOR SPACES: General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space.

INNER PRODUCT SPACES: Inner products, length and angle in inner product spaces, orthonormal bases, Gram-Schmidt process, orthogonal matrices, QR decomposition, best approximation- least square.

LINEAR TRANSFORMATIONS: General linear transformation - kernel and range, matrices of linear transformations, change of basis, rank and nullity.

EIGENVALUES AND EIGENVECTORS: Eigenvalues and eigenvectors, diagonalization, orthogonal diagonalization, quadratic forms, application of conic sections, quadratic surfaces - discrete dynamical systems.


15OH02 ALGEBRAIC STRUCTURES

GROUPS: Groups, subgroups, permutation groups, cosets and Lagranges’s theorem, normal subgroups and quotient groups, homomorphisms, isomorphisms, Cayley’s theorem.

CODING THEORY: Group codes, the communication model and basic notions of error correction, generation of codes by using parity checks - error recovery in group codes.
RINGS: Rings, sub-rings, properties of rings, integral domain, ideals and quotient rings, polynomial rings. (12)

FIELDS: Fields, roots of polynomials, construction of straightedge and compass. (13)

TEXT BOOKS:

REFERENCES:

15OH03 CALCULUS OF VARIATIONS AND TENSOR ANALYSIS 3003

CALCULUS OF VARIATIONS: Basic concepts, method of variations in problems with fixed boundaries - variation and its properties, Euler equation. (12)

FUNCTIONALS: Functional involving first and higher order derivatives, functionals dependent on the functions of several independent variables, variational problems in parametric form – applications: vibrating string and membrane. (12)

VECTOR ANALYSIS: Basic concepts – gradient, directional derivative, divergence, curl, potential vector field, solenoidal vector field, Laplacian vector field. Green's theorem, Stoke’s theorem and Gauss divergence theorem (statement and concepts only) (7)

TENSOR ANALYSIS: Concepts of a tensor field – Ostrogradski’s theorem, field of tensor of rank 2 - flux, divergence and derivative in a direction of tensor field. Integral theorems - theorems related to Ostrogradski’s theorem – applications: equation of motion of a liquid, Archimedes’ law. (14)

TEXT BOOKS:

REFERENCES:

15OH04 GRAPH THEORY AND ITS APPLICATIONS 3003

GRAPHS AND DIGRAPHS: Common families of graphs, degree sequence, handshaking lemma, Havel-Hakimi theorem (statement and concepts). Walk, trail and path, connected graph, distance, radius and diameter. Graph isomorphism. Representations of graphs – adjacency and incidence lists – adjacency and incidence matrices. (10)

SPANNING TREES: Cayley’s formula: Prufer encoding-decoding algorithm. Matrix tree theorem (statement and problems only). Depth-first and breadth-first search algorithms, minimum spanning tree – Prim’s and Kruskal’s algorithms, shortest-path problem – Dijkstra’s algorithm. (9)

EULERIAN AND HAMILTONIAN GRAPHS: Eulerian graphs – Königsberg bridge problem; Eulerian tour algorithm, characterization of Eulerian graph, optimal postman tour. Hamiltonian graphs - non Hamiltonian graphs, sufficient conditions for Hamiltonian graphs (only statements and concepts). Travelling salesman problem - nearest neighbour algorithm. (10)

VERTEX-COLORING: Vertex-coloring - chromatic number of a graph, vertex coloring algorithms – sequential vertex coloring, largest degree first algorithm, applications - scheduling problem, assignment of radio frequencies, fast register allocation for computer programming. (8)


TEXTBOOKS:

REFERENCES:
2. Narsingh Deo, Graph Theory with Applications to Engineering And Computer Science, Prentice Hall, New Delhi 2010.

15OH05 MATHEMATICAL FINANCE

3 0 0 3

FINANCIAL MATHEMATICS: Basic terminology, assumptions, derivative securities. (6)

FORWARD AND FUTURES CONTRACTS: Forward contract, forward price formula, value of a forward contract, futures contract, futures pricing. (12)

OPTION PRICING: Definition and preliminaries, behavior of option prices with respect to variables, pay-off curves, single period and multi period binomial lattice models for option pricing, pricing American options: a binomial lattice model, Black-Scholes formula. (12)

RISK FREE ASSETS: Time value of money, Simple interest, periodic compounding, streams of payments, continuous compounding. Money market: zero coupon bonds, coupon bonds, money market account. (9)

PORTFOLIO MANAGEMENT: Risk and return, expected return standard deviation as risk measure, two securities, risk and expected return on a portfolio. (6)

Total L: 45

TEXT BOOKS:

REFERENCES:

15OH06 MATHEMATICAL MODELING AND SIMULATION

3 0 0 3

SYSTEM MODELS AND STUDIES: System- continuous and discrete system, system modeling, types of models - static physical, dynamic physical, static mathematical, dynamic mathematical models, principles in modeling, corporate model, environment, production, management segment, system analysis – corporate model, system design – message processing in a computer, system postulation – function of liver in the human body. (10)

SYSTEM SIMULATION: Technique of simulation, Monte Carlo Method – area under a curve, estimate of π, comparison of simulation and analytical methods, distributed lag models – national economy, cobweb Models – supply and demand, exponential growth and decay models, logistic curves, simple system dynamics diagrams – population, multi-segment models – product sales, representation of time delays, feedback in socio-economic systems, host and parasite fluctuation. (12)

STATIC SIMULATION: Basics and components of the simulation study, simulation as an analysis tool, static simulations - model for profit on a sale promotion, a financial model for an office building. Random number generation - linear congruential generator, Blum-Blum generator, random variates generation - Bernoulli, uniform, triangular, normal, exponential random variates, a model for loss ratio for an insurance agency. (15)

DYNAMIC SYSTEMS SIMULATION: Financial models and @risk - a model for the price of a stock, dynamic financial models of stock prices, correlated asset values, fitting a distribution to date. (8)

Total L:45

TEXT BOOKS:

REFERENCES:
1. Brian Albright, Mathematical Modeling with Excel, JonesBartlett publishers, Singapore 2010
15OH07 NUMBER THEORY FOR COMPUTING 3 0 0 3

DIVISIBILITY AND DIOPHANTINE EQUATIONS: Theory of divisibility - Basic concepts and properties of divisibility, fundamental theorem of arithmetic, Euclid's algorithm, continued fractions. Diophantine equations - Linear Diophantine equations (8)

ARITHMETICAL FUNCTIONS AND DISTRIBUTION OF PRIME NUMBERS: Multiplicative functions - functions $\varphi(n)$, $\sigma(n)$ and $s(n)$ - functions $\varphi(n)$, and $\mu(n)$. Prime distribution function $\pi(x)$, prime number theorem, the $n^{th}$ prime. (10)

THEORY OF CONGRUENCES: Basic concepts and properties of congruences — linear congruences — Fermat’s Little theorem, Euler’s theorem, Chinese remainder theorem, Legendre and Jacobi symbols, primitive roots. (7)

COMPUTATIONAL NUMBER THEORY: Primality testing: Fermat’s pseudoprimeity test, strong pseudoprimeity test, integer factorization : trial division and Fermat method, quadratic and number field sieves. (10)

APPLICATIONS TO CRYPTOGRAPHY: Random number generation - linear congruential generator, basics of cryptography, public key cryptography: discrete logarithm based cryptosystems - RSA public-key cryptosystem. (10)

TEXT BOOKS:

REFERENCES:

15OH08 OPERATIONS RESEARCH 3 0 0 3


GAME THEORY: Two person zero sum game, pure and mixed strategies, dominance principle, graphical solution, linear programming solution. (7)

NON-LINEAR PROGRAMMING: Constrained NLPP - Lagrange’s multipliers method, convex NLPP- Kuhn-Tucker conditions, Quadratic programming-Wolfe’s method. (8)

QUEUING THEORY: Elements of queueing model, relationship between exponential and Poisson queueing models, (M/M/1), (M/M/1/N), (M/M/c), (M/M/c/N) and self-service model. (9)

REPLACEMENT THEORY: Replacement of items that deteriorate, replacement of items that fail, group replacement. (7)

TEXT BOOKS:

REFERENCES:

15OH09 RELIABILITY AND QUALITY CONTROL 3 0 0 3

STATISTICAL PROCESS CONTROL: Chance and assignable causes of quality variation, statistical basis of the control charts - basic principles, choice of control limits, analysis of patterns on control charts. (7)

CONTROL CHARTS FOR VARIABLES AND ATTRIBUTES: $\bar{X}$ chart, R chart, $s^{2}$ chart, p chart, np chart, c chart, and u chart. (10)

ACCEPTANCE SAMPLING: Types of sampling plans, lot formation, single sampling plans for attributes, double, multiple and sequential sampling plans, acceptance sampling by variables, chain sampling, continuous sampling, skip lot sampling plans. (10)
BASIC RELIABILITY MODELS: The failure distribution, the reliability function, mean time to failure, Hazard rate function, bathtub curve, conditional reliability. Constant failure rate model: Exponential reliability function. Time - dependent Weibull failure model, Time - dependent normal failure model.

RELIABILITY OF SYSTEMS: Serial configuration, parallel configuration, combined series, parallel systems - k out of n: system - system structure function, minimal cuts, minimal paths, common mode failures, three state devices.

REFERENCES:

15OH11 STOCHASTIC MODELS
STOCHASTIC PROCESSES: Definition, Markov chains: Classifications of states, absorption probability, period, Chapman-Kolmogorov equations, steady state probabilities.


BROWNIAN MOTION: First passage time distribution, maximum of a Brownian motion, zeros of Brownian motion, Brownian motion with drift, Geometric Brownian motion, applications to finance.

QUEUEING MODELS: Basic definitions, steady-state solution: M/M/1, M/M/1/K, M/M/c, M/M/c/k Models, queues with unlimited service.

REFERENCES:

15OH20 ANALYTICAL TECHNIQUES FOR MATERIALS CHARACTERIZATION

ELECTRON AND ION SPECTROSCOPIC TECHNIQUES: Mass spectroscopy and X-ray emission spectroscopy (Principle and limitations) - Quadrupole mass spectrometer. Special surface techniques: X ray photoelectron spectroscopy (XPS or ESCA)- photoelectron process of spectrum- elemental analysis-Instrumentation and applications, Auger electron spectroscopy (AES)-Basic principles-Information in Auger spectra-methods for surface and thin film characterization, Secondary ion mass spectrometry(SIMS) – Dynamic and static SIMS-common modes of analysis, Rutherford Backscattering Spectrometry (RBS), Field Ion Microscopy (FIM).

SURFACE STRUCTURE ANALYSIS: The need for surface study. Surface chemical composition: The extension of bulk techniques to surface studies - Unit meshes of finite types of surface nets - diffraction from diperiodic structures. Surface methods using electron, low energy electron diffraction (LEED), reflection high energy electron diffraction (RHEED),

SANNING PROBE MICROSCOPY : Instrumentation, Scanning Tunnelling Microscopy, Tunneling current, probe tips and working environments, operational modes, typical applications, atomic force microscopy, near field forces, force sensors, operational modes, applications, image artifacts (8)

TEXTBOOKS:  

REFERENCES:  

15OH21 LASER TECHNOLOGY  

LASER CHARACTERISTICS: Einstein coefficients - negative absorption, shape and width of spectral lines, spontaneous and stimulated emission. Laser resonators, types of resonators, stability diagram. Spatial and temporal coherence. (9)


DYE LASERS: Liquid lasers, dye lasers, fabrication and excitation mechanisms. Concept of Q-switching and mode-locking, second harmonic generation, theory and experiment, materials for optical SHG. (9)

INDUSTRIAL APPLICATIONS: Laser cutting, drilling & Piercing. Laser welding, operating characteristics and applications. medical. Spectroscopic (qualitative), laser Raman effect, stimulated Raman effect - Brillouin scattering. (9)


TEXTBOOKS:  

REFERENCES:  

15OH22 MICRO ELECTROMECHANICAL SYSTEMS  


SCALING LAWS AND MINIATURIZATION: Introduction. Scaling in geometry. Scaling in rigid body dynamics. The trimmer force scaling vector - scaling in electrostatic forces, electromagnetic forces, scaling in electricity and fluid dynamics, scaling in heat conducting and heat convection. (9)


MICROMACHINING METHODS: Bulk micromachining. Isotropic and anisotropic etching. Wet etchants, etch stops, dry etching comparison of wet and dry etching. Dry etching – physical etching – reactive ion etching, comparison of wet and dry etching. Surface micromachining – process in general, problems in surface micromachining. The LIGA process – description, materials for substrates and photoresists, electroplating, the SLIGA process. (9)


TEXTBOOKS:  
REFERENCE:

15OH23  NANOMATERIALS AND APPLICATIONS  3 0 0 3

INTRODUCTION AND CLASSIFICATION: Atoms, Clusters and Nanomaterials-Classification of nanostructures, nanoscale architecture – Effects of the nanometre length scale – Changes to the system total energy, changes to the system structures, vacancies in nanocrystals, displacements in nanocrystals – Effect of nanoscale dimensions on various properties – Structural, thermal, chemical, mechanical, magnetic, optical and electronic properties.

NANOMATERIALS SYNTHESIS AND PROCESSING: Top-down processes: Ball Milling, lithography, machining process; Bottom-up processes: i) Wet chemical synthesis of nanomaterials- sol-gel, liquid solid reactions; ii) Gas phase synthesis of nanomaterials-Furnace, Flame assisted ultrasonic spray pyrolysis; iii) Gas condensation processing; iv) Chemical vapour deposition (CVD)-plasma-assisted deposition process, MBE and MOVPE-Preparation, safety and storage issues -STM and AFM Techniques.

SEMICONDUCTOR NANOSTRUCTURES: Quantum confinement in semiconductor nanostructures - Quantum wells, quantum wires, quantum dots, superlattices, band offsets and electronic density of states – Fabrication techniques – Requirements, epilaxial growth, cleared edge overgrowth – Growth on vicinal substrates, strain-induced dots and wires, electrostatically induced dots and wires, quantum well width fluctuations, thermally annealed quantum wells and self-assembly techniques.


TEXTBOOKS:

REFERENCES:

15OH24  PHYSICS FOR SOLAR PV SYSTEMS AND SOLID-STATE LIGHTING SYSTEMS  3 0 0 3


PHYSICS OF SEMICONDUCTOR JUNCTIONS: Elemental and compound semiconductors. Band structure of silicon p-n junctions and III-V compound semiconductor junctions. light emission and absorption. Creation and recombination of electron hole pairs. Lattice mediated recombination conservation of momentum. Direct and indirect band gap semiconductors. Structure of Solar PV devices and solid state lighting devices- LEDS. Factors limiting efficiency of conversion of light energy to electrical energy (PV) and vice versa (Lighting) High power LEDS.


TEXT BOOKS:
REFERENCES:

15OH25 SENSORS FOR ENGINEERING APPLICATIONS

STRAIN AND PRESSURE MEASUREMENT: Resistance strain guage, piezoelectric pressure gauge, characteristics. Electronic circuits for strain gauge, load cells. Interferometer, Fibre-optic methods. Pressure gauges Aneroid capacitance pressure gauge, ionization gauge. Using the transducers for applications.

MOTION SENSORS: Capacitor plate sensor, Inductive sensors, LVDT Accelerometer systems, rotation sensors. drag cup devices, piezoelectric devices. Rotary encoders.

LIGHT RADIATION: Color temperature, light flux, photo sensors, photomultiplier, photo resistor and photoconductors, photodiodes, phototransistors, photovoltaic devices, fiber-optic applications, light transducer, solid-state, transducers liquid crystal devices.

HEAT AND TEMPERATURE: Bimetallic strip, Bourdon temperature gauge, thermocouples, Resistance thermometers, thermistors, PTC thermistors, bolometer, Pyroelectric detector.

ELECTRONIC SENSORS: Proximity detectors – Inductive and capacitive, ultrasonic, photo beam detectors Reed switch, magnet and Hall-effect units, Doppler detectors, liquid level detectors, flow sensors, smoke sensors.

TEXTBOOKS:

REFERENCES:

15OH26 THIN FILM TECHNOLOGY


DEPOSITION MONITORING AND CONTROL: Microbalance, Crystal oscillator thickness monitor, optical monitor, Resistance Monitor. Thickness measurement: Multiple Beam Interferometer, Fizeau (Tolansky) technique - Fringes of equal chromatic order (FECO) method - Ellipsometry (qualitative only).


DIELECTRIC PROPERTIES: DC conduction mechanism - Low field and high field conduction. Breakdown mechanism in dielectric films - AC conduction mechanism. Temperature dependence of conductivity.


TEXTBOOKS:
REFERENCES:

15OH27 NONLINEAR SCIENCE AND ENGINEERING APPLICATIONS

INTRODUCTION: Dynamical systems: Linear and Nonlinear Forces, Mathematical Implications of Nonlinearity- Linear waves-ordinary differential equations (ODEs)- Partial differential equations (PDEs)- Methods to solve ODEs and PDEs- Numerical methods – Linear and Nonlinear oscillations- Nonlinear waves- Quantitative features


TEXT BOOKS:

REFERENCES:

15OH28 NONLINEAR FIBER OPTICS


OPTICAL SOLITONS AND DISPERSION MANAGEMENT: Soliton Characteristics - Soliton Stability - Bright and Dark Solitons – Other kinds of Solitons - Effect of Birefringence in Solitons - Solitons based Fiber Optic Communication System (Qualitative treatment) – Dements - Dispersion Managed Solitons (DMS). (9)


APPLICATIONS OF SOLITONS: DMS for single channel transmission – WDM transmission - Fiber Gratings- Fiber Couplers – Fiber Interferometers – Pulse Compression – Soliton Switching – Soliton light wave systems. (9)

TEXT BOOKS:
REFERENCES:

15OH29 CHAOTRONICS
3 0 0 3


TOTAL L: 45

TEXT BOOKS:

REFERENCES:

CHEMISTRY

15OH33 CHEMICAL SENSORS AND BIOSENSORS
3 0 0 3


FLUOROPHORE AND CHROMOPHORES BASED FIBEROPTIC BIOSENSORS:Enzyme Based Nonmediated Fiberoptic Biosensors - Chromophores and Fluorophore Detection -Bioluminescence and Chemiluminescence Based Fiberoptic Sensors - Bioluminescence and Chemiluminescent Reactions - Analytical Potential of Luminescent Reactions – Applications.
DETERMINATION OF METAL IONS BY FLUORESCENCE ANISOTROPY: Theory of Anisotropy Based Determination of Metal Ions - Fluorescent Aryl Sulfonamides for Zinc Determination - Removal of Zinc From Carbonic Anhydrase - Determination of Zinc Using Reagent Approach - Determination of Copper and Other Ions By Using Reagentless Approach. (9)

TEXT BOOKS:

REFERENCES:

15OH37 ENERGY STORING DEVICES AND FUEL CELLS


SECONDARY BATTERIES: Fabrication - Performance Aspects and Rating of Lead Acid and Sealed Lead Acid Battery - Nickel-Cadmium - Ni-Meta-Hydride Lithium Ion Batteries - Rechargeable Zinc Alkaline Batteries and Thermal Batteries. (9)

ADVANCED BATTERIES: Metal / Air - Zinc-Bromine - Sodium-Beta Alumina and Lithium / Iron Sulphide Batteries - Photogalvanic Cells - Battery Specifications for Cars - Heart Pacemakers - Torpedo Batteries - Satellite Batteries. (9)

FUEL CELLS: Classification - Working Principle - Components - Applications and Environmental Aspects of Alkaline - Phosphoric Acid - Solid Oxide - Molten Carbonate - Direct Methanol and Proton Exchange Membrane Fuel Cells. (9)


TEXT BOOKS:

REFERENCES:

15OH39 MODERN ELECTRONIC MATERIALS

MATERIALS FOR ORGANIC ELECTRONICS: Organic Thin Film Transistors and Conducting Polymer Based Electrochemical Transistors - Electroluminescence - Electrochromic - Photoelectrochromic Materials - Nanowires - Nanoswitches - Nanotransducers - Nanooptical Sensors. (9)


TEXT BOOKS:

REFERENCES:

COMPUTER APPLICATIONS

150H49 HIGH PERFORMANCE COMPUTING

3 0 0 3


PARALLEL COMPUTERS: Parallel architectures -Trends in architectures, CMPs, GPUs, and Grids, Multiprocessors, Multicomputers, Multithreading. Pipelining - Data access optimization - Balance analysis and lightspeed estimates - Storage order - Taxonomy of parallel computing paradigms - Shared memory computers - Distributed memory computers - Hierarchical systems – Networks - Basics of parallelization- Parallelism – Parallel scalability.


PRINCIPLES OF PARALLEL ALGORITHM DESIGN: Preliminaries - Decomposition techniques - Characteristics of tasks and interactions - Mapping techniques for load balancing - Methods for containing interaction overheads - Parallel algorithm models – Basic communication operations.


Total L: 45

TEXT BOOKS:

REFERENCES:

150H50 MAINFRAME SYSTEMS

3 0 0 3

EVOLUTION OF MAINFRAME: Overview of Computer Architecture -Classification of Computers -micro, mini, mainframes and super computer -key features – benefits.

MAINFRAME SYSTEM - Attributes of Mainframes - Reasons for opting Mainframes - Users of Mainframes - Difference between Centralized and Distributed computing - Batch processing - Online/Interactive transactions.

MAINFRAME WORKLOADS: Concept - strategy and benefits of the z/OS environment - Application enablement in z/OS - Overview of e-business support in z/OS - Connectivity to the z/OS environment - Security support provided by z/OS

SYSTEM MANAGEMENT: Scalability – availability - backup and recovery features in z/OS - z/OS system services - zSeries processor configurations.

COBOL: Introduction to COBOL - Program Structure - Procedure Division - Table Handling - File Handling.
CASE STUDY : z/VM – Linux – zVSE – zTPF.

TEXT BOOKS:

REFERENCE:

15OH51 Mobile Application Development


BUILDING MENUS: Menus and types – Creating menus through XML – Creating menus through coding – Using the ActionBar – Drop-down List ActionBar.


PUBLISHING ANDROID APPLICATIONS: Setting versioning information – Signing and publishing the applications – Distributing applications - Monetizing the applications.

TEXT BOOKS:

REFERENCE:

15OH54 Programming in Python

BASICS : Python - Variables - Executing Python from the Command Line - Editing Python Files - Python Reserved Words - Basic Syntax-Comments - Strings and Numeric Data Types - Simple Input and Output.


ERROR HANDLING: Run Time Errors - Exception Model - Exception Hierarchy - Handling Multiple Exceptions - Data Streams - Access Modes Writing - Data to a File Reading - Data From a File - Additional File Methods - Using Pipes as Data Streams - Handling IO Exceptions - Working with Directories.


TEXT BOOKS:

Total L: 45
REFERENCES:

15OH55 RESPONSIVE WEB DESIGN


CASCADE STYLE SHEETS: Introduction - Levels of Style Sheets - Style Specification Formats - Style Classes - Properties and Property Values - Color - The span and div Tags.

HTML5: Media Queries supporting different viewports - Syntax - Fluid Layouts - Fluid Images - Serving Different Images for different screen sizes - HTML 5 for responsive designs - semantic elements in HTML5 - Embedding Media in HTML5.

CSS3: Selectors - Typography and Color Modes - Aesthetics with CSS3 - Text shadows - Box shadows - Background Gradients - patterns - Multiple Background Images Transitions - Transformations and Animations Forms with HTML5 and CSS3.


TEXT BOOKS:

REFERENCE:

15OH56 SOCIAL WEB MINING


STRUCTURAL PROPERTIES OF SOCIAL NETWORKS: Notions of centrality - cohesiveness of subgroups - roles and positions - structural equivalence - equitable partitions.


WEB LINKAGE MINING: Hyperlinks- co-citation and bibliographic coupling- page rank and HITS algorithm – web community discovery – web graph measurement and modelling - using link information for webpage classification.

TEXT BOOKS:

REFERENCES:
HUMANITIES

15OH61 AN INTRODUCTION TO INDIAN CONSTITUTION

PREAMBLE AND ITS PHILOSOPHY: Introduction and Evolution of Indian Constitution preamble and its Philosophy. (4)

CENTRE-STATE RELATIONS: Directive Principles of State Policy, Fundamental Rights and Duties, Centre-State Relations. (6)

UNION GOVERNMENT: Powers, Functions and Position of President, Vice-President and Council of Ministers. (6)


JUDICIARY: The Union Judiciary - Supreme Court and High Court. (6)

PUBLIC SERVICES: All India Services, Central Civil Services, State Services, Local Services and Training of Civil Services. (5)

INTERNATIONAL POLITICS: Foreign Policy of India, Foreign Policy of USA, International Institutions like UNO, WTO, SAARC and Environmentalism. (5)

Total L: 45

TEXT BOOKS:

REFERENCES:

15OH62 ENTREPRENEURSHIP

INTRODUCTION TO ENTREPRENEURSHIP: Definition – Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs – Importance or Entrepreneurship. Seminar in R5 & R6. (5)


DEVELOPING AN EFFECTIVE BUSINESS MODEL: The Importance of a Business Model – Starting a small scale industry - Components of an Effective Business Model. (5)

APPRAISAL OF PROJECTS: Importance of Evaluating Various options and future investments- Entrepreneurship incentives and subsidies – Appraisal Techniques. (8)

FORMS OF BUSINESS ORGANIZATION: Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives. (4)


THE MARKETING FUNCTION: Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process. (5)

INTELLECTUAL PROPERTY PROTECTION AND ETHICS: Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges. (4)

Total L: 45

TEXT BOOKS:

REFERENCES:
15OH63 HUMAN RESOURCE MANAGEMENT  

NATURE AND SCOPE OF HUMAN RESOURCE MANAGEMENT: Meaning and Definition of HRM, Objectives and Functions of HRM, Models of HRM, HRM in a changing Environment, Human Resource Management in the wake of Globalization. (6)

TRAINING AND DEVELOPMENT: Principles of Learning, Objectives, Types and Training Methods, Management Development: Its Meaning, Scope and Objectives. (6)

WAGE AND SALARY ADMINISTRATION: Principles and Techniques of Wage Fixation, Job Evaluation, Incentive Schemes. (5)


INTERNATIONAL HRM: Model, Variables that outline difference between local and International HRM approaches to IHRM, Linking HRM to International Expansion Strategies. (6)

TRENDS IN HR: HR Outsourcing – HRIS – Management of Turnover and retention – Workforce Rationalization – Managing Separation and Rightsizing – Case studies in Trends in Employee Engagement and Retention. (6)

Total L: 45

TEXT BOOKS:

REFERENCES:

15OH64 INDUSTRIAL PSYCHOLOGY  

INDUSTRIAL PSYCHOLOGY: Introduction – Concept and Meaning – Characteristics and Scope. (3)


PERCEPTION AND ATTITUDE: Importance of Perception – Need for Shaping Perception – Workplace Attitude. (3)


INTERPERSONAL RELATIONSHIP: Managing emotions – Emotional Intelligence – Building Interpersonal Relations– Managing the Boss – Dealing with Subordinates. (6)

STRESS: Dynamics – Types – Signs – Causes – Workplace Stress and Coping Strategies. (4)

ORGANISATION CULTURE: Meaning – Types – Importance – Changing Organizational Culture and Matching People with Organizational Culture – Working Environment. (5)

INDUSTRIAL FATIGUE BOREDOM: Types of Industrial Fatigue – Symptoms – Causes and Remedies of Industrial Fatigue Industrial Boredom – Causes – Effective Ways to Reduce Boredom. (6)

JOB SATISFACTION: Job Satisfaction – Consequences – Tips for Reducing Job Dissatisfaction. (3)

TEXT BOOKS:  

REFERENCES:  

15OH65 PRINCIPLES OF MANAGEMENT  

PRINCIPLES OF MANAGEMENT: Meaning, Definition and Significance of Management, Basic Functions of Management – Planning, Organizing, Staffing, Directing and Controlling.  

ENGINEERS AND ORGANIZATIONAL ENVIRONMENT: Social, Economic, Technological and Political. Social Responsibility of Engineers.  

MANAGEMENT CONCEPTS: MBO, Theory Z, Kaizen, Six Sigma, Quality Circles and TQM. (Case Study)  

BUSINESS PROCESS REENGINEERING: Need for BPR, Various phases of BPR, Production and Productivity in six sigma and TQM – Factors Influencing Productivity.  

ORGANISATIONAL BEHAVIOUR: Significance of OB, Role of Leadership, Personality and Motivation, Stress, Attitudes, Values and Perceptions at work.  

INDUSTRIAL AND BUSINESS ORGANIZATION: Growth of Industries (Small Scale, Medium Scale and Large Scale Industries). Forms of Business Organizations. Resource Management – Internal and External Sources.  

MANAGING INFORMATION: Why Information Matters – Strategic Importance of Information – Cost of Useful Information – Getting and Sharing Information.  


TEXT BOOKS:  

REFERENCES:  

15OH66 BUSINESS STATISTICS  


DESCRIPTIVES MEASURES: Measures of central tendency, dispersion, Probability Distributions.  

SAMPLING: Definition, Selection of Statistical tools, Sampling Methods, Sampling Frame determining the sample size.  

HYPOTHESIS TESTING: ANOVA- Independent sample t test, Paired t test.  

PARAMETRIC TEST: Concept, Chi square tests for Association and homogeneity, One sample t test.  

CORRELATION AND REGRESSION: Karl Pearson Correlation, Linear regression (Both manual and software applications), Components, Trend-Method of least squares and moving averages, seasonal variation-Simple average method only.  

STATISTICAL DECISION THEORY: Uncertainty and risk and Decision tree analysis  

Total L: 45
TEXT BOOKS:

REFERENCES:

15OH67 DISASTER MANAGEMENT

INTRODUCTION: Disaster – Definition, Factors and Significance, Difference between Hazard and Disaster, History of Disasters and Types, Disaster Aids.

NATURAL DISASTERS: Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche.

MAN MADE DISASTERS: Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster.- Forest Fire-Oil fire –accident in Mines.

GEOSPATIAL TECHNOLOGY: Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping.


DISASTER MANAGEMENT: Legislative responsibilities of disaster management. Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development. -Post Disaster, Emergency Support Functions and their coordination mechanism.

GLOBAL PERSPECTIVE: Study of Environmental Impacts Induced by Human Activity, Industrial Accidents, Outbreaks of Disease and Epidemics, War and Conflicts.

TEXT BOOKS:

REFERENCES:

15OH68 FINANCIAL AND MANAGERIAL ACCOUNTING

INTRODUCTION TO ACCOUNTING: Meaning, Definition and significance of Accounting, Accounting Principles, Concepts and Conventions, Classifications of Accounts.


BASIC FINANCIAL STATEMENTS: Meaning – Types of Financial Analysis Income Statement, common analysis, trend analysis, ratio analysis, corporate cash flow, DuPont Model.

COST ACCOUNTING: Accounting for overheads, Cost sheet, Marginal and Absorption costing, Break even analysis, Effect on profits, Activity Based Costing system.

ACCOUNTING FOR DECISION MAKING: CVP Analysis -Relevant Costs and Revenue for Decision Making, Pricing Decisions, Operational Decisions, Exploring New markets, Make or buy decisions.

ACCOUNTING FOR PLANNING AND CONTROLLING: Budgets, Budgetary Control -Variance Analysis - Cost and Financial Variances.

Total L: 45
**REFERENCES:**

**15OH69 MARKETING MANAGEMENT**

3 0 0 3

**FUNDAMENTALS OF MARKETING:** Meaning & Definition, The Perspectives on Marketing, Selling Vs Marketing, Marketing Environment- Internal & External, prospects & Challenges of marketing in Global Environment. (9)

**MARKETING STRATEGY:** Formulating Marketing Strategy, Key Drivers of Marketing Strategy, Marketing Strategies- Marketing Mix Components. (7)

**COMPETITOR ANALYSIS:** Analysis of Consumer & Industrial Markets, Building Competitive Advantage. (6)


**BUYER BEHAVIOUR:** Understanding Industrial and Individual Buyer Behavior, Influencing Factors, Online Buying Behavior, Building Customer Satisfaction. (6)

**MARKETING RESEARCH & TRENDS IN MARKETING:** Marketing Information System, Marketing Research Process & Purpose, Ethics in Marketing, Online Marketing Trends. (7)

**TEXT BOOKS:**

**REFERENCES:**

**15OH70 DEFENCE PRACTICES AND DISASTER MANAGEMENT**

3 0 0 3

**HISTORY & ENVIRONMENTAL AWARENESS:** NCC- Army, Navy, Air force; Aim and Motto; Ranks and Equivalent Ranks; Honors and Awards; Organization; Training – Nation Building; Civil affairs; Social Service & Needs; Environment & Ecology; Pollution; Rain Water Harvesting; Law and Order; Corruption. (7)

**WEAPONS:** Introduction; Types of Weapons; Armed Forces Fighting Arms; Service Corps; Section Formation & Types; Firing Order; Judging Distance; Types of Land; Working Principle of Rifle, Tank, Missiles; Characteristics of supporting Rifle and its ammunition; Field Craft and Battle Craft; Fighting - Role of Fighting Arms and map reading. (7)

**DISASTER MANAGEMENT:** Definition; Types of Disaster; Elements of Disaster Management, Foundations of Disaster Studies-Review of Concepts, Organizations – NDMA, NIDM, NDMRT, NEC, Disaster Mitigation, Disaster Preparedness, Disaster Relief, Reconstruction Planning, Economic and Social Rehabilitation, Globalization and Disaster Studies, Social Science and Domains Approach. (7)

**LIFE SKILL MANAGEMENT:** Introduction; Concept of Life Skills; Internalizing of Life Skills; Self awareness and Empathy; Knowing Myself; Self care; Empathizing with others; Creative Thinking & Critical Thinking; Practicing Decision making & Problem Solving; Effective Communication – Inter Personal Relationship; Coping with Emotions & Stress; Facilitation skills – Verbal & Non verbal; Training Methodologies. (7)

**HEALTH AND HYGIENE:** Anatomy, Physiology, Microbiology – Personal and Mental Health ; Infectious and Contagious Diseases, its prevention; First Aid in common Medical Emergencies; Basics of Home Nursing; Treatment and care of Wounds and Fractures. (7)

**FIELD TRAINING:** Foot Drill; Handling-Inspection Training; MapReading; Physical Proficiency Training; Introduction to Yoga. (10)

**Total L:** 45
TEXT BOOKS:

REFERENCES:

ENGLISH

15OH75 ENGLISH AND SOFT SKILLS FOR EMPLOYABILITY 3 0 0 3

SELF MANAGEMENT AND ATTITUDES: Self Concept, Stress management, Positive attitude, Influential Skills, Initiative, Empathy, Social Etiquette (5)

COMMUNICATION STYLES: Presentation Skills, Interpersonal Communication Skills, Interviewing Skills, Verbal and Nonverbal (body language) skills, Active Listening, Professional Writing, Effective email writing (16)

TEAM WORK: Inter team cooperation, Intra team cooperation, Diversity, Productivity, Goal Setting and action (4)

LEADERSHIP SKILLS: Empowerment, Planning, Establishing Credibility, Vision & direction, Supervision, Mentoring, Decision-making, Creativity, Flexibility, Team problem solving (5)

MANAGING TIME AND PRESSURES: Managing Change, Time management, Effective meetings (5)

EFFECTIVE AND EXCELLENT CUSTOMER SERVICE: Communication with the customer- telephonic and online services, Managing conflicts or Challenging communication, Setting and resetting customer expectations, Building customer confidence, Growing customer relationship, Opportunity management, Developing team approach to meet customer needs. (10)

Total L: 45

TEXT BOOK:
Monograph prepared by the Faculty, Department of English, 2015.

REFERENCES:

15OH76 ENGLISH FOR COMPETITIVE EXAMINATIONS 3 0 0 3

READING COMPREHENSION: Focus on different levels of Comprehension- Literal, Inferential, Analytical and Critical reasoning (7)
Identifying key words and signal words, decoding the building blocks of a passage, understanding jargons and double distractors (2)

LISTENING COMPREHENSION: Micro skills and Macro skills of Listening (4)
Identifying tone and purpose, eliminating distracters in objective type questions (2)

SPEAKING: Sub skills of speaking- Genre-specific oral communication (4)

VERBAL ABILITY: Word formation and expansion, Selecting and ordering words - Identifying and correlating synonyms and antonyms - Collocations (5)
Sentence Completion (5)
Verbal analogies (3)
Spotting and correcting errors (4)

WRITING: Mapping ideas, developing points and employing Variety in sentence types (3)
Referencing, Ellipsis and substitution in writing – Skillful paragraphing (unity, coherence and cohesion) (3)
Register and Tone in Critical, Analytical writing -Useful Language for describing graphs -Expressing strong opinions (3)

Total L: 45

TEXTBOOK:
Monograph prepared by the Faculty, Department of English, 2015
REFERENCES:

15OH77 GERMAN LANGUAGE – INTERNATIONAL LEVEL A1.1

GUTEN TAG! - LEARNING: To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages; Vocabulary: related to the topic; Grammar: W – Questions, Verbs & Personal nouns I. (7.5)

FREUNDE, KOLLEGEN UND ICH - LEARNING: To speak about hobbies, jobs, learn numbers from 20; Vocabulary: related to the topic; Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural. (7.5)

IN DER STADT – LEARNING: To know places, buildings, question, know transport systems, understand international words; Vocabulary: related to the topic; Grammar: Definite & indefinite articles, Negotiation, Imperative with Sie. (7.5)

GUTEN APPETIT! – LEARNING: To speak about food, shop, converse; Vocabulary: related to the topic; Grammar: Sentence position, Accusative, Accusative with verbs. (7.5)

TAG FÜR TAG – LEARNING: To learn time related expressions, speak about family, ask excuse, fix appointments on phone; Vocabulary: related to the topic; Grammar: Preposition – am, im, um, von...bis, Possessive articles, Modalverbs. (7.5)

ZEIT MIT FREUNDEN – LEARNING: To speak about birthdays, understand & write invitations, converse in the restaurant; Vocabulary: related to the topic; Grammar: Accusative personal pronouns and prepositions. (7.5)

Total L: 45

TEXTBOOK:

REFERENCES:

15OH78 GERMAN LANGUAGE – INTERNATIONAL LEVEL A1.2

KONTAKTE - LEARNING: To arrange appointments, understand and give instructions, understand and reply letters, find information in the text, identify the situations and understand the conversation; Vocabulary: related to the topic; Grammar: Dative Preposition & Article, Accusative Possessive Article. (7.5)

MEINE WOHNUNG - LEARNING: To understand the advertisements related to flats/ho uses, describe a flat, write a text about a flat; Vocabulary: related to the topic; Grammar: Adjective with sein (sehr/zu), wechselpreposition with Dat. (7.5)

ALLES ARBEIT? – LEARNING: To describe daily routine, talk about the past, speake about jobs, position, advertisements, prepare telephone conversation; Vocabulary: related to the topic; Grammar: Conjunctions, Perfect tense (regular & irregular verbs). (7.5)

KLEIDUNG UND MODE – LEARNING: To speak about clothes, understand the conversation at shopping centers, about Berlin. Vocabulary: related to the topic; Grammar: Perfect tense (trennbare & nicht trennbare verbs), personal pronomen & verbs with Dat. (7.5)
GESUND UND MUNTER – LEARNING: To make personal statements, name body parts, understand sport activities, conversation with the doctor, get & give tips to healthy life, e mail writing; **Vocabulary:** related to the topic; **Grammar:** Imperative, Modalverbs.  

(7.5)

AB IN DEN URLAUB! – LEARNING: To suggest a city tour, describe the directions, write a postcard, describe the weather, make a complain in the hotel, speak about the trips, letter writing ; **Vocabulary:** related to the topic; **Grammar:** Adverbs (time).  

(7.5)

**APPLICATIONS OF MATHEMATICS AND COMPUTATIONAL SCIENCES**

**15OH82 OPTIMIZATION TECHNIQUES**

**LINEAR PROGRAMMING:** Graphical method for two dimensional problems – Central problems of Linear Programming – Definitions – Simplex Algorithm – Phase I and Phase II of Simplex Method.  

(8)

**CONVEX OPTIMIZATION:** Convex sets and cones- Convex functions- Convex optimization problems- linear and quadratic programs; second-order cone and semi-definite programs; quasi-convex optimization problems; vector and multi-criterion optimization.  

(5)


(7)

**INTEGER PROGRAMMING:** Gomory cutting plane methods for all integer and mixed integer programming problems - Branch and Bound method (Land – Dolg and Dakin algorithms) – Zero-One Implicit enumeration Algorithm.  

(5)


(5)

**TUTORIAL PRACTICE:**

1. Solving inequalities using Simplex, Two-phase, Dual simplex methods, Revised simplex method.
2. Finding initial basic feasible solution using (i) North-West corner rule(ii) Matrix minimum and (iii) Vogel’s approximation method and also perform optimalitytest using MODI method.
4. Gomory’s cutting plane methods for all IPP and mixed IPP.
6. Critical path for the given PERT and CPM networks.  

**TEXT BOOK:**


**REFERENCES:**


**Total L: 45**
15OH84 DATA VISUALIZATION


STATIC DATA VISUALIZATION – tools – working with various data formats

DYNAMIC DATA DISPLAYS: Introduction to web based visual displays – deep visualization – collecting sensor data – visualization – D3 framework - Introduction to Many eyes and bubble charts

MAPS – Introduction to building choropleth maps

TREES – Network visualizations – Displaying behavior through network graphs

BIG DATA VISUALIZATION – Visualizations to present and explore big data – visualization of text data and Protein sequences

TUTORIAL PRACTICE:
Note: Explore software like R, Python, Google Vision, Google Refine, and ManyEyes ; Data sets are available on Gap minder, Flowing data

1. Visualization of static data.
2. Visualization of web data.
3. Visualization of sensor data.
4. Visualization of protein data.

Total L: 30 + T: 30 = 60

TEXT BOOK:

REFERENCES:

15OH86 PERVERSIVE COMPUTING

INTRODUCTION: Past, present, future; the pervasive computing market, m-Business, challenges and future of pervasive computing - modelling key for pervasive computing - pervasive system environment interaction - architectural design for pervasive system, application examples of pervasive computing: Healthcare, Tracking, emergency information systems, home networking appliances and entertainment.

DEVICE TECHNOLOGY FOR PERVERSIVE COMPUTING: Hardware, computing devices and their characteristics - pervasive information access devices-smart identification, smart card, labels, tokens - embedded controls, smart sensors, actuators -Human-machine interfaces, Biometrics - Various operating systems for pervasive devices.


APPROACHES FOR DEVELOPING PERVERSIVE APPLICATIONS: Categorization - smart services for pervasive application development - developing mobile applications – presentation transcoding – device independent view component – heterogeneity of device platforms - Context Awareness and Mobility to build pervasive applications.

CONTEXT AWARE SYSTEMS: Modelling - mobility awareness - spatial awareness - temporal awareness - ICT system awareness - Intelligent Systems - basic concepts- autonomous systems - reflective and self-aware systems - self management and autonomic computing - complex systems.


TUTORIAL PRACTICE:
1. Create application with onClick, onKeyDown, onFocusChanged Event Handlers.
2. Create application with Toast Notifications.
3. Create application with Android's Advanced User Interface Functions.
5. Create application to Create, Modify and Query an SQLite Database.
6. Create application that Works with an Android Content Provider.
7. Create application that performs Data Storage and Retrieval from Android External Storage.
8. Create Location-Aware application that uses Proximity Alerts and Google Maps API.
9. Implementation of small packages to demonstrate all APIs.

Note: All implementations using android.

Total L: 30+T:30 = 60

TEXT BOOKS:

REFERENCES:

15OH88 CYBER SECURITY

INTRODUCTION: Security Goals, Attacks, Services and Mechanisms – Techniques – Understanding Threats. (2)


WEB SECURITY: Overview, various types of web application vulnerabilities, Reconnaissance, Authentication, Authorization (Fuzzing and Privilege Escalation), Session Management, Cross Site Scripting (XSS), Cross Site Request Forgery (CSRF), SQL Injection and Blind SQL Injection. (5)

OS SECURITY: Memory and Address protection – Access Control –file protection mechanisms –User authentication –models of security –Trusted OS design. (4)

TUTORIAL PRACTICE:
1. Design of a Client server application for a basic cryptosystem.
2. Detection of a Buffer overflow attack.
3. Packet Sniffing using Wireshark Tool to perform the traffic analysis attack.
4. Key distribution using RSA (KDC) – Key hacking.
6. Password authentication.
7. Transaction security using SQL Injection attacks.
8. Port scanning tools.
9. Performing attacks and testing with attack tools.
10. Security testing for Web applications.

Total L:30+TP:30 = 60

TEXT BOOKS:

REFERENCES:

15OH89 RANDOMIZED ALGORITHMS

INTRODUCTION: Randomized algorithms, randomized quick sort, Karger’s min-cut algorithm Las Vegas and Monte Carlo algorithms, computational models and complexity classes. (4)

MOMENT, DEVIATION AND TAIL INEQUALITIES: Occupancy problem, Markov and Chebyshev inequalities- randomized selection- coupon collector’s problem, the Chernoff bound- routing in a parallel computer- a wiring problem. (4)

PROBABILISTIC METHODS: Overview of the method – maximum satisfiability - finding a large cut, Expander graphs. (4)
MARKOV CHAINS AND RANDOMWALKS: Markov chains, Random walk on graphs - connectivity in undirected graphs – Expanders and rapidly mixing random walks. (4)

DATA STRUCTURES AND GRAPH ALGORITHMS: Random Treaps, hashing – hash tables – perfect hashing, skip lists - Fast min-cut. (4)

ONLINE ALGORITHMS: Paging problem-adversary models- paging against an oblivious adversary-relating the adversaries-the adaptive online adversary, k-server problem. (4)

PARALLEL AND DISTRIBUTED ALGORITHMS: Sorting on a PRAM – Maximal Independent sets. (3)

DERANDOMIZATION: The method of Conditional Probabilities -- Derandomizing max-cut algorithm – Constructing pairwise independent values modulo a prime - Pairwise independent – large cut. (3)

TUTORIAL PRACTICE:
1. Implementation of randomized quick sort and solve real time problems using it.
2. Find solution for s-t min-cut problem adapting min cut algorithm.
3. Implementation of randomized selection and problems related to it.
4. Implementation of treap data structure.
5. Implement the shortest path and fast min-cut algorithms.
6. Implement of randomized primality testing.

Total L: 30+TP:30 = 60

TEXT BOOKS:

REFERENCES:

15OH90 APPROXIMATION ALGORITHMS

INTRODUCTION: Definition-performance ratios, vertex-cover problem. (3)

COMBINATORIAL ALGORITHMS: lower bounding techniques and Metric TSP, multiway cut problem, the minimum k-cut problem, FPTAS for knapsack, greedy algorithms for Makespan-PTAS for minimum Makespan, Euclidean TSP. (7)

LINEAR PROGRAMMING RELAXATIONS: LP-duality, min-max relations and LP-duality, rounding applied to vertex cover-simple rounding algorithm-randomized rounding, primal dual method and vertex cover. (5)

CUTS, METRICAL RELAXATIONS AND EMBEDDINGS: multiway cut, sum multi-commodity flow, some applications of multicut, rounding for Sparsest Cut via L1 Embeddings. (5)

SEMIDEFINITE PROGRAMMING: Strict quadratic programs and vector programs, properties of positive semidefinite matrices, the semidefinite programming problem, randomized rounding algorithm, improving the guarantee for MAX-2SAT. (5)

HARDNESS OF APPROXIMATION: reduction, graphs, and hardness factors, the PCP theorem, hardness of MAX-3SAT. (5)

TUTORIAL PRACTICE:
1. Implementation of vertex-cover algorithm.
2. Implementation of Greedy algorithm for makespan.
3. Problems related to Euclidean TSP.
4. Implementation of different algorithms with rounding.
5. Implementation of applications of multicut.

**TEXT BOOKS:**

**REFERENCES:**

**15OH91 NETWORK SCIENCE**

**INTRODUCTION:** Basics of networks and graphs, random network model - degree distribution, evolution, small world property, six degrees of separation, Watts-Strogatz model, local clustering coefficient, random networks and network science.

**BARABÁSI-ALBERT MODEL:** Growth and preferential attachment, Barabási-Albert model, degree dynamics, degree distribution, diameter and the clustering coefficient, preferential attachment - absence of growth, measure, non-linearity, the origins.

**SCALE-FREE PROPERTY:** Power laws and scale-free networks, Hubs, Universality, Ultra-small property, role of the degree exponent, Generating networks with a pre-defined degree distribution.

**EVOLVING NETWORKS:** Bianconi-Barabási model, measuring fitness, Bose-Einstein condensation, evolving networks.

**DEGREE CORRELATIONS:** Assortativity and disassortativity, Measuring degree correlations, Structural cutoffs, Degree correlations in real networks, Generating correlated networks, impact of degree correlations.

**TUTORIAL PRACTICE:**
1. Implementation of Barabási-Albert model.
2. Implementation of Watts-Strogatz model.
3. Implementation of Bianconi-Barabási model.
4. Obtaining Degree correlations in real networks.
5. Case studies of the theory concepts on real networks.

**TEXT BOOK:**

**REFERENCES:**

**15OH92 APPLIED STOCHASTIC PROCESSES**

**STOCHASTIC PROCESSES:** Introduction – Classification of Stochastic Processes – Markov Chain


**RANDOM WALK MODELS:** Symmetric random walk – Random walk on graphs – Gambler's Ruin model


**GENERAL QUEUEING MODELS:** Single and Multi server Poisson Queues - Single Server Queue with Poisson input and general service– General input and exponential service Queueing models.
TUTORIALS PRACTICE:
1. Case Study for Markov Chain: Passport Credit Card Company, Manufacturing, Telecommunication
2. Case Study for generalized Markov Process: Healthy Heart Coronary Care Facility
3. Modeling Network Protocols using Queueing Models
4. Performance Evaluation of Communication Systems
5. Page Ranking Algorithms

TEXT BOOKS:

REFERENCES:

15OH93 MODELLING AND SIMULATION

PRINCIPLE OF COMPUTER MODELLING AND SIMULATION: Monte Carlo simulation. Nature of computer modeling and simulation.Limitations of simulation, areas of application. (3)

SYSTEM AND ENVIRONMENT: Components of a system - discrete and continuous systems. Models of a system - A variety of modelling approaches. (3)


DESIGN AND EVALUATION OF SIMULATION EXPERIMENTS: Input - Output analysis - variance reduction techniques - Antithetic variables - verification and validation of simulation models. (4)

DISCRETE EVENT SIMULATION: Concepts in discrete-event simulation, manual simulation using event scheduling, single channel queue, two server queue, simulation of inventory problem. (5)

SIMULATION LANGUAGES - GPSS - SIMSCRIPT - SIMULA - SIMPLE_1, Programming for Discrete event systems in GPSS, SIMPLE_1 and C. (4)

CASE STUDIES: Simulation of LAN - Manufacturing system - Hospital system. (4)

TUTORIAL PRACTICE:
1. Implement variance reduction.
2. Implement event scheduling.
4. Simulate a manufacturing system.

TEXT BOOKS:

REFERENCES:

**PATH AND TREE ALGORITHMS:** Shortest path problem, Dijkstra’s algorithm, Floyd’s algorithm for all pair shortest path, Bellman-Ford-Moore shortest path algorithm for graphs with negative length edges. Minimum weight spanning tree – fundamental cycles, cotrees and bonds, Prim’s and Kruskals’s algorithms, Chenton-Tarjan algorithm. Depth-first and breadth-first algorithms for finding blocks.

**MATCHING:** Maximum and perfect matchings, augmenting path, Berge’s, Konig’s and Tutte’s theorems, Hall’s theorem, Hungarian algorithm, Edmond-Blossom algorithm. Kuhn-Munker’s algorithm for optimal assignment.

**NETWORK FLOW:** Maximum flow in a network, minimum cut, Ford-Fulkerson algorithm, Max-flow min-cut theorem. Similarity between matching and flow theories.


**VERTEX COLORING:** Vertex coloring and bounds. Sequential coloring, largest degree first algorithms. Maximum clique and vertex coloring. Mycielski’s construction for large chromatic number.

**GRAPH ISOMORPHISM:** Isomorphism, subgraph isomorphism, László Babai’s quasi-polynomial time solution for graph isomorphism problem.

**PLANAR GRAPHS:** Euler’s formula, dual graph, Kuratowski’s theorem, 4-color problem, Wagner’s theorem. Planarity testing – Hopcraft-Tarjan algorithm.

**TUTORIAL PRACTICE:**
1. VLSI Physical design – maximum Independent set, maximum clique and minimum coloring for interval graphs, Steiner minimum tree in routing.
2. Isomorphism/subgraph isomorphism problem in Data mining - common subgraph pattern in networks, chemical compound within a chemical database.
3. Link verification using Eulerian trails.
4. Network flow – finding maximum flow in network
5. Register allocation, frequency assignment using vertex coloring
6. Traveling salesman problem using Hamiltonian concept
7. Planar graph embedding
8. Solving optimal assignment problem

**TEXT BOOKS:**

**REFERENCES:**

**OPEN ELECTIVES OFFERED BY ENGINEERING DEPARTMENTS**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**15MH02 TOTAL QUALITY MANAGEMENT**

**INTRODUCTION:** Definitions of the terms – quality planning, quality control, quality assurance, quality management, total quality management as per ISO 9002 – overview on TQM – the TQM axioms – Commitment – scientific knowledge – involvement. Consequences of total quality.

JURAN ON QUALITY: Developing a habit of quality – Juran quality trilogy – the universal break through sequence – comparison Juran and Deming approaches

CROSBY AND THE QUALITY TREATMENT: Crosby’s diagnosis of a troubled company - Crosby’s quality vaccine - Crosby’s absolutes for quality management - Crosby’s fourteen steps for quality improvement.

KAIZEN : Meaning – kaizen and innovation – the kaizen management practices – total quality control (TQC) –Ishikawa – kaizen – kanban systems – small group activities – quality control circles – comparison of kaizen and Deming’s approach


TEXT BOOKS :

REFERENCES:

DEPARTMENT OF PRODUCTION ENGINEERING

15PH07 VIRTUAL REALITY SYSTEMS AND APPLICATIONS


HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES: Visual Displays, Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces. (6)

3D USER INTERFACE INPUT HARDWARE: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces. (6)


VR IN PRODUCT DEVELOPMENT: Virtual Prototyping, Free-Form Design and Validation, Assembly Verification, Ergonomic Analysis. (3)

VR IN DESIGNING INFRASTRUCTURES: Plant Design and Construction, Building Virtual Worlds and Virtual Heritage, Navigation and Walkthrough. (3)

VR IN MILITARY: Single-Soldier Simulators, Platoon Leadership Training, Company and Battalion-Level Simulators, VESUB, VR Based Close-Range Naval Artillery Training, the Unit Trainer and the Virtual Cockpit, Distributed Mission Training. (5)

VR IN MEDICAL: Virtual Anatomy, Triage and Diagnostics, Emergency Medical Response to Bioterrorism, Endoscopic Examinations, Open Surgery, Rehabilitation. (4)

Total : L : 45

3003
VR IN ENTERTAINMENT: PC Video Games, Location-Based Entertainment.

TEXT BOOKS:

REFERENCES:

DEPARTMENT OF ROBOTICS & AUTOMATION

15RH02 INTRODUCTION TO ROBOTICS AND AUTOMATION 3003


DIRECT KINEMATICS: Dot and cross products, Co-ordinate frames, Rotations, Homogeneous Coordinates, Link co-ordinates, D-H Representation, Arm equation - Two axis, three axis, and four axis robots.

INVERSE KINEMATICS & WORKSPACE ANALYSIS: Inverse Kinematic problem, General properties of solutions, Tool configuration, Inverse Kinematics of Two axis Three axis, Four axis and Five axis robots Workspace analysis of Four axis robots.


PROGRAMMABLE LOGIC CONTROLLERS: Architecture of PLC - Types of PLC – PLC modules, PLC Configuration - Scan cycle - Capabilities of PLC- Selection criteria for PLC – PLC Communication with PC and software- PLC Wiring- Installation of PLC and its Modules.

PROGRAMMING OF PLC: Types of Programming – Bit Instructions - Timers and counters- PLC arithmetic functions PTO / PWM generation- High Speed Counter – Analog Scaling – Encoder Interfacing- Servo drive control – Stepper Motor Control.

TEXT BOOKS:

REFERENCES:
PROFESSIONAL ELECTIVES

15Z001 ADVANCED DATA STRUCTURES  3 0 0 3

AMORTIZED ANALYSIS: Amortization - Methods - Applications. (3)

HEAP STRUCTURES: Min-Max Heaps - Deaps - Leftist Heaps - Binomial Heaps - Fibonacci Heaps. (7)

SETS: Disjoint Sets - Dynamic Set Operations - Van Emde Boas Trees. (6)

SEARCH TREES: AVL Trees - Red-Black Trees - Splay Trees. (6)

MULTIDIMENSIONAL STRUCTURES: K-D Trees - Point Quad Trees - MX-Quad Trees - R-Trees - TV Trees. (9)

GRAPH ALGORITHMS: Network Flow Problems - Biconnectivity - Euler Circuits. (6)

RANDOMIZED ALGORITHMS: Random Number Generators - Skip Lists - Primality Testing - Treaps. (8)

Total L: 45

TEXT BOOKS:

REFERENCES:

15Z002 ADVANCED ALGORITHMS  3 0 0 3

PROBABILISTIC ANALYSIS AND RANDOMIZATION: Hiring Problem - Indicator Random Variables - Randomization - Probabilistic Analysis. (9)

ADVANCED RANDOMIZATION: Algorithm for Bipartite Matching - Constructing Perfect Matching - Randomized Markov Chains - Ergodicity - Time Reversal. (9)


ONLINE ALGORITHMS: Streaming and Dynamic Algorithms - Ski Rental Problem - River Search Problem - The K-Server Problem - List Ordering and Move-to-Front. (9)


Total L: 45

TEXT BOOKS:

REFERENCES:

15Z003 CLOUD COMPUTING  3 0 0 3


CLOUD COMPUTING ARCHITECTURE AND SERVICE MANAGEMENT: Introduction - Cloud Reference Model - Types of Clouds - Economics of the Cloud - Storage as a Service - Database as a Service - Information as a Service - Process as a Service - Application as a Service - Platform as a Service - Integration as a Service - Security as a Service - Management as a Service - Testing as a Service - Infrastructure as a Service.


REFERENCES:

TEXT BOOKS:

REFERENCES:

15Z004 PROGRAMMING PARADIGMS


FIXED POINTS: Recursive Definitions - Iterative Fixed Point Technique - Partial Orders - Complete Partial Orders (CPOs) - Pointedness - Monotonicity and Continuity - Least Fixed Point Theorem - Fixed Point Examples - Continuity and Strictness - Reflexive Domains.


TEXT BOOKS:

REFERENCES:

15Z005 SERVICE ORIENTED ARCHITECTURE


TEXT BOOKS:

REFERENCES:

15Z006 XML AND WEB TECHNOLOGY


XML PROGRAMMING: DOM API - JDOM API - XML Data Binding - SAX API - TypeSafe XML Programming Languages - XDUCE - XACT.


PROGRAMMING WEB APPLICATIONS WITH SERVLETS: Writing Web Applications - The Servlet API - Running Web Applications - Advanced Features - Listeners - Filters - Request Dispatchers - Security - Limitations of Servlets - Web Applications with JWIG.


TEXT BOOKS:

REFERENCES:

15Z007 SEMANTIC WEB TECHNOLOGY


APPLICATIONS: Horizontal Information Products at Elsevier - Data Integration at Audi - Skill Finding at Swiss Life - Think Tank Portal at Enersearch - E-Learning - Web Services. (7)

TEXT BOOKS:

REFERENCE:

15Z008 INTERNET OF THINGS 3003


APPLICATIONS: The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering - Synchronisation and Software Agents. Applications - Smart Grid - Electrical Vehicle Charging. (9)

TEXT BOOKS:
2. Charalampos Doukas, "Building Internet of Things with the Arduino", Create Space, April 2002.

REFERENCES:

15Z009 PARALLEL PROGRAMMING 3003

INTRODUCTION: Computational Demands of Parallel Processing - Mechanisms of Implementing Parallel Processing - Parallel Processing Terminologies - Major Issues in Parallel Processing. (8)

PARALLEL ARCHITECTURES: Loosely Coupled Systems - Tightly Coupled Systems - Interconnection Networks: Linear and Ring - Shuffle Exchange - Two Dimensional Mesh - Hypercube. (8)

**MPI PROGRAMMING**: MPI Model - MPI Program Structure - Collective Communication - Data Decomposition - Communicators and Topologies - Point-to-Point Communication - Advanced Concepts in MPI - Example Programs.


**TEXT BOOKS**:

**REFERENCES**:

**15Z010 OPEN SOURCE SYSTEMS**


**OPEN SOURCE PROGRAMMING LANGUAGES**: Introduction to Open Source Programming and Scripting Languages - Execution Environment - Programming in Web Environment - File Handling and Data Storage - Working with Forms - Case Study: PHP - Python.


**TEXT BOOKS**:

**REFERENCES**:

**15Z011 SOFTWARE PROJECT MANAGEMENT**


PROJECT SCHEDULING AND TRACKING: Basic Concepts - Project Scheduling - Defining a Task Set for the Software Project - Defining a Task Network - Scheduling - Earned Value Analysis. (9)


TEXT BOOKS:

REFERENCES:

15Z012 SOFTWARE TESTING AND QUALITY ASSURANCE 3 0 0 3


TEXT BOOKS:

REFERENCES:

15Z013 USER INTERFACE DESIGN 3 0 0 3

HCI FOUNDATION: The Human - The Computer - The Interaction - Paradigms for Interaction. (8)

USABILITY ENGINEERING: Definition - UI Generations - Evaluation - Lifecycle - Classification of Users - Prototyping - Usability Testing Stages. (9)


REFERENCES:

REFERENCES:
1. NPTEL, “HCI”, http://www.nptel.ac.in/syllabus/106103115/

15Z014 STORAGE MANAGEMENT


TEXT BOOKS:

REFERENCES:

15Z015 SOFT COMPUTING


15Z016 EVOLUTIONARY COMPUTING


15Z017 MACHINE LEARNING

INTRODUCTION: Need - Relevant Disciplines - Learning Problem - Designing a Learning System - Perspectives and Issues - Evaluating Hypothesis. (4)


INSTANCE BASED LEARNING: Instance Based Learning: KNN Learning - Locally Weighted Regression - Radial Bias Functions - Case-Based Reasoning. (5)


TEXT BOOKS:

REFERENCES:

15Z018 COMPUTER GRAPHICS


VISIBLE SURFACE DETECTION METHODS: Classification - Back-Face Detection - Depth-Buffer - Scan-Line - Depth Sorting - BSP - Tree Methods - Area Sub-Division - Octree Methods.

COMPUTER ANIMATION: Design of Animation Sequence - General Computer Animation Functions - Raster Animation - Computer Animation Languages - Key Frame Systems - Motion Specifications - Color Models.

REFERENCES:

15Z019 BASICS OF DIGITAL SIGNAL PROCESSING


REALIZATION OF DISCRETE TIME SYSTEMS: Basic Structures for FIR Systems - Direct Form - Cascade Form - Basic Structures for IIR Systems - Direct Form - Cascade Form - Parallel Form - Feedback in IIR Systems - Transposed Forms.

DISCRETE SPECTRAL ANALYSIS: Discrete Fourier Transform (DFT) - Properties - Fast Fourier Transform - Decimation in Time and Decimation in Frequency Algorithms.

FINITE WORD LENGTH EFFECTS: Finite-Precision Numerical Effects - Number Representation - Effects of Coefficient Quantization - IIR Systems - Poles of Second Order Quantized Sections - FIR Systems - Effects of Round off Noise in Digital Filters - Zero Input Limit Cycles in Fixed Point Realizations of IIR Digital Filters.
TEXT BOOKS:

REFERENCES:

15Z020 UNIX INTERNALS


INTERNAL REPRESENTATION OF FILES: Inode - Structure of a Regular File - Directories - Conversion of a Path Names to an Inode - Superblock - Inode Assignment to a File - Allocation of Disk Blocks - Other File Types. (9)


TEXT BOOK:

REFERENCES:

15Z021 WIRELESS NETWORKS


TEXT BOOKS:

REFERENCES:
1. Jochen Schiller, "Mobile communications", Pearson Education, New Delhi, 2008,
ONE CREDIT COURSES
OFFERED BY THE DEPARTMENT

15ZF01 VIRTUAL MACHINE FUNDAMENTALS 1 0 0 1
INTRODUCTION: Core Concept - Examples - Types - Economics of Virtualizing - Use Cases - Key Technical Challenges. (2)


HARDWARE ARCHITECTURE EVOLUTION AND ROLE OF VIRTUALIZATION: Hardware Assist for System Virtual Machines - Hardware Assist for Program Virtual Machines - Case Study: VMX Instruction Set. (2)

REFERENCES:

15ZF02 SOA AND BUSINESS MASHUPS 1 0 0 1
INTRODUCTION: What is SOA - Advantages of SOA - SOA Design Patterns. (2)


LAB/HANDS ON/EXERCISE: Assignments and Projects. (4)

HARDWARE ARCHITECTURE EVOLUTION AND ROLE OF VIRTUALIZATION: Hardware Assist for System Virtual Machines - Hardware Assist for Program Virtual Machines - Case Study: VMX Instruction Set. (5)

REFERENCES:

15ZF03 DESIGN AND DEVELOPMENT OF ENTERPRISE APPLICATIONS USING .NET 1 0 0 1
INTRODUCTION: Why .NET - Design and Development of Enterprise Applications - Trends - Challenges. (2)


LAB / HANDS ON / EXERCISE: Assignments - Projects using .NET. (8)

REFERENCES:
15ZF04 OPERATING SYSTEM PERFORMANCE - WORKLOAD CONSIDERATIONS, TESTING & MEASUREMENT

INTRODUCTION: Workload Definition - Elements of OS Performance - CPU - I/O - Memory and Disk - Network - Elements of a Performance Test - Load - Stress - Endurance - Spike - Volume - Scalability - Throughput. (2)


CASE STUDY: Comparison of a Specific Workload on Windows & Linux - Performance in a Virtualized World - Distributed Systems & Performance. (3)

HANDS ON: Assignments and Projects. (3)

REFERENCES:

Total L: 15

15ZF05 MULTI-CORE TECHNOLOGY AND PROGRAMMING

PARALLEL ARCHITECTURE AND TERMINOLOGY: Processor Technology Trends - Architecture Trends. (1)

MULTI-CORE ARCHITECTURES: Traditional Architectures - Transition to Multi-Core. (2)

PROGRAMMING THE MULTI-CORE: Programming - OS Interaction - Applications - Synchronization and Scheduling. (11)

PROGRAMMING PARADIGMS: Threading as a Parallel Programming Model - Virtual Environments. (1)

REFERENCES:

Total L: 15

15ZF06 GAME PROGRAMMING

INTRODUCTION TO GAME DESIGN AND DEVELOPMENT: History - Video Games and Development - Programming Languages - Game Engines - Freeware and Commercial Game Engines - Platforms. (2)


GAME MECHANICS: Game Loop - General Flow of Game Loop - Initialization and Shutdown: Modules - Importance - Default Way Of Game Programming - Input APIs - Input Interfaces. Introduction: Keyboard - Mouse - Controllers - Move - Kinect FSM Finite State Machines. Game Data Structures: Importance - Implementation - Multi Threaded Game - General Game Threads - Complexities. (2)

GAME ENGINE: Physics - Collision Detection - Euler Integration - Audio System Importance - Types of Audio in Game - AI - A* Path Finding Algorithm. (2)


REFERENCES:

Total L: 15
15ZF07 DATABASE SYSTEMS IN PRACTICE

PROFILING DATABASES: Profiling Databases and Building a Framework - Implications of Database Transaction Isolation Levels - Maintaining Backward Compatibility. (7)

Tuning: Tune/Change Product Behavior without Building a New Version - Finding a Fix for Problems that are Very Hard to Reproduce. (5)

SIMULATION AND TRACING: Demonstration - Tracing and Logging Capabilities in Java - Python. (3)

REFERENCE:

Total L: 15

15ZF08 DESIGN OF DATABASE QUERY COMPILER

PARSER: Parse Trees - Parse Trees Vs Logical Query Plans - Traditional Programming Language Parser - Parser for SQL. (3)

BASIC LAWS FOR OPTIMAL QUERY PLANS: Pushing Selections and Predicates - Duplicate Elimination - Grouping and Aggregation. (3)


QUERY PLAN ARTIFACTS AND ANALYSIS: IN List to 'OR' Predicates - Physical Plan Representation - Picasso - Finding Defects in the Query Optimizer. (4)

REFERENCE:

Total L: 15

15ZF09 SOFTWARE PRODUCT DEVELOPMENT AND MANAGEMENT

INTRODUCTION AND FOUNDATION: Introduction to Software Product Development Methodology - Phases - Roles - Responsibilities. (2)

PRODUCT PLANNING: Product Envisioning - Conceptualize Product - Product Roadmap - High-Level Planning. (2)

PRODUCT DEVELOPMENT: Initiation - Architecture and Design - Testing Approach - Release Planning - Iterative Development - Design by Feature - Build by Feature - Certify by Feature - Continuous Build and Integration. (4)

PRODUCT RELEASE: Alpha Release / Product Qualification - Beta Release - Product Training Planning. (2)

PRODUCT SALES AND MARKETING: Product Sales and Marketing Approach - Product Legal and Compliance Management - Product Market Rollout. (1)

SERVICES AND SUPPORT: Product Support - Product Governance - Monitoring and Control Through-Out Entire Product Lifecycle. (1)

CASE STUDY. (3)

REFERENCES:

Total L: 15

15ZF10 TEST AUTOMATION USING OPEN SOURCE TOOLS


ALERTS, FRAMES, AND WINDOWS: Interacting with Alerts, Frames, Windows, Exceptions. (3)

SELENIUM GRID: Introduction, Grid Components - Starting Hub and Node, Integrating Script with Selenium Grid. (4)

Total L: 15

TEXT BOOKS:

REFERENCES:

15ZF11 IOT FOR TELECOMMUNICATION SYSTEMS


IOT SYSTEM INTEGRATION: Sending and Receiving Data from Sensors Over Wireless Protocols - Sensor Data Insertion into DB Using REST API - DB Integration With GUI (Query From GUI, Control From GUI) - Device Management and Analytics from GUI - End to End Integration. (3)

Total L: 15

REFERENCES:

OFFERED BY THE DEPARTMENT OF HUMANITIES

15OF01 EXPORT - IMPORT MANAGEMENT

INTRODUCTION: Export – Import Business – Preliminaries for starting Export – Import Business Registration. (3)

EXPORT PROCEDURES: Obtaining an Export License – Export Credit Insurance – Procedures and Documentation. (4)

FOREIGN EXCHANGE: Finance for Exports – Pricing - Understanding Foreign Exchange Rates. (3)

IMPORT PROCEDURES: Import Policy – License - Procedure and Documentation. (3)

EXPORT INCENTIVES: Incentives – Institutional Support. (2)

Total L: 15

REFERENCES:
15OF02 INSURANCE & RISK MANAGEMENT

INTRODUCTION TO RISK MANAGEMENT: Risk in Our Society.

INSURANCE AND RISK: Client Side – Components of the Costs of Risk.


REFERENCES:

Total L: 15

15OF03 VALUES AND ETHICS AT WORK PLACE

HUMAN VALUES AND ETHOS: Meaning and Significance of Values – Sources of Individual Values - Value crisis in the Contemporary Indian Society – Moral and Ethical Values.

APPLICATION OF VALUES: Relevance of Values in Management – Personal Values and Values at Work place – Values for Managers.


SHARED VALUES IN THE ORGANIZATION AND ITS IMPACT: Need to identify and share values – the Value Construct and How to Promote Shared Values.

UNIVERSAL VALUES: Cross Cultural Values - Impact of Culture on Organizations and Managing Workforce Diversity.

REFERENCES:

Total L: 15

15OF04 DEVELOPMENT OF INDUSTRIALISATION

EVOLUTION OF MODERN ECONOMY- Colonialism, Capitalism and economic development.

AMERICAN HISTORY- Before and After European arrival.

ROLE SLAVERY and trade in America.

INDIAN ECONOMY – Pre and Post Independence,

INDUSTRIALIZATION IN ASIA AND AFRICA – Colonialism – anti-colonialism and Socialism.

REFERENCES:

Total L: 15

15OF05 CREATIVITY AND SOCIAL ENTERPRISE

CREATIVITY- Understanding the creative skills
WAYS TO IMPROVE creativity and exercises.  

INNOVATION – Process of Innovating new ideas - Importance of Innovation.  

ENTREPRENEURIAL skills and development – Intrapreneurship.  


REFERENCES:  

15OF06 SOCIAL AND PSYCHOLOGICAL WELL BEING  

DEFINING SOCIAL PSYCHOLOGY and social influences on behavior.  

ANALYSIS OF SOCIAL and psychological problems and the solutions to address social problems.  

ROLE OF SPORTS AND GAMES, yoga practices, tracking and outdoor activities in addressing social and psychological problems.  

ORIGINS OF PSYCHOLOGICAL DISORDER – roots of social anxiety - prevention of psychological disorders.  

NATURE OF INTERVENTIONS – Evaluation of Interventions and implementing the interventions.  

REFERENCES:  

15OF13 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT  


TYPES OF SECURITY: Trading – Orders, Margin Trading – Clearing and Settlement Procedures.  

SECURITY ANALYSIS: Industry Analysis – Company Analysis.  

PORTFOLIO: Measuring Risk and Returns and Treatment in Portfolio Management.  

REFERENCES:  

15OF14 IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM  

INTRODUCTION – Need for Quality – Definitions of Quality – Dimensions of Product and Service Quality – Basic Concept of TQM – Contributions of Deming, Juran and Crosby – Barriers to TQM.  


REFERENCES:

15OF15 FINANCIAL MANAGEMENT

INTRODUCTION: Meaning of finance - Definition of financial management - Scope of Financial Management - Functions of Financial Manager. (2)

OBJECTIVE OF FINANCIAL MANAGEMENT: Profit Maximization and Wealth Maximization. (4)

CAPITAL STRUCTURE: Designing of Capital Structure - Profitability and Liquidity Aspects. (4)

DIVIDEND POLICY: Determinants of Dividends- Bonus share – Tax aspects. (3)

CORPORATE RESTRUCTURING: Merger and Acquisition (M&A) - Case Studies. (2)

REFERENCES:

15OF16 PERSONALITY DEVELOPMENT THROUGH TRANSACTIONAL ANALYSIS

EXPLORING THE PERSONALITY - Structural Ego states - Functional Ego states. (2)

MOTIVATION – Strokes Maslow’s Hierarchy of Needs. (4)

INTERPERSONAL RELATIONSHIP - Time Management – Transactions - Time Structuring. (4)

STRESS MANAGEMENT - Working Styles – Contamination. (3)

ASSERTIVENESS AND LEADERSHIP SKILLS - Life positions – Competency. (2)

REFERENCES:
OFFERED BY THE DEPARTMENT OF ENGLISH

15OF10 CORPORATE COMMUNICATION

INTRODUCTION: Basics of Corporate Culture, Etiquette, Code governing manners and conduct, Personal Grooming, People relationship, Worthy goals/ideals. (3)

ORAL COMMUNICATION: Communicating in Organizational Settings - Recognizing effective Communication - Mastering Listening and Nonverbal Communication Skills - Overcoming Barriers to Communication - Communicating in Teams and adapting to Cross Cultural Communication contexts. (4)

WRITTEN COMMUNICATION: Planning, Writing, and completing business messages - Writing messages for Electronic Media - Creating effective E-mail messages - Writing routine and positive and negative messages - Writing persuasive messages – Training on writing Reports and proposals – Mastering the Format and layout of Business Documents. (5)

Presentation and Negotiation Skills. (3)

REFERENCES:

15OF11 INTERPERSONAL AND ORGANIZATIONAL COMMUNICATION

UNDERSTANDING ORGANIZATIONAL COMMUNICATION: Communication Networks in an Organization; Intra- organizational communication; Inter-organizational communication; Flow Nomenclature; Workplace diversity and intercultural aspects of communication (4)

COMMUNICATION FUNCTIONS IN ORGANIZATIONS: Teamwork and team dynamics; Conflict resolution strategies and styles; Leading and influencing others-facilitation skills (3)

WRITTEN COMMUNICATION: Email Writing, Professional Reports, and Memos (4)

INTERPERSONAL SKILLS: Nature and Dimensions of Interpersonal Communication; Personality and Communication styles; Active listening and intentional responding; Working with emotional intelligence. (4)

REFERENCES:

15OF12 HUMAN VALUES THROUGH LITERATURE


DRAMA: Karnad, Girish, Tughlaq – Statesmanship and friendship (3)

ONE-ACT PLAY: Chekhov, Anton. The Bear – Love (1)

SHORT STORY: Maugham, Somerset. “Mr. Know-All” – Empathy, Desai, Anita. “Devoted Son” – Family Bond. (2)

NOVEL: Murthy, Sudha. Gently Falls the Bakula – Gender equality (2)

REFERENCES:
3. Additional readings on individual texts

Total L: 15 hrs
OFFERED BY THE DEPARTMENT OF MATHEMATICS

15OF21 PRINCIPLES OF BUSINESS ANALYTICS

PREDICTIVE ANALYTICS: CLASSIFICATION AND DISCRETE CHOICE PROBLEMS: Simple linear regression - multiple linear regression model development and diagnostics - analysis of transactional data using binary logistic and multinomial logistic regression models - discrete choice models, non-linear regression. Classification Trees, Classification and Regression Tree (CART) - forecasting.


REFERENCES:

Total L: 15