SEMESTER - 1

19Z101 CALCULUS AND ITS APPLICATIONS

3 1 0 4

DIFFERENTIAL CALCULUS : Functions of two variables, limit, continuity, partial derivatives, differentiability, linearization and total differential, extreme values and saddle points, Taylor's formula for two variables. (9 + 3)

MULTIPLE INTEGRALS I : Double integrals over rectangles, double integrals as volumes, Fubini's theorem, double integrals over general regions, changing the order of integration, double integrals in polar form, applications to area, volume. (9 + 3)

MULTIPLE INTEGRALS II : Triple integrals in rectangular coordinates, spherical and cylindrical coordinates, applications to volume. (9 + 3)

SECOND ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS : Homogeneous equations with constant coefficients, superposition principle, initial value problem, general solution, Euler-Cauchy equation, non- homogeneous linear equations, method of variation of parameters, modeling of electric circuits. (9 + 3)

VECTOR CALCULUS : Directional derivative and gradient vectors, vector fields, divergence, curl. Integration in vector field - line integrals, work, circulation and flux, path independence. Green's, Gauss divergence and Stokes's theorems. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:
1. Maurice D. Weir, Joel Hass, Christopher Heil "Thomas' Calculus", Pearson Education., New Delhi, 2018
2. Erwin Kreyszig "Advanced Engineering Mathematics", Wiley India Pvt Ltd., New Delhi, 2015

REFERENCES:
1. Gilbert Strang "Calculus", Wellesley-Cambridge Press., USA, 2017
2. Marsden J E, Tromba A J, Weinstein A "Basic Multivariable Calculus", Springer Verlag., NewYork, 2019
3. James Stewart "Multivariable Calculus", Cengage Publishing., Boston, 2017
4. Howard Anton, Irl Bivens, Stephen Davis "Calculus", John Wiley and Sons, INC., USA, 2016

19Z102 ELECTRICAL AND ELECTRONICS SYSTEMS

3 0 0 3

DC CIRCUIT : current-voltage –power-energy, electrical circuit elements: resistors-inductor- capacitor, source of electrical energy. Ohm's law-Kirchhoff's laws, series and parallel circuits, Maxwell's loop current method, Network theorems: superposition theorem-thevenin'stheorem-Norton'stheorem-maximum power transfer theorem. (9)

AC CIRCUITS : Single phase AC circuits: Average and RMS values of sinusoidal wave form-RLC Circuit-Phasor representation-active ,reactive apparent power –power factor, analysis of RLC Circuit, three phase circuit: star and delta connection-phase and line quantities-balance and unbalance systems (9)

ELECTROMAGNETISM AND MAGNETIC CIRCUITS : Electromagnetic induction: induced currents, Faraday's law, induction and energy, motional emf and Lenz's law. Magnetic field-magnetic circuit-inductance and mutual inductance-magnetic materials –ideal transformers and real transformers (8)

SEMICONDUCTOR DEVICES : Basic diode concepts-diode circuit: half wave rectifier-full wave rectifier-bridge rectifier-special purpose diodes-zener diode –transistor fundamentals –transistor biasing- bipolar junction transistors-basis amplifier concept-loading effect-power supplies and efficiency. (10)

OPERATIONAL AMPLIFIERS : Definition of terms — Inverting and non-inverting amplifiers, inverting summing amplifier, integrators and differentiators. (9)

Total L: 45

TEXT BOOKS:
1. John Hiley, Keith Brown, Ian McKenzie Smith, Edward Hughes "Electrical and Electronic Technology", Pearson education., New Delhi, 2016 , twelfth edition
2. Murugesh Kumar K "Basic Electrical Science and Technology", Vikas Publishing House., New Delhi, 2009

REFERENCES:
1. Leach D P "Digital Principles & Applications", Tata McGraw Hill., 2014 , eighth edition
2. Hambley A R "Electrical Engineering Principles and Applications", PHI Learning Pvt. Ltd., New Delhi, 2011
3. Boylestad R. L., Nashelsky L "Electronic Devices and Circuit Theory", Pearson Education., Noida, 2014 , eleventh edition
4. Theraja B. L. "Basic electronic Solid State", S. Chand & Company Ltd.,., New Delhi, 2010

19Z103 CHEMISTRY OF ELECTRONIC MATERIALS

3 0 0 3

CONDUCTING PROPERTIES OF MATERIALS : Molecular orbital treatment of bonding in metals, insulators, semiconductors — direct band and indirect band, elemental, p-doped, n-doped, stoichiometric compound semiconductors and chalcogen semiconductors. Crystal defects and their influence on properties of materials — intrinsic defects - schottky and frenkel, non-stoichiometeric compounds, extrinsic defects - oxide ion conductors - applications. Nanoscale materials – Quantum dots-band gap – size dependant optical properties. (9)

POLYMERIC MATERIALS : Classification, degree of polymerization, average molecular weights, polydispersity. Polymerization reactions — chain and condensation. Thermal properties -glass transition temperature(Tg) — factors affecting Tg - determination by DSC. Mechanical properties — significance in fabrication of electronics. Electrical insulating properties - dielectric breakdown - aging of polymer insulations - discharges in voids, electrical treeing.Thermal and photochemical degradations. Additives - plasticisers, stabilisers, functional additives. (9)

FLEXIBLE ELECTRONIC MATERIALS : Conjugated polymers — electronic energy bands - mechanism of charge transport — intrachain and interchain - solitons, polarons and bipolarons. Factors influencing charge transport — structural features - defects, molecular weight, crystalline/amorphous nature, doping- oxidative and reductive. Synthesis, properties and applications of polyaniline, polythiophene and polypyrrole. Molecular electronics - graphene, fullerenes, carbon nanotubes – structure, synthesis, properties and applications. (9)

OPTOELECTRONIC MATERIALS : Electroluminescence- exciton, OLED materials– emitters- charge transfer complexes, metal chelates, polycyclic aromatic oligomers, conjugated polymers — polyphenylenes, polyfluorenes. Liquid crystalline polymers- classification of liquid crystals, chemical constitution, stability and applications.Organic and dye sensitized photovoltaics — working principle, materials, advantages and disadvantages. Preparation of ultrathin polymer films - Langmuir-Blodgett Films –self assembled monolayers. (9)

MATERIALS FOR ELECTRONICS PROCESSING : Semiconductor wafer fabrication -Overview and challenges –high purity chemicals, air filters for clean rooms, electronic grade water- quality parameters, water treatment stages for ultrapure water production — membranes and ion-exchange resins, electrodialysis. Photoresists for wafer fabrication — microlithography, resist requirements, material chemistry. Electronic packaging materials-adhesives, connectors, eutectic alloys, phase change materials-phase diagrams, applications. (9)

Total L: 45

TEXT BOOKS:

1. Lesley E.Smart, Elaine A.Moore "Solid State Chemistry - an Introduction", CRC Press., London, 2005. , fourth edition
2. Cowie J.M.G, Valeria Arrighi "Polymers: Chemistry and Physics of modern materials", CRC Press., London, 2007. , third edition

REFERENCES:

1. Bansi D. Malhotra "Handbook of Polymers in Electronics", Rapra Technology Ltd.., UK, 2002. , first edition
2. Stergios Logothetidis "Handbook of Flexible Organic Electronics Materials - Manufacturing and Applications", WoodHead publishing., London, 2015. , first edition
3. Peter Van Zant "Microchip Fabrication: A Practical Guide to Semiconductor Processing", Mc Graw Hill,., 2014. , sixth edition
4. Shashi Chawla "A Textbook of Engineering Chemistry", Dhanpat Rai and Co.., New Delhi, 2005 , first edition

19Z104 PROBLEM SOLVING AND PYTHON PROGRAMMING

3 0 0 3

INTRODUCTION TO PROBLEM SOLVING : Introduction - Problem solving and Decomposition - Abstraction - Notations - Pseudo code - Flow chart - Programming language (8)

ALGORITHMIC PROBLEM SOLVING : Algorithm Implementation - Top down design - Simple strategies for developing algorithms - Iteration - Recursion - Fundamental algorithms - Anticipating and Dealing with Errors (8)

BASICS BUILDING BLOCKS OF PYTHON : Variables - Immutable variables - Data types - Operators - Python Reserved Words - Understanding error messages (9)

CONTROL STATEMENTS AND STRUCTURED TYPES : Control Flow - Indenting - if Statement - while Loop - break and continue - for Loop - String - Lists - Tuples - Sets - Dictionaries (10)

FUNCTIONS , MODULES AND FILES : Definition - Hiding redundancy - Arguments and return values - Variable Number of Arguments - Scope - Passing Functions to a Function - Mapping Functions in a Dictionary - Lambda function - Recursive Functions - Modules: Standard Modules - OS and SYS modules - User defined Modules - Importing modules - Writing into a File - Reading from a File - File Methods (10)

Total L: 45

TEXT BOOKS:

1. R. G. Dromey "How to Solve it by Computer", Pearson Education., 2015

2. Charles Dierbach "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India., 2015

REFERENCES:

1. John V. Guttag "Introduction to Computation and Programming using Python", The MIT press., 2016
2. Paul Gries, Jennifer Campbell, Jason Montojo "Practical Programming: An Introduction to Computer Science using Python 3", Pragmatic Programmers., 2013 , Second edition
3. Robert Sedgewick, Kevin Wayne, Robert Dondero "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India., 2016
4. Karl Beecher "Computational Thinking - A beginner's guide to problem solving and Programming", BCS Learning & Development., 2017

19G105 ENGLISH LANGUAGE PROFICIENCY

2 1 0 3

LEARNING LANGUAGE THROUGH STANDARD LITERARY AND GENERAL TEXTS : Integrated tasks focusing on language skills ; Training based on Text based vocabulary, tone, register and Syntax features (12 + 0)

GRAMMAR IN CONTEXT : Word Order ; Subject Verb Concord ; Style features - Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals, Cloze and Spotting Error exercises (10 + 0)

GUIDELINES FOR WRITTEN COMMUNICATION : Principles of clear writing, Paragraph writing, Essay writing, Emphasis Techniques, Summarizing and Paraphrasing, Analytical writing (8 + 0)

FOCUS ON SPOKEN ENGLISH : Task — based activities: 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 (0 + 10)

LISTENING ACTIVITY : Task based activities using Language Laboratory. (0 + 5)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Faculty Incharge "Course Material on "English Language Proficiency", PSG College of Technology., Coimbatore, 2019

REFERENCES:

1. Jill Singleton "Writers at Work: The Paragraph", Cambridge University Press., New York, 2012
2. Simon Haines, Mark Nettle and Martin Hewings "Advanced Grammar In Use", Cambridge University Press., New Delhi, 2008
3. Anne Laws "Writing Skills", Orient Black Swan., Hyderabad, 2011
4. Sinha DK "Specimens of English Prose", Orient Black Swan., Hyderabad, 2012

19Z110 BASIC SCIENCES LABORATORY

0 0 4 2

PHYSICS (ANY EIGHT EXPERIMENTS) :

1. Determination of Hysteresis loss of a ferromagnetic material
2. Determination of resistivity of metal and alloy using Carey Foster bridge
3. Determination of Temperature Coefficient of Resistance of metallic wire using post office box
4. Determination of capacitance using LCR bridge
5. Study of reverse bias characteristics of Germanium diode and determination of its band gap
6. Study of I-V characteristics of solar cell and determination of its efficiency
7. Thermistor: Measurement of temperature and band gap
8. Study of characteristics of Photo Diode
9. Operational Amp. (741) – Inverting and non inverting modes
10. Operational Amp. (741) – Integrator and differentiator (30)

CHEMISTRY (ANY EIGHT EXPERIMENTS) :

1. Determination of hardness,TDS, pH and conductivity of a water sample.
2. Determination of molecular weight of polymers by Ostwald / Ubbelohde Viscometer.
3. Construction of phase diagram for eutectic system – for application in electronic cooling system.
4. Study of a galvanic cell.
5. Conductometric estimation of acid strength of a pickling bath.
6. Potentiometric estimation of ferrous ion in an effluent.
7. Anodizing of aluminium and determination of thickness of anodised film.
8. Preparation of chloride ion sensor by anodizing silver and calibration.
9. Electroplating of nickel & copper and determination of cathode efficiency.
10. Examination of different forms of corrosion using Ferroxyl indicator and determination of corrosion rate by current measurement. (30)

Total P: 60

REFERENCES:

1. Department of Chemistry "Chemistry Laboratory Manual", ., 2019
2. Department of Physics "Physics Practicals", ., 2019
3. Wilson J. D., Hernandez C. A. "Physics Laboratory experiments", Houghton Miffin Company., New York, 2005

19Z111 ENGINEERING PRACTICES

0 0 2 1

MODULE 1 :
1. Foundry- Tools, preparation of moulding sand, patterns, cores, foundry exercises.
2. Welding - Metal arc welding tools and equipment, exercises on arc welding and MIG welding processes.
3. Fitting - Tools, operations, exercises on “T”-Joint and “L” Joint, types of joints.
4. Carpentry- Tools, carpentry process, exercises on types of joints.
5. Plumbing-Exercises on external thread cutting and joining.
6. Sheet metal work and soldering - Tools, operations, exercise on rectangular tray using Galvanized Iron sheet. (15)

MODULE 2 :
1. Study of passive and active components (resistors, capacitors, inductors, diodes and transistor).
2. Generation of Signals (DSO, Function generator).
3. Rectification of AC wave using bridge rectifier.
4. Construction of series and parallel circuits using resistors.
5. Assembling and disassembling of PC and troubleshooting.
6. Monitoring CPU Performance. (15)

Total P: 30

REFERENCES:

1. Department of Mechanical Engineering "Engineering Practices Laboratory Manual", PSG College of Technology., Coimbatore, 2019
2. Chapman W.A.J "Workshop Technology", Edward Arnold., 2001
3. Hambley A R "Electrical Engineering Principles and Applications", PHI Learning Pvt. Ltd., New Delhi, 2017
4. Wikibooks Contributors "How to assemble your Desktop PC", Platypus Global Media., 2011
5. Govindarajalu B "IBM PC and CLONES : Hardware, Troubleshooting and Maintenance", TATA McGraw-Hill Education., 2008
6. Jeff Heaton "Build a Computer from Scratch", Heaton Research Inc., 2006

19Z112 PYTHON PROGRAMMING LABORATORY

0 0 4 2

BASICS OF PROGRAMMING:
1. Scratch Programming
2. Algorithm and Flow Chart (24)

PROGRAMMING USING PYTHON :
1. Input/Output Statements and data types
2. Applications using Decision Making statements
3. Applications using Looping Statements
4. Applications using Set
5. Applications using Lists
6. Applications using Tuples
7. Applications using Dictionary
8. Applications using Functions
9. Applications using Modules
10. Applications using Files (32)

DEBUGGING :
1. Application Debugging

(4)

Total P: 60

REFERENCES:

1. Charles Dierbach "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition., 2015
2. Kenneth Lambert "Fundamentals of Python: First Programs", Course Technology, Cengage Learning., 2016
3. John V Guttag "Introduction to Computation and Programming Using Python", MIT Press., 2015 , Revised and expanded Edition

19IP15 INDUCTION PROGRAMME

0 0 0 0

As per AICTE guidelines

SEMESTER - 2

19Z201 TRANSFORMS AND ITS APPLICATIONS

3 1 0 4

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, differentiation and integration of transforms. (9 + 3)

APPLICATION OF LAPLACE TRANSFORMS : Convolution, solving differential equations with constant coefficients and variable coefficients, integral equations, systems of ODEs by using Laplace transform technique. (9 + 3)

Z TRANSFORMS : Z transform, inverse transform, shifting theorem, convolution theorem, initial and final value theorem, difference equation, application of Z transform to solve difference equations. (9 + 3)

FOURIER SERIES : Fourier series — even and odd functions, half range expansion, convergence of Fourier series, basic concepts of PDE's, wave equation, solution by separating variables, solution of one dimensional heat equation and steady state two dimensional heat equation. (9 + 3)

FOURIER TRANSFORMS : Fourier integral, Fourier cosine and sine integrals, Fourier transform, Discrete Fourier transform, Fast Fourier transform – DIT algorithm. (9+3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley &Sons., New Delhi, 2015
2. Dean G.Duffy "Advanced Engineering Mathematics", CRC., USA, 2017

REFERENCES:

1. Peter V.O. Neil "Advanced Engineering Mathematics", Cengage., New Delhi, 2018
2. Wylie C. R. and Barrett L. C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019
3. Jain. R. K. and Iyenger. S. R. K. "Advanced Engineering Mathematics", Narosa Publishing House., New Delhi, 2018
4. Alexander D Poularikas "Transforms and Applications Primer for Engineers with Examples and MATLAB", CRC press., USA, 2010

19Z202 MATERIALS SCIENCE

3 0 0 3

QUANTUM MECHANICS : Wave particle duality, de Broglie waves- Heisenberg's uncertainty principle. Wave function-normalization. The wave equation. Schrodinger's equation of motion: Time dependent form, steady-state form. Particle in a box. Quantum Tunneling and applications to Scanning Tunneling Microscope and Tunnel diode. (9)

ELECTRICAL PROPERTIES : Conducting materials-quantum free electron theory -Fermi Dirac Statistics-Band theory of solids-the density of states. Dielectrics-types of polarization-measurement of dielectric permittivity-Loss factor-Dielectric loss mechanisms. Magnetostriction. Electron ballistics- materials for thermionic emission electron guns-electron gun for electron beam machining-electric discharge plasma-EDM machining. (9)

MAGNETIC PROPERTIES : Types of magnetic materials-domain theory-hysteresis- hard and soft magnetic materials-Applications-eddy current brakes, regenerative braking. Magnetic lenses. Superconductivity –Meissners effect- Josephson junction, SQUID magnetometer, applications of squid magnetometer- superconducting Magnets, and Magnetic levitation. (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)

STORAGE DEVICES : Computer Data Storage , Types of Storage , Primary Storage- RAM, ROM, Cache. Secondary Storage –Hard disk , Tertiary Storage — Magnetic tape, Compact disc, Digital versatile disc, Blue-ray. Off-line Storage — USB Flash drive, memory card. Storage Device Features . (9)

Total L: 45

TEXT BOOKS:

1. William D CallisterJr "Materials Science and Engineering-An Introduction", John Wiley and Sons Inc., NewYork, 2018 , tenth edition
2. Shaffer J P, Saxena A, Antolovich S D, Sanders T H Jr, Warner S B "The Science and Design of Engineering Materials", McGraw Hill Companies Inc., New york, 2000 , second editon

REFERENCES:

1. Arthur Beiser "Concepts of Modern Physics", Tata Mcgraw Hill., India, 2003 , sixth editon
2. Van Vlack "Elements Of Material Science And Engineering", Pearson Education., India, 2008 , sixth edition
3. Sze S.M "Physics of Semiconductor Devices", John Wiley and Sons., USA, 2007 , third edition
4. Donald R Askeland, Wendelin J Wright "Essentials of Materials Science and Engineering", Cengage Learning., 2013 , third edition
5. James F Shackelford S "Introduction to Materials Science for Engineers", Macmillan Publishing Company., New york, 2015 , eighth edition

19Z203 INDUSTRIAL ELECTROCHEMISTRY

2 0 0 2

ELECTROCHEMISTRY : Conductance of strong and weak electrolytes, mobility of ions - transport number, applications of conductance measurement. Electrode potential — standard and reference electrodes, Nernst equation, emf series — applications. Galvanic and concentration cells. Applications of emf measurements — glass electrode - pH measurement, potentiometric- redox titrations. (6)

CORROSION : Mechanisms - Galvanic and differential aeration corrosion. Corrosion rate — factors influencing corrosion - galvanic series. Corrosion control - corrosion inhibitors, cathodic protection - sacrificial anode, current impression, conversion coatings — anodizing — determination of thickness of anodized film. Nature inspired coatings-superhydrophobic coatings, self healing coatings. Corrosion in electronic components — control by vapour phase inhibitors. (6)

METAL FINISHING IN ELECTRONIC INDUSTRY : Electroplating — plating parameters- polarization and overvoltage, current and energy efficiency. Electroplating of Cu, Ni, and Cr. Electroless deposition of Ni and Cu. Production of plated through hole PCBs, electroforming - fabrication of CD stampers, electrochemical etching of Cu from PCBs , Electrophoretic painting, Electrochemical etching of semiconductors. (6)

ELECTROCHEMICAL POWER SOURCES : Batteries- types, characteristics. Fabrication and working of lechlanche cell, primary lithium cell, lead- acid battery, Ni-metal hydride and lithium ion batteries. Supercapacitors. Fuel cells - Classification, working principle, components, applications of proton exchange membrane, direct methanol and solid oxide fuel cells. Hydrogen as a fuel-production and storage. (6)

SENSORS : Components of electrochemical sensors, electrochemical transducers-potentiometric, amperometric and conductometric methods – ion-selective electrodes – solid-state electrode, liquid ion-exchange membrane electrodes. Gas sensors—CO_2, O_2 and NH_3 sensing. Sensors for health care—glucose and urea. (6)

Total L: 30

TEXT BOOKS:

5. Derek Pletcher and Frank C. Walsh "Industrial Electrochemistry", Chapman and Hall., London, 1993. , second edition
6. John O'M.Bockris and Amulya K. N. Reddy "Modern Electrochemistry 2B", Kluwer Academic/Plenum Publishers., New York, 1998. , second edition

REFERENCES:

1. Dell R. M. and Rand D. A. J "Understanding Batteries", Royal Society of Chemistry., UK, 2001. , first edition
2. Brian Eggins "Chemical Sensors and Biosensors", John Willey & Sons., US, 2002. , first edition
3. Zaki Ahmad, Digby Macdonald "Principles of Corrosion Engineering and Corrosion Control", Butterworth- Heinemann., London, 2013. , second edition
4. Shashi Chawla "A Textbook of Engineering Chemistry", Dhanpat Rai and Co.., New Delhi, 2005. , first edition

19Z204 DIGITAL DESIGN

3 0 0 3

NUMBER SYSTEM AND BOOLEAN ALGEBRA : Number Systems and Number-Base Conversion - Complements of Numbers (Diminished Radix Complement, Radix Complement) - Signed Binary Numbers - Arithmetic Operation with the Binary Numbers - Binary Codes(BCD,8421 Code, Gray Code, ASCII) - Boolean Algebra - Basic Theorems and Properties of Boolean Algebra - Simplification of Boolean Functions - Canonical and Standard Forms - Other Logic Operations (12)

DESIGN OF COMBINATIONAL CIRCUITS : Introductory Digital Concepts - Digital Logic Gates - Karnaugh Map Method - Don't Care Conditions - The Tabulation Method - NAND and NOR Implementation - Design Procedure - Adder - Subtractor - Magnitude Comparator - Decoders - Encoders - Priority Encoder - Multiplexers - Demultiplexers - Three State Gates - Design Examples (9)

SEQUENTIAL CIRCUITS : Introduction - Storage Elements: - Latch(S-R Latch, D-Latch) - Flip-Flops(S-R Flip Flop,D- Flip Flop, J-K Flip Flop, T-Flip Flop) - Master Slave Configuration of J-K Flip Flop - Shift Registers - Design of Asynchronous and Synchronous Counter (7)

DESIGN OF SEQUENTIAL CIRCUITS : Mealy and Moore Models of Finite State Machines(FSM) - Synchronous Sequential Logic - State Reduction and Assignment - Design Procedure - Algorithmic State Machines (ASMs) - Asynchronous Sequential Logic - Race Conditions - Design Procedure - Reduction of State and Flow Tables - Race Free State Assignment - Hazards - Design Examples (12)

MEMORY AND PROGRAMMABLE LOGIC : Introduction - Random Access Memory - Memory Decoding - Read Only Memory - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Sequential Programmable Devices (5)

Total L: 45

TEXT BOOKS:
1. M. Morris Mano, Michael D. Ciletti "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", Pearson Education., USA, 2018 , Sixth Edition
2. M. Morris Mano "Digital Logic and Computer Design", Pearson Education., India, 2017
3. Thomas L. Floyd "Digital Fundamentals", Pearson Education., USA, 2015

REFERENCES:
1. Charles H. Roth, Jr, Larry L. Kinney "Fundamentals of Logic Design", Cengage Learning., USA, 2014
2. John F. Wakerly "Digital Design: Principles and Practices", Pearson Education., USA, 2018
3. Roger L Tokheim "Digital Electronics: Principles and Applications", McGraw-Hill Education., USA, 2013
4. Ronald Tocci, Neal Widmer, Greg Moss "Digital Systems", Pearson Education., USA, 2016
5. Donald D. Givone "Digital Principles and Design", McGraw-Hill Education., USA, 2003

19Z205 C PROGRAMMING

2 2 0 4

C PROGRAMMING BASICS : Introduction to C programming - C Program Structure - Program Compilation & Execution - Character Set - Keywords - Data Types - Libraray functions - Control Statements :Branching and Looping. (3 + 4)

ARRAYS AND STRINGS : Single Dimensional Array, Two Dimensional Arrays, Multidimensional Array:Initialization, Unsized Array Initialization. - Strings : Defining, initializing of strings, Processing strings, Array of Strings - (5 + 6)

FUNCTIONS : Definition of Function - Prototypes - Storage Classes - Scope Rules - Recursion - Command Line Argument. (6 + 6)

POINTERS : Pointer Declaration - Operations on Pointer - Passing Pointers to a Function - Calling Function: Call by Value, Call by Address - Return Statement - Passing Arrays to Function - Pointers and One Dimensional, two dimensional Array - Array of Pointers - Dynamic Memory Allocation. (8 + 6)

STRUCTURES, UNION AND FILES : Definition - Processing a Structure - Typedef - Array of Structure, and Pointer to Structure - Passing Structure to Functions. - Self-Referential Structures - Nested Structures - Union - Introduction to Files - File Access - File Organization - File Operations. (8 + 8)

Total L: 30 +T: 30 = 60

TEXT BOOKS:
1. Byron S. Gottfried, Jitendar Kumar Chhabra "Programming with C", Tata McGraw Hill Publishing Company., New Delhi, 2018. , fourth edition
2. Kernighan B. W., Ritchie D. M. "C Programming Language (ANSI C)", Prentice Hall of India Private Limited., New Delhi, 2010 , second edition

REFERENCES:
1. Herbert Schildt "C – The Complete Reference", Tata McGraw Hill Publishing Company., New Delhi, 2010 , fourth edition
2. PradipDey and Manas Ghosh "Programming in C", Oxford University Press., New Delhi, 2018
3. Yashavant P. Kanetkar "Let Us C", BPB Publications., 2017 , 16th edition
4. H. M. Deitel, P. J. Deitel "C How to Program", Pearson Education., New Delhi, 2013. , seventh edition

19Z211 DIGITAL DESIGN LABORATORY

0 0 4 2

COMBINATIONAL AND SEQUENTIAL CIRCUITS :
1. Study of Digital IC Technologies
2. Verification of Logic Gates
3. Implementation of Boolean equations
4. Design and Implementation of Arithmetic Circuits
5. Implementation of Multiplexer and De-Multiplexer circuits

6. Implementation of Encoder and Decoder circuit
7. Implementation of Latches and Flip-Flops
8. Conversion between Flip-Flops
9. Implementation of Shift Registers
10. Design of Asynchronous and Synchronous Counters
11. Study of HDL
12. Implementation of Combinational and Sequential Circuits using HDL

Total P: 60

REFERENCES:

1. M. Morris Mano, Michael D. Ciletti "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", Pearson Education., USA, 2018 , Sixth Edition
2. Thomas L. Floyd "Digital Fundamentals", Pearson Education., USA, 2015

19Z213 ENGINEERING GRAPHICS

0 0 4 2

INTRODUCTION :
1. Lettering practice
2. Geometric constructions
3. Dimensioning practice as per BIS conventions (12)

THEORY OF PROJECTION :
1. Projection of points and lines
2. Projection of planes
3. Projection of solids (12)

SECTIONS OF SOLIDS :
1. Sections of regular solids as per BIS conventions
2. Types of sections - sectional views of engineering components
3. Constructing sectional views (12)

DEVELOPMENT OF SURFACES :
1. Development of lateral surfaces of regular solids
2. Projection of truncated solids and simple engineering sheetmetal components (12)

ORTHOGRAPHIC PROJECTION :
1. Projection of simple engineering components and missing view exercises
2. Modeling of simple engineering components using CAD software (12)

Total P: 60

TEXT BOOKS:

1. Venugopal K, Prabhu Raja V "Engineering Graphics", New Age International Publishers., New Delhi, 2018 , Fifteenth Multi color edition
2. P.I Varghese "Engineering Graphics", McGraw Hill Education India Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. K C John "Engineering Graphics for Degree", PHI Learning private limited., 2009
2. Bureau of Indian Standards "Engineering Drawing Practices for Schools and Colleges SP 46-2003", BIS., New Delhi, 2004

19Z216 INTERNSHIP

0 0 0 2

THE HISTORY OF THE COMPUTER GENERATIONS: Generation of Computers- Computer Science Engineering as a Discipline: List of pioneers in computer science - Significant Event Timeline — Career paths.

DESIGN THINKING: Need - Persona - empathy map - scenario map - prioritization - needs and risk identification - Localisation - proposing solutions.

REPOSITORIES: Open source case study — Github - Bitbucket — Gitorious - Source Forge

CODING TECHNIQUES AND DEBUGGING: Coding Standards and Code Reviews — Best practices. Tools and techniques — Open source case study - Chrome DevTools - Sentry -GDB (GNU Debugger)

PACKAGE DEVELOPMENT: Problem Identification - Requirements Analysis - Design - Implementation - Testing - Documentation using standard digital tools.

GUIDELINES FOR SUCCESSFUL ENGINEERING CAREER: Relationship Building — Character Building and Personality Development - Laws for Engineers

TEXT BOOKS:
1. Stephen J Marshall "The Story of the Computer: A Technical and Business History", CreateSpace Independent Publishing Platform., 2017 , first edition.
2. Roger S. Pressman "Software Engineering: A Practitioner's Approach", McGraw-Hill Education., 2014 , eighth edition.

SEMESTER - 3

19Z301 LINEAR ALGEBRA

3 1 0 4

LINEAR EQUATIONS : Systems of linear equations - row reduction and echelon forms - vector equations - matrix equation - solution sets to linear systems - linear independence. (9 + 3)

VECTOR SPACES : General vector spaces- real vector spaces - Euclidean n-space - subspaces - basis and dimension - row space, column space and null space - rank and nullity. (9 + 3)

LINEAR TRANSFORMATIONS: General linear transformation - kernel and range - matrices of linear transformations - change of basis - geometry of linear operators on R^2. (9 + 3)

INNER PRODUCT SPACES: Inner products- angle and orthogonality in inner product spaces, orthonormal bases, Gram-Schmidt process, QR decomposition, best approximation- least squares. (9 + 3)

EIGENVALUES AND EIGENVECTORS : Eigenvalues and eigenvectors, diagonalization- orthogonal diagonalization - quadratic forms - application of conic sections - quadratic surfaces- spectral decomposition- singular value decomposition- discrete dynamical systems. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:
1. Howard Anton and Chris Rorres , "Elementary Linear Algebra", Wiley India, New Delhi, 2018.
2. David C Lay , "Linear Algebra and its Applications", Pearson, New Delhi, 2016.

REFERENCES:
1. Gareth Williams , "Linear Algebra with Applications", Narosa Publishing House, New Delhi, 2012.
2. Gilbert Strang , "Linear Algebra and its Applications", Cengage, New Delhi, 2012.
3. Friedberg, Insel and Spence , "Linear Algebra", Pearson Education, USA, 2015.
4. Kenneth Hoffman and Ray Kunze , "Linear Algebra", Prentice Hall, New Jersey, 2015.

19Z302 DATA STRUCTURES

4 0 0 4

INTRODUCTION : Need for Data Structures - Types of Data Structures - Abstract Data Type - Program Development Life Cycle - Algorithms - Characteristics of Algorithms - Recursive Algorithms - Complexity Analysis - Best case and worst case complexities - Asymptotic notations -Master theorem (10)

ARRAYS AND LISTS : Array Representation and Operations - Linear Search and Binary Search - Insertion and Bubble Sort - Matrix representation using Multi dimensional arrays - Linked List Representation - Operations on a Singly Linked List - Types of Linked List - Polynomial Addition - Sparse Matrices (10)

STACKS AND QUEUES : Stack ADT - Representation and Operations - Expression Handling - Role of Stack in implementing recursive algorithms - Queue ADT - Representation and Operations - Types of Queues - Circular Queue - Deque - Priority Queue (10)

BINARY TREES : Terminologies - Binary Tree - Traversal - Expression Trees - Threaded Binary Tree - Binary Heap - Heap Sort - Priority Queue implementation using Binary Heap - Binary Search Tree (10)

MULTI WAY SEARCH TREES AND GRAPHS : m-way search trees - B Tree - B+ Tree - Applications - AVL Tree - Trie Structure - Hash Table - Hash Functions - Resolving Collisions - Rehashing - GRAPH Terminologies - Types of Graphs - Representation - Breadth First Search - Depth First Search - Topological Sort (20)

Total L: 60

TEXT BOOKS:
1. Mark Allen Weiss , "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2010.
2. Venkatesan R, S.Lovelyn Rose , "Data Structures", 2nd Edition, Wiley India Pvt Ltd, 2019.

REFERENCES:
1. Jean Paul Tremblay, Sorenson , "An Introduction to Data Structures with Applications", McGraw Hill Publishing Company, New Delhi,2012.

2. Aho , "Data Structures and Algorithms", 1st Edition, Pearson, 2011.
3. Salaria R S , "Data Structues and Algorithms using C", 5th Edition, Khanna Book Publishing, New Delhi, 2012.
4. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran , "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press, 2011.

19Z303 COMPUTER ARCHITECTURE

3 1 0 4

COMPUTER ORGANIZATION & DESIGN : Stored program organization (Von Neumann architecture) - Computer Registers - Computer Instructions - Timing and Control (Hardwired and Micro programmed) - Instruction Cycle - Memory reference instructions - Input / Output Instructions - Quantitative Principles of computer design. (10 + 3)

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) - RISC Vs CISC (9 + 3)

MEMORY AND I/O SYSTEMS : Memory Hierarchy - Associative Memory - Cache Memory - Mapping policies – Cache optimization; I/O Systems: Introduction-Interrupts-Modes of Transfer -DMA. (8 + 3)

PARALLELISM : Pipelining - Pipelining Hazards - Overcoming Hazards - Instruction Level Parallelism – Dependencies (10 + 3)

MULTIPROCESSOR SYSTEMS : Symmetric and Distributed shared memory architectures - Challenges – Cache Coherence - Snooping protocol (8 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Morris Mano , "Computer System Architecture", Prentice Hall of India, Prentice Hall of India, 2007.
2. John L. Hennessey, David A. Patterson , "Computer Architecture: A Quantitative Approach", Elsevier India Pvt. Ltd, New Delhi, 2015.

REFERENCES:

1. Carl Hamacher , "Computer Organization", Tata McGraw Hill Publishing, New Delhi, 2002.
2. Kai Hwang , "Advanced Computer Architecture Parallelism, Scalability, Programmability", Tata Mc Graw Hill, New Delhi, 2010.
3. William Stallings , "Computer Organization and Architecture", Pearson Education / Prentice Hall of India, New Delhi, 2006.
4. Kai Hwang, Faye A Briggs , "Computer Architecture and Parallel Processing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.

19Z304 DISCRETE STRUCTURES

2 1 0 3

LOGIC: Propositional logic - propositional equivalences - predicates and quantifiers - rules of inference – normal forms. (6 + 3)

PROOF TECHNIQUES: Direct proofs - contraposition - contradiction - mathematical induction- program correctness. (6 + 3)

GROUP THEORY: Semi groups, monoids, groups, subgroups, cosets - Lagrange's theorem, group homomorphism – properties, permutation groups, normal subgroups. (6 + 3)

CODING THEORY : Hamming distance, error correction and detection, maximum likelihood decoding and minimum distance decoding, group codes – decoding – nearest neighbor decoding. (6 + 3)

RING THEORY : Rings, integral domains, fields, polynomial rings and polynomial codes. (6 + 3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Kenneth H Rosen , "Discrete Mathematics and its Applications", Tata McGraw Hill, New Delhi, 2016.
2. Tremblay J P and Manohar R , "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, New Delhi, 2017.

REFERENCES:

1. Ralph P Grimaldi , "Discrete and Combinatorial Mathematics - An Applied Introduction", Pearson, Addison Wesley, USA, 2017.
2. Herstein I N , "Topics In Algebra", Wiley India, New Delhi, 2013.
3. Bernard Kolman, Robert C Busby, Sharon Cutler Ross , "Discrete Mathematical Structures", Prentice Hall, New Delhi, 2015.
4. Liu C.L, Mohapatra D.P , "Elements of Discrete Mathematics: A computer oriented approach", Tata McGraw Hill, New Delhi, 2017.

19Z305 OBJECT ORIENTED PROGRAMMING

3 0 0 3

OBJECT ORIENTED PROGRAMMING: Features of OOP - Abstraction - classes and Objects - Encapsulation - Inheritance - Polymorphism. (8)

JAVA FUNDAMENTALS : Characteristics of Java - Java development Kit - Java Virtual Machine - Java Runtime Environment - Java REPL Data types - variables - Arrays - operators - control statements - Classes and methods constructors - Inheritance - abstract class (10)

INTERFACES AND PACKAGES : INTERFACES: Defining and implementing interface - extending interfaces - PACKAGES : package structure - Member access - Importing Packages - String handling. (7)

EXCEPTION HANDLING AND I/O : Exception Types - Try Catch Block - Throw - Throws - Finally - User Defined Exceptions - Java Input and output - Streams - Reading/writing console I/O - Reading and Writing Files. (8)

JAVA ADVANCED FEATURES : Collections framework - Collection interfaces and classes - Working with Maps - Generic classes and methods - generic restrictions - Lambda Expressions - fundamentals - method and constructor references - Java Archives - JAR file creation and usage - Module - creation and execution (12)

Total L: 45

TEXT BOOKS:
1. Schildt H , "Java: The Complete Reference", 11th Edition, McGraw-Hill Education, 2018.
2. Deitel P and Deitel H , "Java: How to Program", 11th Edition, Prentice Hall, 2018.

REFERENCES:
1. Hortsmann CS and Cornell G , "Core Java: Volume 1 - Fundamentals", 11th Edition, Prentice Hall, 2018.
2. James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley and Daniel Smith , "The Java Language Specification – Java SE", 13th Edition, Oracle America Inc., USA, 2019.
3. Daniel liang L , "Introduction to Java Programming", 10th Edition, Pearson Education, New Delhi, 2015.
4. Matt Weisfeld , "The Object Oriented Thought Process", 5th Edition, Addison-Wesley Professional, US, 2019.

19O306 ECONOMICS FOR ENGINEERS

3 0 0 3

INTRODUCTION : Definition – Nature and Scope – Central Problems of an Economy – Positive and Normative Economics– Micro Economics and Macro Economics, Significance of Economics, Economic Assumptions. (9)

THEORY OF CONSUMER BEHAVIOR : Utility – Indifference Curve Analysis - Properties, Consumer's Budget Line - Demand Analysis: Demand Function and Law of Demand, Elasticity of Demand. Demand forecasting using Econometric Techniques. Supply – Factors Affecting Supply, Market Equilibrium Price, Consumer Surplus. (9)

PRODUCTION, COST AND REVENUE: Production Function, Total Product, Average Product and Marginal Product, Returns to Scale. Costs, Nature of Costs, Short-run and Long-run Cost Curves, Revenue concepts. (9)

MARKET STRUCTURE : Types of Markets - Perfect Competition – Characteristics – Imperfect Competition: Monopoly Monopolistic Competition – Oligopoly and Duopoly - Price Discrimination and Product Differentiation under Different Markets – Price and Output Determination in Short run and Long run and profit maximization. (9)

PERFORMANCE OF AN ECONOMY (MACRO ECONOMICS): Demand and Supply of Money – Quantity Theory of Money, Banking – Functions of Commercial Banks and Central Bank – Inflation – Causes – Control Measures – National Income – Concepts – Methods of Calculating National Income – Problems in Calculating National Income. (9)

Total L: 45

TEXT BOOKS :
1. Varian H.R. , "Intermediate Microeconomics", East– West Press, New Delhi, 2014.
2. Dewett.K.K, Navalur. M.H. , "Modern Economic Theory", S. Chand, New Delhi, 2015.

REFERENCES :
1. William A, McEachern, Simrit Kaur , "Micro ECON", Cengage Learning, Noida, 2013.
2. William A, McEachern, Indira A. , "Macro ECON", Cengage Learning, Noida, 2014.
3. Deepashree , "Principles of Economics", Ane Books Pvt Ltd, New Delhi, 2010.
4. Dwivedi , "Essentials of Business Economics", Vikas Publishing House Pvt Ltd, New Delhi, 2010.

19Z310 DATA STRUCTURES LABORATORY

0 0 2 1

LIST OF EXPERIMENTS :
1. Solving Problems using arrays
2. Implementation of Linked List
3. Applications of Linked List
4. Implementation Stack and queue
5. Applications of Stack

6. Operations on Binary Search Trees
7. Applications of Binary Search Tree, AVL tree
8. Graphs - Depth First Search and Breadth First Search
9. Hashing and Collision Resolution
10. Sorting algorithms

Total P: 30

19Z311 OBJECT ORIENTED PROGRAMMING LABORATORY

0 0 2 1

LIST OF EXPERIMENTS :
1. Study of JDK,JRE,JVM, IDE
2. Study of REPL
3. Java Basics,Classes and Overloading
4. Inheritance,Overriding
5. Interfaces and packages
6. String handling
7. Exception Handling
8. IO Streams
9. IO Streams and Generics
10. Lambda Expression and Modules

Total P : 30

19K312 ENVIRONMENTAL SCIENCE

2 0 0 0

INTRODUCTION TO ENVIRONMENT : Environment - Definition, scope and importance. Types and composition of atmosphere – particles, ions and radicals. Ozone layer- significance, formation and depletion. Ecosystems- Structure and functions, components, energy flow, food chains, food web, Biodiversity-levels, values and threats – India as a mega-diversity nation – hotspots of biodiversity – endangered and endemic species of India – conservation of biodiversity. (6)

ENERGY RESOURCES : Introduction – National and International status- exploitation - sustainable strategies- Fossil fuels-classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas; solar energy - introduction, harnessing strategies. Wind energy - availability, wind power plants, wind energy conversion systems, site characteristics, and types of wind turbines. Supporting renewable energy resources - tidal –geothermal - hydroelectric. (6)

ENVIRONMENTAL POLLUTION : Definition – Sources, causes, impacts and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards (h) RF hazards - Role of an individual in prevention of pollution. DISASTER MANAGEMENT: Floods, earthquake, cyclone and landslides – Case studies, consequences and rescue measures (6)

WASTE MANAGEMENT : Wastewater - Characteristics of domestic and industrial wastewater - COD and BOD – Various stages of treatment – primary, secondary, tertiary treatment- Biological and advanced oxidation processes. Solid waste management – Characteristics of municipal solid waste(MSW), biomedical, automobile and e-wastes and their management – landfills, incineration, pyrolysis, gasification and composting. (6)

SOCIAL ISSUES AND THE ENVIRONMENT : Environmentally Sustainable work practices- Rain water harvesting – Role of non-governmental organizations. Human ethics and rights- impact on environment and human health – role of information technology on environment and human kind. Green IT policies, Process of EIA - ISO14000. Legislation-Environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act. (6)

Total L: 30

TEXT BOOKS :
1. Gilbert M.Masters , "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2004.
2. De A K , "Environmental Chemistry", New Age International P Ltd, New Delhi, 2006.

REFERENCES :
1. Benny Joseph , "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. KoteswaraRao MVR , "Energy Resources: Conventional & Non-Conventional", BSP Publications, New Delhi, 2006.
3. Deswal S and Deswal A , "A Basic Course in Environmental Studies", Dhanpat Rai and Co, New Delhi, 2004.

SEMESTER - 4

19Z401 PROBABILITY, STOCHASTIC PROCESSES AND STATISTICS

3 1 0 4

PROBABILITY AND DISCRETE RANDOM VARIABLES : Probability, axiomatic approach to probability, Baye's theorem, discrete random variables, probability mass function, families of discrete random variables - binomial, poisson and geometric random variables, cumulative distribution functions, expectations. (9 + 3)

CONTINUOUS RANDOM VARIABLES : Continuous random variables, cumulative distribution functions, probability density function, families of continuous random variables - uniform, exponential, Erlang and Gaussian random variables, expectations. (9 + 3)

PAIRS OF RANDOM VARIABLES : Joint cumulative distribution function – joint probability mass function – marginal probability mass function – joint probability density function – marginal probability density function – expected values–independentrandomvariables–covariance–correlation. (9+3)

STOCHASTIC PROCESSES : Types of stochastic processes – discrete time Markov chains- classification of states- limiting state probabilities - Poisson process - continuous time Markov chain - steady state probabilities. (9 + 3)

STATISTICAL INFERENCE : Point estimation and interval estimation for means, proportions and variances – hypothesis concerning mean, proportion and variance – single and two samples – goodness of fit – test for independence. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS :
1. Roy D Yates and David J Goodman, "Probability and Stochastic Processes - A friendly Introduction for Electrical and Computer Engineers", Wiley India, New Delhi, 2014.
2. Ronald E. Walpole, Raymond H Myers, Sharon L Myers and Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson, New Delhi, 2016.

REFERENCES :
1. Saeed Ghahramani , "Fundamentals of Probability with Stochastic Processes", CRC Press, Taylor & Francis Group, USA, 2018.
2. Douglas C Montgomery and George C Runger , "Applied Statistics and Probability for Engineers", Wiley India, New Delhi, 2018.
3. Athanasios Papoulis and Unnikrishna Pillai S , "Probability, Random Variables and Stochastic Processes", Tata McGraw Hill, New Delhi, 2011.
4. Arnold O Allen, "Probability, Statistics and Queueing theory: with computer science applications", Academic press, New York, 2014.

19Z402 DESIGN AND ANALYSIS OF ALGORITHMS

3 1 0 4

DIVIDE AND CONQUER : Introduction to Algorithm Design techniques - Divide and Conquer Methodology - Solving recurrence relations - Masters Theorem - Finding Maximum and Minimum Element - Quick sort - Merge sort - Convex Hull. (10 + 3)

GREEDY METHOD : Greedy Strategy - Knapsack Problem - Minimum Spanning Trees - Single Source Shortest Path Method - Huffman Trees (8 + 3)

DYNAMIC PROGRAMMING : Principle of Optimality - Knapsack Problem - All Pairs Shortest Path - Optimal Binary Search Tree - Multistage Graphs. (9 + 3)

BACKTRACKING: State Space Tree - Knapsack Problem - The Eight Queens Problem - Sum of subsets - Graph Coloring (9 + 3)

BRANCH AND BOUND : Bounding Functions - 0/1 Knapsack Problem - Traveling SalesPerson Problem - Assignment Problem (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:
1. Anany Levitin , "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Prentice Hall of India, New Delhi, 2012.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran , "Fundamentals of Computer Algorithms", Galgotia Publications, New Delhi, 2010.

REFERENCES:
1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press, England, 2009.
2. Jon Kleinberg, Eva Tardos , "Algorithm Design", Pearson Education, 2006.

3. Jeffrey J McConnell , "Analysis of Algorithms", Jones and Bartlett Publishers, 2008.
4. Parag Himanshu Dave, Himanshu Bhalchandra Dave, "Design and Analysis of Algorithms", Pearson Education, 2008.

19Z403 OPERATING SYSTEMS

3 0 0 3

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

PROCESS MANAGEMENT : Process Model - Creation — Termination - Hierarchies - States - Implementation - Scheduling Criteria Scheduling Algorithms - Multithreading Models - Thread Libraries - Threading Issues - Thread and Multiprocessor Scheduling Algorithms - Interprocess Communication. (10)

PROCESS SYNCHRONIZATION AND DEADLOCKS : Race Conditions - Critical Section - Mutual Exclusion - Peterson's Solution — Synchronization: Hardware - Semaphores - Mutex - Monitor - Message Passing, Dining Philosophers Problem - Readers Writers Problem. Deadlocks: Conditions - Detection - Recovery - Prevention - Avoidance. (9)

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)

STORAGE MANAGEMENT : Files: Naming - Structure - Types - Access - Attributes - Operations - Implementation. Directories: Operations - Path Names - Hierarchical Directory System - Implementation - Allocation Methods - Free Space Management - NFS - Efficiency and Performance - Recovery. Mass Storage:Disk Structure – Disk Scheduling Algorithms - Swap Space Management - Case Study: Linux. (10)

Total L: 45

TEXT BOOKS:

1. Silberschatz A, Galvin P, Gagne G , "Operating Systems Concepts", 9th Edition, John Wiley & Sons, USA, 2018.
2. Andrew S Tanenbaum, Herbert Bos , "Modern Operating Systems", Prentice Hall of India, New Delhi, 2015.

REFERENCES:

1. Andrew S Tanenbaum , "Modern Operating Systems", Pearson, New Delh, 2016.
2. William Stallings, "Operating Systems: Internals and Design Principles", Prentice Hall, 2018.
3. Gary Nutt, "Operating Systems", Addison Wesley, USA, 2009.
4. Harvey M Deite , "Operating System", Prentice Hall of India, New Delhi, 2008.

19Z404 DATABASE MANAGEMENT SYSTEMS

3 0 0 3

INTRODUCTION TO DATABASE: Purpose of Database System – Views of data – Data Models – specialty databases- Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL (9)

DATABASE DESIGN: Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – traps - Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multivalued Dependencies and Fourth Normal Form — Join Dependencies and Fifth Normal Form (9)

DATA STORAGE AND QUERYING: RAID – File Organization – Organization of Records in Files — Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing stages – Query optimization using Heuristics and Cost Estimation. (9)

TRANSACTIONS MANAGEMENT: Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery - Backup and Recovery System. (9)

ADVANCED TOPICS: Parallel Database - Multidimensional Database - Datawarehouse-Multimedia Database - Web Database - Mobile Database- Nosql database. (9)

Total L: 45

TEXT BOOKS:

1. Abraham Silberchatz, Henry F Korth and Sudarshan S , "Database System Concepts", 6th Edition, Tata McGraw- Hill, New Delhi, 2011.
2. Ramez Elmasri and Shamkant B Navathe , "Fundamentals of Database Systems", 6th Edition, Addison Wesley, USA, 2010.

REFERENCES:

1. Raghu Ramakrishnan and Johannes Gehrke , "Database Management Systems", 6th Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Gupta G K , "Database Management System", Tata McGraw-Hill, New Delhi, 2011.

3. Jeffrey A. Hoffer, Ramesh Venkataraman, Heikki Topi , "Modern Database Management", 12th Edition, Pearson, New Delhi, 2016.
4. Atul Kahate , "Database Managment Systems", 1st Edition, Pearson, New Delhi, 2011.

19Z405 SOFTWARE ENGINEERING

3 0 0 3

SOFTWARE PROCESS : The Evolving Role of Software - Software Characteristics - Software Applications - Software Myths - Software Process Models - The Linear Sequential Model - The Prototyping Model - The RAD Model - Evolutionary Software Process Models - The Incremental Model - Spiral Model - Agile Process Extreme Programming and Scrum. (8)

REQUIREMENTS ENGINEERING AND ESTIMATION : Functional requirements - Requirements Elicitation - Requirements Analysis and Negotiation - Requirements Validation - Requirements Management – Relationship between Size and Effort - Different techniques for Effort estimation - COCOMO - Function Point Analysis (10)

SOFTWARE ANALYSIS AND DESIGN : Analysis modeling - Translating Analysis Model into Design Model - Design Process - Modularity - Functional Independence - Cohesion - Coupling - Design Documentation – Software Architecture - User Interface Design (7)

TESTING TECHNIQUES : Software Testing Fundamentals - Test Case Design - White Box Testing - Black Box Testing - Testing for Specialized Environments - Testing Strategies - Unit Testing - Integration Testing – Validation Testing - System Testing Performance Testing - Case Study. (8)

SOFTWARE QUALITY ASSURANCE: Quality Concepts - Cost of Quality - Software Quality Group - Roles and Responsibilities of SQA Group - Formal Technical Reviews - Quality Standards - Software Configuration Management - Baselines - SCM Process - Version Control - Software Configuration Audit - Software Maintenance. (12)

Total L: 45

TEXT BOOKS:

1. Roger S Pressman , "Software Engineering - A Practitioner‘s Approach", McGraw Hill International Edition, Singapore, 2015.
2. Pankaj Jalote , "A Concise Introduction to Software Engineering", Springer, New Delhi, 2011.

REFERENCES:

1. Ian Sommerville , "Software Engineering", Pearson Addison Wesley, Boston, 2017.
2. Shari Lawrence Pfleeger , "Software Engineering: Theory and Practices", Pearson, New Delhi, 2009.
3. James Peter, Pedrycz W , "Software Engineering: An Engineering Approach", John Wiley & Sons, 2007.
4. Glenford J Myers, Tom Badgett, Corey Sandler , "The Art of Software Testing", 3rd Edition, John Wiley & Amp sons Inc, New Jersy, 2015.

19Z410 OPERATING SYSTEMS LABORATORY

0 0 2 1

LIST OF EXPERIMENTS: :

1. Installation of Operating system: Windows/ Linux
2. Exploring xv6 Operating System
3. Shell Programming
4. Process Management using System Calls: Fork, Exit, Getpid, Exit, Wait, Close.
5. Process synchronization using Semaphores
6. CPU Scheduling Algorithms
7. Multi threaded and Multi process applications
8. Deadlock Avoidance Algorithm
9. Page Replacement Algorithms
10. Disk Scheduling Algorithms

Total P: 30

19Z411 DATABASE MANAGEMENT SYSTEMS LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1. Practice Data Definition Language (DDL) and Data Manipulation Language (DML) commands.
2. Database design using E-R model – case study.
3. Implement Views and stored procedures.
4. Implement functions, Cursors and Triggers.
5. Study assignment on performance monitoring and tuning Tools.
6. Mini project- Application development.

Total P: 30

19O412 INDIAN CONSTITUTION

2 0 0 0

INTRODUCTION : Evolution of Indian Constitution; Significance of Constitution; Composition; Preamble and its Philosophy. (4)

RIGHTS, DUTIES AND DIRECTIVE PRINCIPLES : Fundamental Rights- Writs and Duties, Directive Principles of State Policy. (6)

COMPOSITION OF PARLIAMENT AND FEDERALISM : : Union Government, President and Vice President, Houses of the Parliament and their functions; Composition of State Legislature; Powers, Functions and Position of Governor, Function of Chief Ministers, Council of Ministers; The Indian Federal System, Administrative Relationship between Union and States. (8)

BILLS AND CONSTITUTION AMENDMENT PROCEDURE: Types of Bills, Stages of passing of Bill into an Act, Veto Power, Constitution Amendment Procedure, Various Amendments made and their significance for India. (6)

JUDICIARY : Supreme Court and High Court; Functions and powers, Judicial Review. (6)

Total L: 30

TEXT BOOKS:

1. Subash C. Kashyap , "Our Constitution", 5th Edition, NBT, India, New Delhi, 2015.
2. Basu D D , "Indroduction to the Constution of India", 20th Edition, Prentice Hall of India, New Delhi, 2011.

REFERENCES:

1. Briji Kishore Sharma , "Intrdouction to the Consitution of India", 8th Edition, Prentice Hall of India, New Delhi, 2017.
2. Hoshiar Singh , "Indian Adminstration", 1st Edition, Pearson Education, New Delhi, 2011.
3. Jain M C , "The Consitution of India", 5th Edition, State Mutual Book & Periodical Service, Limited, New Delhi, 1988.
4. Shukla V N , "Consitution of India", 13th Edition, Eastern Book Company Limited, New Delhi, 2017.

19Q413 SOFT SKILLS DEVELOPMENT

0 0 2 1

SOFT SKILLS DEVELOPMENT :

1. Body Language and Professionalism
2. Interpersonal skills
3. Goal setting
4. Impression Management
5. Team Building
6. Time Management
7. Stress Management
8. Convincing Skills
9. Motivation
10. Change Management
11. Communication Confidence
12. Group discussion basics
13. Personal Interview basics
14. Resume writing

Total P: 30

REFERENCES:

1. Jeff Butterfield , "Soft Skills for Everyone", 6th Edition, Cengage Learning, Delhi, 2015.
2. Rao M S , "Soft Skills - Enhancing Empolyability", LK International Publishing House, New Delhi, 2011.

SEMESTER - 5

19Z501 THEORY OF COMPUTING

3 1 0 4

FINITE AUTOMATA : Need for automata theory - Finite Automaton – DFA and NFA – Finite Automaton with ε- moves – Regular Languages- Properties - Regular Expression – Equivalence of NFA and DFA – Equivalence of NFA's with and without ε-moves – Equivalence of finite Automaton and regular expressions –Minimization of DFA – Pumping Lemma for Regular sets . (9 + 4)

GRAMMARS : Types of Grammar – Chomsky's hierarchy of languages – Context Free Grammars and Languages– Properties - Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees —Simplification of CFG – Greiback Normal form – Chomsky normal form– pumping lemma for CFL. (8 + 2)

PUSH DOWN AUTOMATA: Definitions – Moves – Instantaneous descriptions – Deterministic and non-deterministic pushdown automata — Equivalence of Pushdown automata and CFL. (8 + 4)

TURING MACHINE : Definitions of Turing machines – Models – Computable languages and functions –Turing machine construction – Multihead and Multitape Turing Machines – The Halting problem (8 + 2)

UNSOLVABLE PROBLEMS AND COMPUTABLE FUNCTIONS : Unsolvable Problems and Computable Functions – Primitive recursive functions –PCP-MPCP- Recursive and recursively enumerable languages — Properties - Universal Turing machine - Measuring and classifying complexity- Tractable and Intractable problems- Tractable and possibly intractable problems — complexity classes - Polynomial time reductions — P and NP completeness — SAT problem - Clique problem - Space complexity (12 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. John C Martin , "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.
2. Hopcroft J.E., Motwani R. and Ullman J.D , "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, New Delhi, 2008.

REFERENCES:

1. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2nd Edition, Prentice Hall of India, New Delhi, 2015.
2. Peter Linz , "An Introduction to Formal Language and Automata", 6th Edition, Narosa Publishers, New Delhi, 2016.
3. Ganesh Gopalakrishnan , "Automata and Computability", 1st Edition, Chapman and Hall/CRC, USA, 2019.
4. D Shanthi, N Uma Maheshwari, S Jeyanthi , "Theory of Computation", 1st Edition, Yesdee, India, 2017.

19Z502 MICROPROCESSORS AND INTERFACING

3 0 0 3

ARCHITECTURE & PROGRAMMING OF 8086 : Architecture - Register Organization - Assembly Language Programming - The Instruction Set - Addressing Modes - Types Of Instructions - Data Transfer - Arithmetic - Logical - Shift And Rotate - Flag Control – Compare - Control Flow and Jump Instructions - Subroutine - Loop and String Handling Instructions (10)

MEMORY INTERFACES : Signal Description - Hardware organization of the memory address space – Memory interface circuits - Bus Cycles - Minimum Mode and Maximum Mode (10)

I/O INTERFACES : I/O Addressing Capability - I/O Data Transfers and Instructions - Parallel Interface - 8255 Programmable Peripheral Interface - Serial Interface - 8251 Programmable Communication Interface (10)

INTERRUPT: Interrupt Mechanism - Types and Priority - Interrupt Vector Table - Interrupt Instructions - Enabling and Disabling of Interrupts - Hardware Interrupts - Software Interrupts - Internal Interrupts (8)

MODERN MICROPROCESSORS : Overview of Pentium Processor - Intel i3, i5, i7 processors - ARM Processor - Case study on Raspberry pi - Arduino - Intel Galileo (7)

Total L: 45

TEXT BOOKS:

1. Walter A Triebel, Avtar Singh , "The 8088 and 8086 Microprocessors – Programming, Interfacing, software, Hardware and Applications", Pearson Education, New Delhi, 2009.
2. Ray A K, Bhurchandi K M , "Advanced Microprocessors and Peripherals", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2009.

REFERENCES:

1. Barry B Brey , "Intel Microprocessors: 8086/8088, 80286, 80386, 80486, Pentium, Pentium Pro Processors, Pentium II, Pentium III and Pentium 4 : Architecture, Programming and Interfacing", Pearson Education, New Delhi, 2009.
2. Douglas V Hall , "Microprocessors and Interfacing", Tata Mcgraw Hill, New Delhi, 2009.
3. Steve Furber , "ARM System-On-Chip Architecture", Pearson Education Limited, USA, 2010.
4. Simon Monk , "Electronics Cookbook", 2nd Edition, O'Reilly Media, Inc., Boston, 2017.

19Z503 ARTIFICIAL INTELLIGENCE

3 0 0 3

INTRODUCTION : Artificial Intelligence - The state of art - Intelligent Agents - Rationality - Nature of Environments - Structure of Agents - Example problems (9)

PROBLEM SOLVING AGENTS : Searching for solutions: Uninformed search - BFS, DFS, Uniform cost search, Iterative deepening search - Informed Search - Greedy Best First search, A* search, AO* search - Adversarial search - Games - Optimal decisions in Games, alpha - beta pruning (9)

KNOWLEDGE AND REASONING : Logical Agents - First order logic, Inference in first order logic - Probabilistic Reasoning: Representing knowledge in uncertain domain - Bayesian Networks - Inference (9)

PLANNING AND LEARNING: Algorithms for Planning as state space search - Planning Graphs - Learning: Forms of learning - supervised learning, unsupervised learning, reinforcement learning - Reinforcement learning task - Q learning (9)

NATURAL LANGUAGE PROCESSING: Language models - Phrase structure grammars - Syntactic Analysis - Augmented Grammars and Semantic Interpretation (9)

Total L: 45

TEXT BOOKS:

1. Stuart J Russell and Peter Norvig , "Artificial Intelligence – A Modern Approach", 3rd Edition, Prentice Hall of India/ Pearson Education, New Delhi, 2018.
2. Elaine Rich, Kevin Knight and Shivashankar B Nair , "Artificial Intelligence", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017.

REFERENCES:

1. Tom Mitchell, "Machine Learning", McGraw Hill Education, New Delhi,, 2017.
2. George F Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", 5th Edition, Pearson Education, New Delhi, 2017.
3. Nils J Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, New Delhi, 2002.
4. Patrick Henry Winston, "Artificial Intelligence", 3rd Edition, Pearson Education, New Delhi, 2013.

19Z504 COMPUTER NETWORKS

3 0 0 3

INTRODUCTION AND MEDIUM : Building a Network - Network Edge and Core - Layering and Protocols - TCP/IP Protocol suite - OSI Reference Model - Network Topologies - Internet Architecture–Physical Layer: Signal Characteristics – Transmission media – Signal Encoding Techniques – Performance Metrics. (10)

LINK LAYER SERVICES : Link Layer Services - Framing - Flow Control - Error Control - Media Access Control - Ethernet - Wireless LAN – Introduction about Bluetooth, Zigbee. (8)

SWITCHING AND ROUTING : Switching : Circuit Switching - Packet Switching – IPV4 - Global Address - Datagram Forwarding - Subnetting - CIDR - ICMP - Routing Algorithms: Distance Vector Routing and Link State Routing - IPV6 Addressing — IPV6 Protocol. (9)

CONNECTION-ORIENTED AND CONNECTION-LESS SERVICES : Overview of Transport Layer - UDP - TCP – Reliable Byte Stream - Connection Management - Flow Control - Congestion Control - SCTP. (9)

APPLICATION LAYER SERVICES : Needs/Principles of Application Layer Protocols — Role of proxy, Web and HTTP - FTP - Electronic Mail (SMTP - POP3 - IMAP - MIME) – DHCP – DNS – DASH - QUIC. (9)

Total L: 45

TEXT BOOKS:

1. Larry L Peterson, Bruce S Davie , "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers, USA, 2012.
2. James F Kurose, Keith W Ross , "Computer Networking - A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, New Delhi, 2017.

REFERENCES:

1. Prakash C Gupta , "Data Communication and Computer Networks", Prentice Hall of India, New Delhi, 2014.
2. Achyut S Godbole , "Data Communication and Networking", 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.
3. Nader F Mir , "Computer and Communication Networks", Pearson Prentice Hall, New Delhi, 2014.
4. Andrew S Tanenbaum, David J Wetherall , "Computer Networks", 5th Edition, Prentice Hall of India/ Pearson Education, New Delhi, 2012.

19Z505 OBJECT ORIENTED ANALYSIS AND DESIGN

2 2 0 4

OBJECT MODEL: Complexity - Structure and Attributes of Complex Systems - Designing Complex Systems - Foundations of Object Models - Elements of an Object Model – Unified Software Development Process. (6 + 6)

UML AND USE CASE MODELING : Introduction - UML Views - Classification of UML Diagrams - Use Case Diagrams: Modeling Requirements - Components - Use Case Identification and Description - Use-Case Relationships (6 + 6)

BEHAVIORAL MODELING: Activity Diagram: Components – Construction. State Diagram: Components – Construction. Sequence Diagrams - Collaboration Diagrams - Timing Diagrams (6 + 6)

CLASSES AND OBJECTS: UML Class Diagrams - conceptual classes and description classes – Associations – Attributes – conceptual class Hierarchies – Aggregation and Composition- identification of analysis and design classes. (6 + 6)

STRUCTURAL DIAGRAMS AND PATTERNS : Package Diagram - Component Diagram - Deployment Diagram - Design Patterns MVC (6 + 6)

Total L: 30 +T: 30 = 60

TEXT BOOKS:

1. Booch G, Maksimchuk RA, Engel M W, Young B J, Conallen J, Houston K A , "Object Oriented Analysis and Design with Applications", 3rd Edition, Addison-Wesley, 2007.
2. Booch G, Rumbaugh J, Jacobson I , "The Unified Modeling Language User Guide", 2nd Edition, Addison Wesley Professional, 2005.

REFERENCES:

1. Bahrami A , "Object Oriented System Development - International Edition", McGraw Hill, 2007.
2. Pressman RS , "Software Engineering - A Practitioner's Approach", McGraw Hill, 2007.
3. Simon Bennett, Steve Mc Robb, Ray Farmer , "Object Oriented Systems Analysis and Design Using UML", 4th Edition, Mc-Graw Hill Education, 2010.
4. Craig Larman , "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2005.

19Z510 COMPUTER NETWORKS LABORATORY

0 0 2 1

LIST OF EXPERIMENTS :

1. Study of Network Components,Basic Network Commands and Network Configuration Commands
2. Chat Program using TCP Sockets using C language
3. Sliding Window Protocol using TCP Sockets using C language
4. DNS using UDP Sockets using C language
5. Study of Wireshark Tool
6. Capturing of packet header at each layer using Wireshark
7. Tracing of TCP and UDP Connection using Wireshark
8. Study of any Simulator Tool
9. Performance comparison of TCP and UDP protocols using Simulation tool
10. Set up a typical network in a lab

Total P: 30

19Z511 MICROPROCESSORS AND INTERFACING LABORATORY

0 0 2 1

MICROPROCESSOR – 8086 :

1. Arithmetic operations
2. Recursion
3. Searching and Sorting
4. String Manipulations (14)

INTERFACING WITH 8086 :

1. Interfacing DAC/ADC
2. Keyboard/Display interfacing (6)

INTERFACING WITH ARM :

1. Study of ARM programming environment
2. Interfacing LED and Switch
3. Interfacing 4x4 Matrix Keypad Interfacing the LCD
4. Interfacing the LCD (10)

Total P: 30

19Z512 SOFTWARE PACKAGE DEVELOPMENT

0 0 4 2

PACKAGE DEVELOPMENT:

1. Problem identification - Requirements analysis and design - Implementation using coding standards - Library construction and usage - Testing and documentation.

Total P: 60

19Q513 BUSINESS AND MANAGERIAL COMMUNICATIONS

0 0 2 1

BUSINESS AND MANAGERIAL COMMUNICATIONS:

1. Advanced Group discussion
2. Advanced Resume writing
3. Mock Group discussion
4. Advanced Personal Interview
5. Mock Personal Interview
6. Cracking special Interviews
7. Essential Grammar for Placements
8. Vocabulary for Placements
9. Email writing
10. Paragraph writing
11. Essay writing

Total P: 30

REFERENCES:

1. Priyadarshi Patnaik , "Group Discussion and Interview Skills", Cambridge, New Delhi, 2011.
2. Hari Mohan Prasad, Rajnish Mohan , "How to Prepare for Group Discussion and Interview", 2nd Edition, Tata McGrawhill, New Delhi, 2009.

SEMESTER - 6

19Z601 MACHINE LEARNING

3 0 0 3

INTRODUCTION : Types of Learning - Designing a learning system - concept learning - Find-s Algorithm - Candidate Elimination - Data Preprocessing - Cleaning - Data Scales - Transformation - Dimensionality Reduction. (9)

LINEAR MODELS : Linear Regression Models ,Maximum Likelihood Estimation - Least Squares - Bias-Variance Decomposition - Bayesian Linear Regression - Linear Models for Classification, Probabilistic Generative Models - Probabilistic Discriminative Models - Linear Discriminant Analysis (9)

NEURAL NETWORKS AND DECISION TREES : Feed-forward Networks - Network Training - Delta Rule- Gradient Descent - Error Backpropagation - Regularization in Neural Networks - Generalisation - Decision Tree Learning- Representation - Inductive Bias- Issues (9)

KERNEL AND GRAPHICAL METHODS : Constructing Kernels - Radial Basis Function Networks – Gaussian Processes - Maximum Margin Classifiers - SVM - Bayes Theorem - Naive Bayes - Bayesian Networks (9)

UNSUPERVISED AND REINFORCEMENT LEARNING : Measures of Similarity and Dissimilarity - Clus tering - Partitioning methods - KMeans - Hierarchical Methods - Outliers - Reinforcement Learning - Reinforcement Learning Tasks - Q-learning (9)

Total L: 45

TEXT BOOKS:

1. Tom Mitchell , "Machine Learning", McGraw Hill, 2017.
2. Christopher M Bishop , "Pattern Recognition and Machine Learning Learning", Springer, 2011.

REFERENCES:

1. Ethem Alpaydin , "Introduction to Machine Learning", 3rd Edition, PHI Learning, 2015.
2. Trevor Hastie, Robert Tibshirani, Jerome friedman , "The Elements of Statistical learning", 2nd Edition, Springer, 2017.
3. Kevin Murphy , "Machine Learning - A Probabilistic Perspective", MIT Press, 2012.
4. Yaser S. Abu-Mostafa , "Learning from Data", AML, 2017.

19Z602 COMPILER DESIGN

3 1 0 4

INTRODUCTION TO COMPILERS : Translators - Compilation and Interpretation - The Phases of Compiler – Errors Encountered in Different Phases - The Grouping of Phases - Compiler Construction Tools - JIT. (7 + 2)

LEXICAL ANALYSIS : Need and Role of Lexical Analyzer - Input Buffering - Lexical Errors - Expressing Tokens by Regular Expression - Finite Automata: NFA- DFA - Converting NFA to DFA - Minimization of DFA- Converting Regular Expression to DFA. LEX Tool: Structure of LEX Program — Predefined Variables — Library routines – Design of Lexical Analyzer for a Sample Language. (9 + 3)

SYNTAX ANALYSIS : Need and Role of the Parser - Context Free Grammars - Top Down Parsing: Recursive Descent Parser - Predictive Parser. Bottom Up Parsers: Shift Reduce Parser - LR Parser - LR (0) Item - Construction Of SLR Parsing Table - CLR Parser - LALR Parser. Error Handling and Recovery in Syntax Analyzer — YACC Tool: Structure of YACC Program — Communication between LEX and YACC - Design of a Syntax Analyzer for a Sample Language. (10 + 5)

INTERMEDIATE CODE GENERATION : Benefits- Intermediate Languages - Generation of Three Address Code - Declarations - Assignment Statements - Arrays - Boolean Expressions - Backpatching - Flow of Control Statements — Procedure calls. (9 + 3)

RUN-TIME ENVIRONMENT, CODE OPTIMIZATION AND GENERATION : Source Language Issues - Storage Organization - Storage Allocation - Symbol Tables. Principal Sources of Optimization - Optimization of Basic Blocks - Global Optimization - Global Data Flow Analysis - Issues in Design of A Code Generator - A Simple Code Generator Algorithm. (10 + 2)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Alfred V Aho, Monica Lam, Ravi Sethi , Jeffrey D Ullman , "Compilers - Principles, Techniques and Tools", Essex Pearson, Harlow, 2014.
2. Sudha Sadasivam G , "Compiler Design", Scitech Publications (India) Private Limited, Chennai, 2010.

REFERENCES:

1. Dick Grone, Henri E Bal, Ceriel J H Jacobs , Koen G Langendoen , "Modern Compiler Design", John Wiley & Sons, USA,

2000.
2. Dhamdhere D M , "Compiler Construction Principles & Practice", Macmillan India Limited, New Delhi, 1997.
3. O.G. Kakde , "Compiler Design", 5th Edition, An Imprint of Laxmi Publications Pvt. Ltd., 2015.
4. V Raghavan , "Principles Of Compiler Design", Tata Mcgraw Hill Publishing Co Ltd, 2016.

19Z603 DISTRIBUTED COMPUTING

3 0 0 3

INTRODUCTION, MESSAGE PASSING AND RPC : Definition - System models - Design issues of distributed operating systems - Message Passing: Features and Issues–Buffering - Process addressing - Failure handling RPC: Model - Implementation - Stub generation - RPC Messages - Marshaling - Server management – Call semantics (10)

SYNCHRONIZATION : Clock synchronization - Physical clocks - Logical clocks - Election algorithms – Mutual exclusion - Deadlocks (8)

PROCESS AND RESOURCE MANAGEMENT: Process migration: Features – Mechanism. Resource Management: Load balancing approach - Load sharing approach (9)

CLOUD AS A DISTRIBUTED ENVIRONMENT : The Vision of Cloud Computing - Defining a Cloud - Historical Developments - Cloud Computing Reference Model –Cloud Deployment Models - Public, Private, Community, Hybrid Clouds - Cloud Delivery Models - IaaS, PaaS, SaaS - Characteristics and Benefits – Challenges. (8)

CLOUD TECHNOLOGIES : Technologies for Infrastructure as a service - Platform as a Service– Software as a service - Cloud Storage: MapReduce, GFS, HDFS - Cloud container: Docker. (10)

Total L: 45

TEXT BOOKS:

1. Pradeep K Sinha , "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, New Delhi, 2009.
2. Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi S , "Mastering Cloud Computing", Tata McGraw Hill Education Private Limited,, New Delhi, 2013.

REFERENCES:

1. Andrew S Tanenbaum, Marteen Van Steen , "Distributed Systems Principles and Paradigms", Pearson Education / Prentice Hall of India, New Delhi, 2007.
2. George Coulouris, Jean Dollimore , "Distributed Systems Concept and Design", Pearson Education, New Delhi, 2006.
3. David S Linthicium , "Cloud Computing and SOA Convergence in your Enterprise", Pearson, USA, 2010.
4. Sébastien Goasguen , "Docker in the Cloud -Recipes for AWS, Azure, Google, and More", O'Reilly Media, USA, 2016.

19Z604 EMBEDDED SYSTEMS

2 2 0 4

INTRODUCTION : Fundamental Components of Embedded Systems - Challenges for Embedded Systems - Examples - Programming Languages - Recent Trends in Embedded Systems - Architecture of Embedded Systems - Embedded Design Life Cycle - Development Environment (7 + 4)

MEMORY AND INTERRUPTS : Types of Memory - Direct Memory Access - Memory Testing - Common Memory problems - validating memory contents - Interrupts - Interrupt Service Routines (6 + 6)

COMMUNICATION INTERFACES : Interfacing Buses - Serial Interfaces - RS232/UART - RS422/RS485 - I2C Interface - SPI Interface (6 + 7)

REAL TIME OPERATING SYSTEMS : Real-Time Concepts - Task Management - Task Scheduling - Classification of Scheduling Algorithms - Clock Driven Scheduling - Event Driven Scheduling - Resource Sharing - Priority Inheritance Protocol - Priority Ceiling Protocol - Commercial RTOS (7 + 7)

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 (4 + 6)

Total L: 30 +T: 30 = 60

TEXT BOOKS:

1. Arnold S Berger , "Embedded Systems Design - An Introduction to Processes, Tools and Techniques", Elsevier, New Delhi, 2011.
2. Prasad K V K K , "Embedded/Real-Time Systems: Concepts, Design and Programming - The Ultimate Reference", Himal Impressions, New Delhi, 2003.

REFERENCES:

1. Sriram V Iyer, Pankaj Gupta , "Real-time Systems Programming", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
2. Michael Barr, Anthony Massa , "Programming Embedded Systems: with C and GNU Development Tools", 2nd Edition, OReilly, 1999.
3. Michael J Pont , "Embedded C", Pearson Education, 2007.

4. Raj kamal , "Embedded Systems Design", 3rd Edition, Tata McGraw Hill, 2009.

19Z610 MACHINE LEARNING LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, AO*)
3. Min-Max Search Trees and Alpha Beta Pruning
4. Knowledge Representation and Reasoning
5. Data Preparation for Machine Learning
6. Linear models : linear regression and classification
7. Non-Linear models : ANN and Decision Tree
8. Kernel and Hybrid methods : SVM and Baysien Network
9. Unsupervised Learning : Outlier Detection and Clustering
10. Use Machine Learning for solving any problem with sufficient data.

Total P: 30

19Z611 DISTRIBUTED COMPUTING LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1. Client Server Implementation using RPC
2. Implementation of Election algorithms.
3. Implementation of Distributed deadlock detection
4. Study of MPI
5. Simple application using MPI broadcasting (Matrix Multiplication, Pi calculation)
6. Point - to – Point application in MPI (Matrix Multiplication, Pi calculation)
7. Study of Hadoop & Map- Reduce Programming
8. Map- Reduce Programming on single files
9. Application development and deployment on cloud
10. Dockers

Total P: 30

19Z612 APPLICATION DEVELOPMENT LABORATORY

0 0 4 2

LIST OF EXPERIMENTS:

1. Create a simple webpage using HTML.
2. Use frames to Include Images and Videos in a web page.
3. Add a Cascading Style sheet for designing the web page
4. Design a dynamic web page with validation using JavaScript.
5. Design a Simple web application using Servlets.
6. Study of mobile computing, android operating system and ios
7. Develop an application that uses GUI components, Font and Colors.
8. Develop an application that uses Layout Managers and event listeners.
9. Write an android application that draws basic graphical primitives on the screen.
10. Develop an application that makes use of mobile database.

Total P: 60

REFERENCES:

1. Matt Neuburg , "Learning Web App Development: Build Quickly with Proven JavaScript Techniques", 1st Edition, O'Reilly Media, 2018.
2. Jr. Annuzzi Joseph, Lauren Darcey, Shane Conder , "Introduction to Android Application Development: Android Essentials (Developer's Library)", 5th Edition, Addison-Wesley Professional, 2016.
3. K Talukder, Hasan Ahmed, Roopa Yavagal , "Mobile Computing: Technology, Applications and Service Creation by Asoke", 2nd Edition, McGraw Hill Education, 2017.
4. John Ray , "iOS 9 Application Development in 24 Hours", 7th Edition, Sams Publishing, 2016.

19Q613 QUANTITATIVE AND REASONING SKILLS

0 0 2 1

QUANTITATIVE AND REASONING SKILLS :

1. Number System, Time and Work
2. Percentages , Simple and Compound Interests
3. Time, Speed and Distance
4. Permutation, Combination and Probability
5. Ratio and Proportion
6. Profit, Loss and Partnership
7. Logarithms, Progressions, Geometry and Quadratic Equations
8. Coding and Decoding
9. Series, Analogy and Odd Man Out
10. Visual Reasoning
11. Data Arrangements

12. Blood Relations
13. Clocks, Calendars and Direction Sense
14. Cubes, Logical Connectives and Syllogisms
15. Venn Diagrams, Interpretations and solving

Total P: 30

REFERENCES:

1. Aggarwal R S , "Quantitative Aptitude for Competitive Examinations", 3rd Edition, S Chand Publishing, New Delhi, 2017.
2. ETHNUS , "Aptimithra", 1st Edition, McGraw-Hill Education Pvt Ltd, 2013.
3. FACE , "Aptipedia Aptitude Encyclopedia", 1st Edition, Wiley Publications, Delhi, 2016.

19Z620 INNOVATION PRACTICES

0 0 4 2

INNOVATIVE PRACTICES :
1. This course involves preparing students to think innovatively and present possible solutions to identified industry/academic problem or issue

Total P: 60

SEMESTER - 7

19Z701 CRYPTOGRAPHY

2 2 0 4

COMPUTER SECURITY CONCEPTS : The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Number Theory Concepts: Fermat's and Euler's Theorems, Euclidean Algorithm - Classical Encryption Techniques (5 + 4)

SYMMETRIC CIPHERS : Block Ciphers and Stream Ciphers - Random Bit Generation and Stream Ciphers: Principles of Pseudorandom Number Generation - Pseudorandom Number Generators:Linear Congruential Generators - Block Cipher Modes - Data Encryption Standard (6 + 6)

PUBLIC-KEY CRYPTOGRAPHY : Principles of Public Key Cryptosystems - The RSA Algorithm - Diffie-Hellman Key Exchange - Elliptic Curve Cryptography (5 + 5)

CRYPTOGRAPHIC HASH FUNCTIONS : Secure Hash Algorithm (SHA) - Message Authentication Codes - Message Authentication Requirements - Message Authentication Functions - Digital Signatures - Digital Signature Standard (DSS) - Blockchain: The growth of blockchain technology - Types, Consensus, and Mining Task - Platforms. (6 + 8)

ROLE OF CRYPTOGRAPHY IN SECURITY PROTOCOLS : Network and Internet Security Protocols: Transport-Level Security -Secure Sockets Layer (SSL) - Email Security: Pretty Good Privacy (PGP) - Firewalls: Characteristics and Types (8 + 7)

Total L: 30 +T: 30 = 60

TEXT BOOKS:

1. Hans, Knebl, Helmut, Delfs , "Introduction To Cryptography Principles And Applications", 3rd Edition, Springer- Verlag, Berlin Heidelberg, 2015.
2. William Stallings , "Cryptography and Network Security: Principles and Practice", 7th Edition, Prentice Hall of India, Pearson Education, New Delhi, 2017.

REFERENCES:

1. Behrouz A Forouzan , "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill Ltd, New Delhi, 2015.
2. Atul Kahate , ", Cryptography and Network Security", 3rd Edition, Tata McGraw Hill Ltd, New Delhi, 2013.
3. Imran Bashir , "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", 7th Edition, Packt Publishing Ltd, 2018.
4. Douglas Robert Stinson, Maura Paterson , "Cryptography: Theory and Practice", 4th Edition, Chapman and Hall/CRC, 2018.

19Z720 PROJECT WORK I

0 0 4 2

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

SEMESTER - 8

19Z820 PROJECT WORK II

0 0 8 4

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
- Testing and Validation
- Results and future work
- Consolidated report based on standards

Total P : 120

LANGUAGE ELECTIVES

19G001 COMMUNICATION SKILLS FOR ENGINEERS

0 0 4 2

COMMUNICATION CONCEPTS :
Process of Communication
Inter and Intrapersonal Communication
Inter and Intrapersonal CommunicationActivities

(9)

FOCUS ON SOFT SKILLS :
Etiquette — Work Place etiquette — Telephone etiquette
Body Language
Persuasive Communication
Public Speaking
Critical Reasoning and Conflict Management based on Case Studies
Group Communication
Meetings
Interview Techniques

(14)

TECHNICAL WRITING :
Technical Writing Principles
Style and Mechanics
Technical Definitions – Physical, Functional and Process Descriptions
Technical Report Writing
Preparing Instructions and Manuals
Interpretation of Technical Data

(15)

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

TECHNICAL COMMUNICATION :
Seminars
Process Description and Group Discussions
Use of Visual Aids

(15)

Total P: 60

TEXT BOOKS:

1. Faculty Incharge "Course Material on "Communication Skills for Engineers"", PSG College of Technology., Coimbatore, 2019

REFERENCES:

1. Jeff Butterfield "Soft Skills for Everyone", Cengage Learning., New Delhi, 2013
2. Jean Naterop B and Rod Revell "Telephoning in English", Cambridge University Press., Cambridge, 2011
3. David A Mc Murrey and Joanne Buckley "Handbook for Technical Writing", Cengage Learning., New Delhi, 2011
4. Simon Sweeney "English for Business Communication", Cambridge University Press., New Delhi, 2012

19G002 GERMAN- LEVEL A1.1

0 0 4 2

GUTEN TAG! :
1. To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages
2. Vocabulary: related to the topic
3. Grammar: W — Questions, Verbs & Personal pronouns I.

(10)

FREUNDE, KOLLEGEN UND ICH :
1. To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers
2. Vocabulary: related to the topic
3. Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural

(10)

IN DER STADT :
1. To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences
2. Vocabulary: related to the topic
3. Grammar: Definite & indefinite articles, Negotiation, Imperative with Sien verbs

(12)

GUTEN APPETIT! :
1. To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences
2. Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs

(13)

TAG FŸR TAG/ZEIT MIT FREUNDEN :
1. To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant; ask excuse, fix appointments on phone
2. Vocabulary: related to the topic
3. Grammar: Time related prepositions, Possessive articles, Modalverbs

(15)

Total P: 60

TEXT BOOKS:

1. Dengler Stefanie "Netzwerk A1.1", Klett-Langenscheidt Gmbh., München, 2013
2. Sandra Evans, Angela Pude "Menschen A1", Hueber Verlag., Germany, 2012

REFERENCES:

1. Stefanie Dengler "Netzwerk A1", Klett-Langenscheidt Gmbh., München, 2013
2. Hermann Funk, Christina Kuhn "Studio d A1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2009
3. Rosa-Maria Dallapiazza "Tangram Aktuell 1 (Deutsch als Fremdsprache)", Max Hueber Verlag., Munchen, 2004
4. Christiane Lemcke und Lutz Rohrmann "'Grammatik Intensivtrainer A 1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2012

19G003 FRENCH LANGUAGE LEVEL 1

0 0 4 2

PARTS OF SPEECH :
1. inviter et répondre à une invitation, Pronoms sujets
2. L'article définis, l'article indéfinis
3. Conjugation : présent, adjectifs possessifs
4. interrogation, décrire les personnes
5. La vie de quatre parisiens de professions différentes

(12)

ELEMENTS OF GRAMMAR :
1. Exprimer l'ordre et l'obligation demander et commander
2. l'adjectif possessifs, l'article partitif, l'article démonstratif, négation ne
3. pas, l'article contracté

4. verbe pronominaux
5. prepositions

(12)

SENTENCE STRUCTURE :
1. Raconter et reporter-donner son avis
2. Futur simple, pronom complètement d'objet direct, passé composé
3. plusieurs région de France, imparfait, pronom y/en, imparfait

(12)

TENSES AND NUMBERS :
1. Demander l'autorisation-passé récent, futur proche
2. La vie administrative et régionale, Pluriel des noms, moyens de transport

(12)

DISCOURSE :
1. le discours rapporté, décrire un lieu, exprimer ses préférences
2. décrire la carrière, discuter d'système éducation de France
3. parler de la technologie de l'information

(12)

Total P: 60

TEXT BOOKS:

1. Christine Andant étal "À propos (livre de l'élève", LANGER., NEW DELHI, 2012
2. Myma Bell Rochester "Easy French Step By Step", MCGrawhill Companies., USA, 2008

REFERENCES:

1. Michael D. Oates "Entre Amis: An Interactive Approach", Houghton Mifflin., 2005 , 5th
2. Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French", .,
3. Simone Renaud, Dominique van Hooff "En bonne forme", .,

19G004 BASIC JAPANESE

0 0 4 2

JAPANESE PEOPLE AND CULTURE :
1. Basic greetings and responses
2. Basic script — Method of writing hiragana and katakana — Combination sounds and simple words
3. Self introductions: "Hajimemashite" -Demonstratives "Kore", "Sore", "Are" — Demonstrative "Kono", "Sono", "Ano"
4. Possessive noun particle "no" — Japanese apartments: Greeting your neighbor

(12)

PATICLE "NI (AT)" FOR TIME :
1. kara (from) ~ made(until) — Particle "to (and)"
2. Time periods: Days of the week, months, time of day –Verbs (Present / future and past tense)
3. Telephone enquiry: Asking for a phone no. And business hours- Destination particle "e".

(12)

LIKES AND DISLIKES :
1. Potential verbs (wakarimasu and dekimasu) — "Kara (~ because)"
2. Adverbs — Asking some one out over the phone-Verbs denoting presence
3. Introduction to Adjectives (na and ii type) -Verb groups — I, II and III — Exercises to group verbs- Please do (te kudasai)
4. Present continuous tenses (te imasu) — Shall I? (~ mashou ka) — Describing a natural phenomenon (It is raining)

(12)

DIFFERENT USAGES OF ADJECTIVES :
1. Comparison — Likes and dislikes — Going to a trip- Need and desire (ga hoshii) — Wanting to . . . (Tabeti desu)- Going for a certain purpose (mi –ni ikimasu)
2. Choosing from a menu-Adjectives ("i" and "na" type) — Adjectives (Positive and negative useage) (12)

ROLE PLAYS IN JAPANESE :
1. Framing simple questions & answers
2. Writing Short paragraphs & Dialogues
3. A demonstration on usage of chopsticks and Japanese tea party (12)

Total P: 60

TEXT BOOKS:

1. Minna no Nihongo, Honsatsu Roma "ji ban (Main Textbook Romanized Version)", . International publisher — 3A Corporation., Tokyo, 2012

REFERENCES:

1. Eri Banno et.al "Genki I: An Integrated Course in Elementary Japanese I -Workbook", ., 1999
2. Tae Kim "A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar", ., 2014
Minna No Nihongo "Translation & Grammatical Notes In English Ele

PROFESSIONAL ELECTIVES

19Z001 APPROXIMATION ALGORITHMS

3 0 0 3

INTRODUCTION AND COMBINATORIAL ALGORITHMS: Definitions - Performance ratios - vertex cover problem - Lower bounding - Greedy set cover problem - Layering - Application to shortest superstring (9)

LINEAR PROGRAMMING DUALITY AND ROUNDING : LP-Duality theorem - Min-max relations and LP-Duality - LP- rounding for set cover problem - randomized rounding - Primal-Dual method for set cover problem (9)

CUTS AND LP RELAXATIONS : Multicut and Integer Multicommodity - Primal-dual scheme for Multicut - Multiway Cut - Randomized rounding algorithm for multiway cut - Multicut in General Graphs - Sum multicommodity flow - LP-rounding-based algorithm (9)

SEMIDEFINITE PROGRAMMING: Strict quadratic and vector programs - Properties of positive semidefinite matrices-Semidefinite programming problem - Randomized rounding algorithm - Improving the guarantee for MAX-2SAT (9)

HARDNESS OF APPROXIMATION: Reduction, graphs, and hardness factors - PCP theorem - hardness of MAX- 3SAT - Hardness ofset cover (9)

Total L: 45

TEXT BOOKS:

1. Vijay V. Vazirani , "Approximation Algorithms", Springer Nature (SIE), Berlin, 2010.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein , "Introduction to Algorithms", 3rd Edition, MIT Press,England, 2009.

REFERENCES:

1. David P. Williamson, David P. Shmoys , "The Design of Approximation Algorithms", Cambridge University Press, England, 2011.
2. Ellis Horrowitz, Sartaj Sahni, Sanguthevar Rajasekaran , "Fundamentals of Computer Algorithms", 1st Edition, Galgotia Publications, New Delhi, 2010.
3. Bernd Gärtner, Jiri Matousek , "Approximation Algorithms and Semidefinite Programming", Springer, Berlin, 2012.
4. Christos H. Papadimitriou, Kenneth Steiglitz , "Combinatorial Optimization: Algorithms and Complexity", 1st Edition, Dover Publications, New York, 2013.

19Z002 ADVANCED DATA STRUCTURES

3 0 0 3

AMORTIZED ANALYSIS AND SETS : Amortization - Methods - Applications. Sets: Disjoint Sets - Dynamic Set Operations - Van Emde Boas Trees. (9)

HEAP STRUCTURES : Min - Max Heaps - Deaps - Leftist Heaps - Binomial Heaps - Fibonacci Heaps. (8)

SEARCH TREES : Red-Black Tree - AA Tree - Interval Tree - Splay Trees. (7)

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

RANDOMIZATION : Random Number Generators - Skip Lists - Primality Testing - Treaps. - Probabilistic analysis and Randomization. (12)

Total L: 45

TEXT BOOKS:

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein , "Introduction to Algorithms", MIT Press,, Massachusetts 2009.
2. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta , "Fundamentals of Data Structures in C++", University Press, New Delhi, 2013.

REFERENCES:

1. Subrahmanian V S , "Principles of Multimedia Database Systems", Morgan Kaufman, USA, 2001.
2. Mark Allen Weiss , "Data structures and Algorithm Analysis in C++", Pearson Education, New Delhi, 2006.
3. Peter Brass , "Advanced Data Structures", Cambridge University Press, USA, 2008.
4. Venkatesan R and Lovelyn Rose S , "Data Structures", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, 2015.

19Z003 BIG DATA AND ANALYTICS

3 0 0 3

INTRODUCTION : Overview-data science- big data characteristics – architecture of big data systems – challenges-usecases –dataanalyticslifecycle (4)

NOT ONLY SQL : Data modeling — CAP theorem — Key value stores –Riak– Column family datastores – Hbase – DocumentDataStore—MongoDB—Graphdatastores—Neo4j—Case studies (10)

MAPREDUCE PROGRAMMING : HDFS architecture - MapReduce Architecture: Loading data into HDFS, Executing the Map phase, Shuffling and sorting, Reducing phase; MapReduce Programs - Creation and execution of MapReduce Programs-examples, Basic statics using MapReduce; Optimizing MapReduce Tasks — Hadoop Ecosystem — Introduction to Spark (10)

THEORY AND METHODS : MapReduce Implementation of PCA — MapReduce implementation of clustering approaches — Kmeans, Kmedoids — MapReduce implemenation of classification approaches — Regression, KNN, SVM- Time series analysis — Autocorrelation, Autoregression, Moving average, ARMA, ARIMA (12)

TEXT AND STREAM ANALYTICS: Process of text analytics — Collecting raw text, representing text, TFIDF, categorization using topics , determining sentiments — Case study — Architecture for mining data streams — Processing—Sampling, filtering—real time analytics platform—case study (9)

Total L: 45

TEXT BOOKS:
1. G. Sudha Sadasivam,R. Thirumahal, "Big Data Analytics",Oxford University Press,2020.
2. EMC Educational Series , "Data Science and Big Data Analytics", Wiley, New Delhi, 2015.

REFERENCES:
1. David Stevenson , "Big Data Demystified", Pearson Education, 2018.
2. Venkat Ankam , "Big Data Analytics", Packt Publishing, 2016.
3. Vignesh Prajapathi , "Big Data with R and Hadoop", Packt Publishing, Delhi, 2013.
4. U Dinesh Kumar , "Business Analytics – The Science of Data Driven Decision Making", Wiley, India, 2017.

19Z004 COMPUTER GRAPHICS

3 0 0 3

INTRODUCTION : Application Areas of Computer Graphics - Overview of Graphics Systems - Video Display Devices - Raster Scan Systems - Random Scan Systems - Graphics Monitors and Work Station - Input Devices - Output Primitives: Points and Lines - Line Drawing Algorithms - Mid-Point Circle and Ellipse Algorithms - Attributes of Output Primitives. (10)

TWO-DIMENSIONAL CONCEPTS : Two-Dimensional Geometric Transformations - Two-Dimensional Viewing - Two-Dimensional Point and Line Clipping - Sutherland-Hodgernan Polygon Clipping - Weiler-Atherton Polygon Clipping - Text Clipping - Exterior Clipping. (10)

THREE-DIMENSIONAL CONCEPTS : Three-Dimensional Display Methods - Three-Dimensional Object Representations - Three-Dimensional Geometric and Modeling Transformations - Three-Dimensional Viewing and Clipping. (10)

VISIBLE SURFACE DETECTION AND SURFACE RENDERING METHODS : Classification of visible surface detection algorithm - Back-face Detection - Depth-buffer method - Scan-line method - Area Sub-division - Octree methods - Surface Rendering method. (8)

COMPUTER ANIMATION : Color Models - Design of Animation Sequence - General Computer Animation Functions - Raster Animation - Computer Animation Languages - Key Frame Systems - Motion Specifications. (7)

Total L: 45

TEXT BOOKS:
1. Donald Hearn and Pauline Baker M , "Computer Graphics C Version", 2nd Edition, Pearson Education, Asia, 2011.
2. Foley, Vandam, Feiner and Huges , "Computer Graphics: Principles & Practice", 3rd Edition, Pearson Education, Asia, 2013.

REFERENCES:
1. Zhigand Xiang and Roy Plastock , "Schaum's outlines of Computer Graphics", 2nd Edition, Tata McGraw Hill, USA, 2015.
2. David F Rogers , "Procedural elements for Computer Graphics", 2nd Edition, Tata McGraw Hill, USA, 2000.
3. Steve Marschner, Peter Shirley , "Fundamentals of Computer Graphics", 4th Edition, CRC press, 2015.
4. Steven Harrington , "Computer Graphics: A programming Approach", 2nd Edition, Tata McGraw-Hill, 2017.

19Z005 COMPUTER VISION

3 0 0 3

IMAGE PROCESSING FOUNDATIONS : Review of image processing techniques – classical filtering operations –

thresholding techniques — edge detection techniques — corner and interest point detection — mathematical morphology–texture. (9)

SHAPES AND REGIONS : Binary shape analysis — connectedness — object labeling and counting — size filtering — distance functions — skeletons and thinning — deformable shape analysis — boundary tracking procedures — active contours — shape models and shape recognition — centroidal profiles — handling occlusion — boundary length measures – boundary descriptors. (9)

HOUGH TRANSFORM : Line detection — Hough Transform (HT) for line detection — foot-of-normal method — line localization — line fitting — RANSAC for straight line detection — HT based circular object detection — accurate center location—speed problem—ellipse detection—Case study: Human Iris location. (9)

3D VISION : Methods for 3D vision — projection schemes — shape from shading — photometric stereo — shape from texture — shape from focus — active range finding — surface representations — point-based representation — volumetric representations – 3D object recognition (9)

3D MOTION : 3D reconstruction – introduction to motion – triangulation – bundle adjustment — translational alignment — parametric motion -spline-based motion – optical flow – layered motion. Application: Photo album – Face detection – Face recognition – Open CV (9)

Total L: 45

TEXT BOOKS:

1. D. L. Baggio , "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
2. E. R. Davies , "Computer & Machine Vision", 4th Edition, Academic Press, 2012.

REFERENCES:

1. Jan Erik Solem , "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.
2. Mark Nixon, Alberto S. Aquado , "Feature Extraction & Image Processing for Computer Vision", 3rd Edition, Academic Press, 2012.
3. R. Szeliski , "Computer Vision: Algorithms and Applications", Springer, 2011.
4. Simon J. D. Prince , "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

19Z006 DEEP LEARNING

3 0 0 3

DEEP LEARNING FUNDAMENTALS : Artificial Intelligence, Machine Learning and Deep Learning - Need for Deep Learning - Data Representations for Neural Networks - Tensor Operations - Error Functions - Optimization Techniques - Activation functions - Initialization Techniques (10)

RECURRENT NEURAL NETWORKS : Recurrent Neural Networks Architecture - Backpropagation through time (BPTT)- Vanishing and Exploding Gradients — Bidirectional RNN - Truncated BPTT — GRU- LSTMs — Neural Turing Machine - Recursive Neural Networks - Applications of RNN (12)

CONVOLUTIONAL NEURAL NETWORKS : Layers in CNN architecture — ReLu and the variants - Feature Map — Weight sharing — Translation invariance - Pretrained Models - Transfer Learning - Applications of CNN (7)

AUTOENCODER, RESTRICTED BOLTZMANN MACHINE : Features of autoencoders — Vanilla autoencoder — Convolutional autoencoder — Regularized autoencoders - Denoising autoencoder - Sparse Autoencoders - Contractive Autoencoder - Applications of autoencoder. RBM— Deep Belief Networks (8)

GENERATIVE, BAYESIAN, REINFORCEMENT DEEP LEARNING : Generative Modeling — Variational autoencoders - Generative Adversarial Networks – Bayesian Deep Learning – Deep Reinforcement Learning (8)

Total L: 45

TEXT BOOKS:

1. S Lovelyn Rose, L Ashok Kumar, D Karthika Renuka , "Deep Learning using Python", Wiley India Pvt. Ltd., New Delhi, 2019.
2. Francois Chollet , "Deep Learning with Python", Manning Publications, New York, 2018.

REFERENCES:

1. Thomas Farth , "Deep Learning: A Comprehensive Guide for Beginners", Atlantic Publishers, 2019.
2. David Foster , "Generative Deep Learning", O'Reilly Media, Inc., 2019.
3. Eugene Charniak , "Introduction to Deep Learning", MIT Press, London, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville , "Deep Learning", MIT Press, 2016.

19Z007 INFORMATION RETRIEVAL

3 0 0 3

INTRODUCTION : Boolean retrieval - IR problem - Inverted index - Processing Boolean queries - Extended Boolean model and ranked retrieval - Document delineation - Determining vocabulary of terms - Skip pointers – Search structures for dictionaries - Wildcard queries - Spelling and phonetic correction (9)

INDEX CONSTRUCTION : Blocked sort-based indexing - Single-pass in-memory indexing - Distributed indexing -

Dynamic indexing - Statistical properties of terms in IR - Dictionary compression - Postings file compression (9)

VECTOR SPACE MODEL AND EVALUATION : Term frequency and weighting - Vector space model - Queries as vectors - Computing vector scores - IR system evaluation - Standard text collections - Evaluation of unranked and ranked retrieval sets (9)

PROBABILISTIC AND LANGUAGE MODELS : Probability ranking principle - Binary independence model - Appraisal of probabilistic models - Language models - Query likelihood models - Merits and demerits of language models (9)

WEB SEARCH : Web characteristics - Search user experience - Index size and estimation - Near-duplicates and shingling - Web crawler features and architecture - URL frontier - Link analysis - Web as a graph - PageRank algorithm - Hubs and authorities (9)

Total L: 45

TEXT BOOKS:

1. Manning C, Raghavan P, Schutze H , "Introduction to Information Retrieval", Cambridge University Press, New Delhi, 2008.
2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto , "Modern Information Retrieval: The Concepts and Technology behind Search", Addison Wesley, USA, 2011.

REFERENCES:

1. Bruce Croft W, Metzler D, Strohman T , "Search Engines: Information Retrieval in Practice", Addison Wesley, USA, 2009.
2. Gerald K , "Information Retrieval Architecture and Algorithms", Springer, Heidelberg, 2013.
3. Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack , "Information Retrieval: Implementing and Evaluating Search Engines", MIT Press, Cambridge, USA, 2016.
4. Hang Li , "Learning to Rank for Information Retrieval and Natural Language Processing", 2nd Edition, Morgan & Claypool Publishers, USA, 2014.

19Z008 INFORMATION SECURITY

3 0 0 3

INTRODUCTION : History - Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing the Components - Balancing Security and Access - The SDLC - The Security SDLC (9)

SECURITY INVESTIGATION : Need for Security - Business Needs - Threats - Attacks - Legal - Ethical and Professional Issues in Information Security (9)

RISK MANAGEMENT : Risk Identification - Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy (9)

STANDARDS AND PRACTICES : Blueprint for Security - Information Security Policy - Standards and Practices - ISO17799/BS 7799 - NIST Models - Design of Security Architecture - Continuity Strategies (9)

PHYSICAL DESIGN : Security Technology - IDS - Scanning and Analysis Tools - Cryptographic Algorithms and Tools - Physical Security - Implementing Information Security - security and Personnel - Information Security Maintenance - Digital Forensics (9)

Total L: 45

TEXT BOOKS:

1. Michael E Whitman, Herbert J Mattord , "Principles of Information Security", 6th Edition, Cengage Learning Inc, United States, 2017.
2. Micki Krause, Harold F Tipton , "Handbook of Information Security Management,Volume 1-3", CRC Press LLC, 2007.

REFERENCES:

1. Matt Bishop , "Computer Security Art and Science", Pearson/PHI, 2003.
2. William Stallings , "Cryptography and Network Security Principles and Practice", 7th Edition, Prentice Hall of India, Pearson Education, New Delhi, 2017.
3. V. K. Pachghare , "Cryptography and Information Security", 2nd Edition, PHI Learning, Private Limited, 2015.
4. Ritendra Goel, Praveen Kumar Shukla, Surya Prakash Tripathi , "Introduction to Information Security and Cyber Laws", Kogent Learning Solutions Inc, 2014.

19Z009 INTERNET OF THINGS

3 0 0 3

INTRODUCTION : Definitions and Functional Requirements - M2M Architecture - IoT Architecture - Basics of Sensors and Actuators - Analog Sensors - Digital Sensors - Actuators - IoT Architecture for Enterprises - Enterprise IoT – Technology Stack-Middle ware layer –Micro service Vs Monolithic Architecture (10)

IOT PROTOCOLS : IoT Protocol Standardization - Efforts - The Connectivity Standards - IEEE 802.15.4 – Zigbee Architecture -IEEE 802.11 - LoRA - 5G for IoT (8)

PROTOTYPING IOT PROJECTS : Open Source versus Closed Source - Prototyping Embedded Devices - CLOUD

COMPUTING AND IoT - Integration of IoT and cloud - Drivers for integration - Challenges and Open Issues - Predictive analytics in Cloud (9)

MOVING INTELLIGENCE TO THE EDGE : The Need for Edge Analytics - Challenges in Centralized IoT - Edge Analytics Architecture - Capabilities needed at Edge Devices - Running Data Analytics at Edge Devices - The Edge Analytics Platforms - Case Studies (9)

CYBER PHYSICAL SYSTEMS - CASE STUDIES : Real world design constraints - Smart Energy: Influence of Digitization - Generation, Transmission, Distribution and Metering - Self healing in Smart Grids - Connected Healthcare: The rise of connected healthcare solutions with IoT - Opportunities and Challenges - Smart City : Key Drivers - Smart City Examples - IoT Business Models (9)

Total L: 45

TEXT BOOKS:

1. Honbo Zhou , "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
2. Arvind Ravulavaru , "Enterprise Internet of Things Handbook: Build end-to-end IoT solutions using popular IoT platforms", Packt Publishing Limited, 2018.

REFERENCES:

1. Dieter Uckelmann, Mark Harrison and Florian Michahelles , "Architecting the Internet of Things", Springer, 2011.
2. Oliver Hershent, David Boswarthick , "The Internet of Things - Key applications and Protocols", Wiley,, 2012.
3. David Boswarthick, Omar Elloumi, Olivier Hersent , "M2M Communications: A Systems Approach", Wiley & Sons Ltd, UK, 2012.
4. Arshdeep Bagha, Vijay Madisetti , "Internet of Things: A Hands-On Approach", 2014, .

19Z010 MULTICORE ARCHITECTURE

3 0 0 3

INTRODUCTION : Taxonomy - Single core to Multi-core architectures — Shared Memory Architectures - Simultaneous Multithreading – Design Issues - Applications (9)

PARALLELISM : Parallelization Process - Partitioning for Performance - Data Access and Communication in a Multi-Memory System - Orchestration for Performance - Performance Factors from the Processors' Perspective - Scaling Workloads and Machines (9)

MEMORY ORGANIZATION : Hierarchical memory organization – Advanced cache optimization - Symmetric and Distributed Shared Memory Architectures - Cache coherence – Snoopy based protocol – Synchronization – Memory consistency (9)

INTERCONNECTION NETWORK : Introduction - Organizational Structure - Network on Chips (NoC) – Interconnection Topologies - Evaluating Design Trade-offs in Network Topology — Routing - Switch Design - Flow Control (9)

GPU COMPUTING : CUDA programming model — Memory Hierarchy — Optimization Techniques — Dynamic parallelism – Debugging and Profiling CUDA programs (9)

Total L: 45

TEXT BOOKS:

1. John L. Hennessey, David A. Patterson , "Computer Architecture: A Quantitative Approach", Elsevier India Pvt. Ltd, New Delhi, 2015.
2. David E Culler, Jaswinder Pal Singh, Anoop Gupta , "Parallel Computer Architecture, A Hardware / Software approach", Morgan Kaufman, New Delhi, 2013.

REFERENCES:

1. Kai Hwang , "Advanced Computer Architecture Parallelism, Scalability, Programmability", Tata Mc Graw Hill, New Delhi, 2010.
2. Gerassimos Barlas , "Multicore and GPU Programming: An Integrated Approach", Morgan Kaufman, New Delhi, 2017.
3. Manferdelli, Redmond Govindaraju, Crall , "Challenges and Opportunities in Many-Core Computing", Proceedings of the IEEE, Vol 96, Issue 5, 2008.
4. Owens, Davis Houston, Green, Stone, Phillips , "GPU Computing", Proceedings of the IEEE,Vol 96, Issue 5, 2008.

19Z011 MULTI-TIER COMPUTING

3 0 0 3

INTRODUCTION AND BUSINESS NEEDS : The Business opportunity- Driving forces- Major issues in information Technology- Right sizing- Review of Host & Non-distributed computing. Basis of Distributed computing — Decomposition approaches Layers vs Tiers. Basis of Client / Server computing –Components.Client / Server computing –Approaches –Applications development-Cost –Implementation. OPEN SYSTEM STANDARDS FOR CLIENT/SERVER COMPUTING: Understanding Client/Server computing –Dispelling the Myths-Obstacles-Upfront and Hidden-Standards Setting Organizations-Factors for Success (9)

CLIENTS,SERVERS, TRANSACTIONS AND OPERATING SYSTEMS : The Anatomy of a server program, Operating System Basic and Extended Services for server applications, Server Scalability, Client Anatomy, Client/server Hybrids - Comparison of two and three tier- Client side, Server side and Middleware side- Hardware and Softwarerequirements- Transaction

servers-TP lite Vs TP Heavy (9)

MIDDLEWARE : Hardware and Software requirements-Netware connectivity-Types of Middleware –DataBase/SQL middleware –Standards, NOS: Extending the Local OS's reach, Global directory Services,X.500, LDAP, Distributed Time services, Distributes Security services, Peer-to-peer communications, Remote Procedure call, Messagingand Queuing, MOM versus RPC (9)

DISTRIBUTED COMPUTING ENVIRONMENT : The Enterprise NOS, The Internet as a NOS, MULTI-TIER COMPUTING: Overview –Benefits –Disadvantages-Components –Tier separations and Interaction. THIN CLIENT COMPUTING: Introduction to computing models – Comparison –Components-environments (9)

FRONT END TOOLS AND CURRENT TRENDS : Overview-The Client components-Essential features of a front end tools - Architecture roles in building multi-tier systems. MULTI-TIER ARCHITECTURAL CASE-STUDIES : Enterprise Information Sharing System, Sales automation system, Accounting system and online courseware system (9)

Total L: 45

TEXT BOOKS:

1. Robert Orfali, Dan Harkey, Jeri Edwards , "Essential Client/Server Survival Guide", Galgotia Publications, New Delhi, 2001.
2. Patrick Smith, Steve Guengesich , "Client/Server Computing", Prentice Hall of India, New Delhi, 2002.

REFERENCES:

1. Dawana Travis Dewire , "Client/Server Computing", ", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
2. Joel P Kaster , "Understanding Thin Client/Server Computing", Prentice Hall of India, New Delhi, 2001.
3. Dmitriy Dorofeev, Sergey Shestakov , "2-tier vs. 3-tier Architectures for Data Processing Software", ACM, New York, 2018.
4. Mike Wasson, Marc Wilson, Alex Buck , "N-tier architecture style", Microsoft, Redmond, 2018.

19Z012 NATURAL LANGUAGE PROCESSING

3 0 0 3

INTRODUCTION: N e e d - Approaches to language - Am biguity - Language Resources and Properties - Mathematical and Linguistic Essentials (9)

WORDS: Regular Expressions and Automata - Words and Transducers - N-grams - Part of Speech Tagging - Hidden Markov and Maximum Entropy Models. (9)

SYNTAX: Formal Grammars of English - Parsing with Context-Free Grammars - Statistical Parsing - Features and Unification - Language and Complexity (9)

SEMANTICS : Representing Meaning - Computational Semantics - Lexical semantics - Computational Lexical semantics -Computational Discourse (9)

NLP TASKS: Information Extraction - Question Answering - Summarization - Chatbots (9)

Total L: 45

TEXT BOOKS:

1. Daniel Jurafsky, James H Martin , "Speech and Language Processing", 1st Edition, Pearson Education, Singapore, 2008.
2. Christopher D Manning, Hinrich Schütze , "Foundations of Statistical Natural Language Processing", 1st Edition, MIT Press, Cambridge, 2003.

REFERENCES:

1. James Allen , "Natural Language Understanding", 1st Edition, Pearson Education, New Delhi, 2003.
2. Jacob Eisenstein , "Introduction to Natural Language Processing", 1st Edition, MIT Press, Cambridge, USA, 2019.
3. Hobson Lane, Hannes Hapke, Cole Howard , "Natural Language Processing in Action: Understanding, analyzing, and generating text with Python", 1st Edition, Manning Publications, NY, USA, 2019.
4. Grant S. Ingersoll, Thomas S. Morton, Drew Farris , "Taming Text: How to Find, Organize, and Manipulate It", 1st Edition, Manning Publications, NY, USA, 2013.

19Z013 OPEN SOURCE SYSTEMS

3 0 0 3

PRINCIPLES OF OPEN SOURCE SOFTWARE : Introduction to Open Source - The Philosophy of OSS - The Cathedral and Bazaar Model - Commercial Software and OSS - Free Software and Freeware - Open Source Licenses - Copyrights and Copyleft — Patents - Economics of FOSS: Zero Marginal Cost - Income – Generation Opportunities - Problems with Traditional Commercial Software -Internationalization. (9)

OPEN SOURCE OPERATING SYSTEMS AND DATABASE : Kernel Types - Architectures - Supported File Systems — Security Issues - Case Study: Flavors Of Linux - SQL Standard Compliance - Supported Platforms - Programming Interfaces. Case Study: Mysql - Internals and Portability - Data Types - Security - Scalability - Connectivity - Localization - Postgresql - Mongodb - Hbase. (9)

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 — Datatypes, looping statements, Arrays, Array functions, String functions, File concepts, Forms, database connection. (9)

OPEN SOURCE WEB SERVER : Web Server - Feature — Architectures - Case Study: Apache Web Server - Configuring and Using Web Server - Comparison of Apache Web Server with Commercial Web Servers. (9)

TOOLS AND TECHNOLOGIES : Integrated Development Environment for Development and Testing Eclipse, NetBeans, Code::Blocks, Aptana Studio3, Xcode - Text Processing Tools - E-Learning Tools — Moodle, Sakai, EFront Learning- Version Control tools — Bazaar, GIT, SVN- Content Management Tools — WordPress — Joomla- Magneto - Parallel and System Programming Tools- FastFlow, CUDA - Virtualization and Cloud Computing - Social Network Engine. (9)

Total L: 45

TEXT BOOKS:

1. Kailash Vadera, Bhavyesh Gandhi , "Open Source Technology", University Science Press, New Delhi, 2009.
2. Richard Petersen , "Linux: The Complete Reference", Tata McGraw Hill, New Delhi, 2007.

REFERENCES:

1. Sandeep Koranne , "Handbook of Open Source Tools", Springer Science & Business Media, Heidelberg, 2010.
2. Christopher Negus, Christine Bresnahan , "Linux Bible", Wiley, USA, 2015.
3. Brian D Foy , "Mastering Perl", O'Reilly Media, USA, 2014.
4. Julie Meloni , "Teach Yourself PHP, MySQL and Apache All in One", Sams Publishers, USA, 2012.

19Z014 PARALLEL PROGRAMMING

3 0 0 3

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)

OPENMP : OpenMP Programming Model - OpenMP Directive Format - OpenMP Programming Constructs - OpenMP Runtime Library Routines - OpenMP Environment Variables Solutions to Parallel Programming Problems - Data Races - Deadlocks and Livelocks - Non-Blocking Algorithms - Memory and Cache Related Issues. (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 (8)

PRINCIPLES OF PARALLEL ALGORITHM DESIGN : Design Approaches - Design Issues - Performance Measures and Analysis - Complexities - Anomalies in Parallel Algorithms - Case Study - Parallel Search Algorithms. Shared Memory Multiprocessor System - Shared Bus - Cross Bar - Multiport Memory-Memory Contention and Arbitration Techniques - Cache Coherence - Protocols - Handling Shared Variables. (13)

Total L: 45

TEXT BOOKS:

1. Seyed H Roosta , "Parallel Processing and Parallel Algorithms", Springer Series, New York, 2012.
2. Wen Mei Hew, David Kirk , "Programming Massively Parallel Processors: A Hands-on Approach", Morgan Kaufmann, USA, 2012.

REFERENCES:

1. Michael J Quinn , "Parallel Computing Theory and Practice", McGraw Hill, Singapore, 2003.
2. Kai Hwang, Feye A Briggs , "Computer Architecture and Parallel Processing", Tata McGraw Hill Publishing Company, New Delhi, 2007.
3. Barry WilkinSon, Michael Allen , "Parallel Programming", Pearson Education, New Delhi, 2011.
4. John Paul Shen, Mikko H Lipasti , "Modern Processor Design: Fundamentals of superscalar processors", Tata McGraw Hill, New Delhi, 2005.

19Z015 PROGRAMMING PARADIGMS

3 0 0 3

IMPERATIVE AND OBJECT ORIENTED PROGRAMMING : Design Considerations - Programming with Invariants - Data Representation - Data Types - Error Checking - Object Oriented Constructs - Information Hiding - Design With Modules - Defined Types - Declarations Inheritance - Polymorphism - Dynamic Allocation - Templates. (9)

FORMAL SEMANTICS AND LANGUAGE DESCRIPTION: Semantic Methods: Synthesized Attributes, Attribute Grammars, Natural Semantics, Denotational Semantics - Static Types and Lambda Calculus: Equality, Substitution, Pure Lambda Terms, Programming Constructs as Lambda Terms, Typed Lambda Calculus, Polymorphic Types. (9)

FUNCTIONAL PROGRAMMING : Types, Values And Operations - Expression Evaluation - Lexical Scope - Type Checking - Lists - Function Declaration By Cases - Functions as First-Class Values - ML: Implicit Types – Data Types -Exception Handling In ML - Scheme: Structure of Lists, List Manipulation, Simplification of Expressions (9)

LOGIC PROGRAMMING: Computing With Relations - Prolog: Data Structures, Programming Techniques, Control, Cuts, Atoms ,Rules, Backtracking (9)

CONCURRENT PROGRAMMING: Parallelism In Hardware, Streams And Implicit Synchronization, Concurrency As Interleaving, Liveness Properties - Safe Access To Shared Data. (9)

Total L: 45

TEXT BOOKS:
1. Sethi R , "Programming Languages: Concepts and Constructs", Addison-Wesley, USA, 2002.
2. Sebesta R W , "Concepts of Programming Languages", Addison-Wesley, USA, 2012.

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1. Friedman D P, Wand M , "Essentials of Programming Languages", 3rd Edition, The MIT Press, 2008.
2. Harper R , "Practical Foundations for Programming Languages", Cambridge University Press, 2012.
3. Scott M L , "Programming Language Pragmatics", Morgan Kaufmann, 2009.
4. Turbak F A, Gifford D K, Sheldon M A , "Design Concepts in Programming Languages", The MIT Press, Massachusetts, 2008.

19Z016 RANDOMIZED ALGORITHMS

3 0 0 3

RANDOMIZED AND PROBABILISTIC METHODS : Randomized algorithms, Karger's mincut algorithm, Las Vegas and Monte Carlo algorithms, Computational models and Complexity classes. PROBABILISTIC METHODS: overview - maximum satisfiability - finding a large cut - Expander Graphs (12)

DEVIATION AND INEQUALITIES : Occupancy problem, Markov and Chebyshev inequalities - randomized selection - coupon collector's problem, the Chernoff bound, routing in a parallel computer - a wiring problem (10)

MARKOV CHAINS AND RANDOM WALKS : Markov Chains: Definition, Markov Chains with two states, transition probabilities, transition matrix, ChapmanKolmogorov equations, time - homogeneous chains, initial distribution, branching processes. Random walk on graphs - connectivity in undirected graphs - Expanders and Rapidlymixing random walks. (9)

APPLICATIONS : Data Structure and Graph Algorithms : Random Treaps, Primality Testing, Skip Lists - Hash tables - Fast mincut. Parallel and Distributed Algorithms: Sorting on a PRAM - Maximal Independent sets (9)

DERANDOMIZATION : The method of Conditional Probabilities - Derandomizing maxcut algorithm - Constructing pairwise independent values modulo a prime - Pairwise independent - large cut (5)

Total L: 45

TEXT BOOKS:
1. Rajeev Motwani and prabhakar Raghavan , "Randomized Algorithms", Cambridge University Press, Cambridge, 2014.
2. Micheal Mitzenmacher and Eli Upfal , "Probability & Computing: Randomization and Probabilistic Techniques in Algorithms and Data Analysis", Cambridge University Press, Cambridge, 2017.

REFERENCES:
1. Mark Allen Weiss , "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2014.
2. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest , "Introduction to Algorithms", MIT Press, Cambridge, 2018.
3. Jon Kleinberg and Eve Tardos , "Algorithm Design", Pearson Education, 2014.
4. Noga Alon, Joel H Spencer , "The Probabilistic Method", 4th Edition, Wiley-Interscience, 2016.

19Z017 SEMANTIC WEB TECHNOLOGY

3 0 0 3

SEMANTIC WEB VISION AND STRUCTURED WEB DOCUMENTS: Introduction to Semantic web - Evolution of web- Semantic Web Technologies - Recommended Layered Architectures. Structured web documents- The XML Language: Structuring - Namespaces - Addressing and Querying XML Documents - Processing. (9)

DESCRIBING WEB RESOURCES: Introduction - RDF: Basic Ideas - `-Based Syntax. RDF Schema: Basic Ideas - RDF and RDF Schema in RDF Schema - An Axiomatic Semantics for RDF and RDF Schema — Querying in SPARQL (9)

ONTOLOGY ENGINEERING AND OWL : Introduction - Constructing Ontologies Manually - Reusing Existing Ontologies - Using Semi automatic Methods - On-to-Knowledge Semantic Web Architecture –OWL Language — Ontology Examples- OWL In OWL - Future Extensions. (9)

LOGIC AND INFERENCE: Rules - Monotonic Rules: Syntax - Semantics - Representing Family Relationships. Non monotonic Rules: Syntax - Brokered Trade as an Example - Monotonic and Non monotonic Rule Markup. (9)

TOOLS AND APPLICATIONS : Development tools for semantic web- Jena Framework- Semantic Wikis-Semantic web service, Horizontal Information Products at Elsevier - Data Integration at Audi - Skill Finding at Swiss Life. (9)

Total L: 45

TEXT BOOKS:

1. Grigoris Antoniou, Frank vanHarmelen , "Semantic Web Primer", MIT press, USA, 2008.
2. Michael C Daconta, Leo J Obrst, Kevin T Smit , "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Wiley, USA, 2003.

REFERENCES:

1. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph , "Foundations of Semantic Web Technologies", CRC Press, 2009.
2. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez , "Semantic Web Programming", 1st Edition, Wiley, 2009.
3. Liyang Yu , "A Developer's Guide to the Semantic Web", First, Springer, 2011.
4. Ducharme B , "Learning SPARQL", 1st Edition, O'Reilly Media, 2011.

19Z018 SERVICE ORIENTED ARCHITECTURE

3 0 0 3

INTRODUCTION : Business Computing - Globalization and development of enterprise computing - Inventory of Distributed computing - Service Orientation - Loose Coupling - Granularity - Scope variance - Software Architectures - Service oriented architecture - Benefits - Obstacles and roadmap for Service Oriented Architecture (SOA) - Service orientation - Object and Component orientation - Comparison - Basic of SOA concepts - Key Service characteristics - Technical and Business Benefits (11)

FUNDAMENTALS OF SOAP : SOAP message structure - SOAP encoding - Message exchange models - Communications and Messaging - Limitations of SOAP - Fundamentals of RESTFUL web services - Development and deployment of RESTFUL services - Web service life cycle - Anatomy of WSDL document - Describing web services - WSDL bindings, tools - Limitations - Discovering web services using UDDI - UDDI programming - Transaction and security aspects in Web Service based application development. (7)

WEB SERVICES SECURITY AND TRANSACTION : Meta Data Management - Advanced Messaging - Addressing - Reliable Messaging - Policies - WS Policy - Security - WS Security - Transaction Management. (5)

BUSINESS PROCESS MANAGEMENT AND MULTI CHANNEL ACCESS : Basic Business process management Concepts - Examples - Business modeling - Options - Basis of workflow - Atomic services and composite services - Service orchestration and Choreography - Business Process Execution Language - Business process modeling Notations - Business process re engineering and management - Combining BPM, SOA and Web Services - SOA for Multi-Channel Access (11)

CASE STUDIES : Design and implementation of Inter Enterprise applications using services and micro services - Insurance Claim processing - Card based online transaction - Direct to Home/Customer Services - SOA, Web services and micro services in .Net, J2EE framework, Software stacks,Cloud and gird Platform (11)

Total L: 45

TEXT BOOKS:

1. Dirk Krafzig, Karl Banke, Dirk Slama , "Enterprise SOA, Service Oriented Architectures Best Practices", Prentice Hall, 2016.
2. Eric Newcomer, Greg Lomow , "Understanding SOA with Web Services", Pearson Education India, New Delhi, 2016.

REFERENCES:

1. Thomas Erl , "Service Oriented Architecture (SOA): Concepts, Technology and Design", Prentice Hall, USA, 2016.
2. Chatterjee, Sandeep, James Webber , "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall of India, New Delhi, 2005.
3. Douglas K Barry , "Web Services and Service oriented Architectures - The Savvy Manager's Guide", Morgan Kaufmann Publishers, USA, 2003.
4. Kapil Pant, MatiazJuric , "Business Process Driven SOA using BPMN and BPEL: From Business Process Modeling to Orchestration and Service Oriented Architecture", Packt Publishing, 2008.

19Z019 SIGNAL PROCESSING

3 0 0 3

REPRESENTATION OF SIGNALS : Mathematical Representation of Signals and Systems, Sinusoidal signals, Phasors and complex number review, Spectrum Representation: Sum of Sinusoids, Operations on Spectrum, Periodic Signals, Fourier series, Time–Frequency Spectrum. (9)

SAMPLING AND RECONSTRUCTION : Sampling, Aliasing, Spectrum View of Sampling and Reconstruction, Discrete-to-Continuous Conversion, The Sampling Theorem. (7)

FIR FILTERS : Discrete-Time Systems, General FIR Filter, Unit Impulse Response and Convolution, Linear Time- Invariant Systems, Frequency response, Properties of Frequency Response, Running Sum Filtering. (10)

FOURIER ANALYSIS : Discrete-time Fourier transform (DTFT): Forward DTFT, The Inverse DTFT, Properties of DTFT, Discrete Fourier transform (DFT): Forward DTFT, The Inverse DTFT, Properties, Periodicity, Spectrum analysis. (10)

Z-DOMAIN ANALYSIS : Introduction, Properties, Linear systems, Convolution, Relationship between the z–Domain and the ωˆ—Domain, Zeros and Poles. (9)

Total L: 45

TEXT BOOKS:
1. James H. McClellan, Ronald W. Schafer, Mark A. Yoder , "DSP First", 2nd Edition, Pearson Education, 2015.
2. Richard G. Lyons , "Understanding Digital Signal Processing", 2nd Edition, Pearson Education, 2009.

REFERENCES:
1. Alan. V. Oppenheim, Alan. S. Willsky, S. Hamid Nawab , "Signals and Systems", 2nd Edition, Pearson Education, India, 2015.
2. John. G. Proakis, Dimitris. G. Manolakis , "Digital Signal Processing: Principles, Algorithms, and Applications", 4Th Edition, Pearson Education, India, 2014.
3. Hwei. P. Hsu , "Signals and Systems", 3rd Edition, McGraw Hill Education, India, 2013.
4. Simon Haykin, Barry Van Veen , "Signals and Systems", 2nd Edition, Wiley India Pvt. Ltd, India, 2014.

19Z020 SOFT COMPUTING

3 0 0 3

INTRODUCTION: : Soft computing vs. hard computing - Various types of soft computing techniques - Basic tools of soft computing –Artificial Neural networks :Introduction - Evolution of neural networks - Scope of neural networks, characteristics- Gradient descent technique - Supervised learning network – unsupervised learning networks – Applications (9)

GENETIC ALGORITHM: : Introduction —Basic concepts, Genetic modeling– Encoding- Genetic operators – Genetic programming – Multilevel optimization – Real life case studies- Advances in GA. (9)

FUZZY LOGIC : : Introduction to Fuzzy logic - Fuzzy sets and membership functions - Operations on Fuzzy sets - Fuzzy relations, rules, propositions, implications and inferences - Defuzzification techniques - Fuzzy logic controller design -Some applications of Fuzzy logic. (9)

NEURO-FUZZY MODELING : : Adaptive Neuro-Fuzzy inference systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression–Data Clustering Algorithms - Rule base structure identification - Neuro-Fuzzy Control (8)

HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS: : Introduction to hybrid systems – Genetic neuro hybrid systems – Genetic fuzzy hybrid and fuzzy genetic hybrid systems — Applications: A fusion approach of multispectral images with SAR, optimization problems using genetic algorithm approach. Inference and Decision Support Systems: Fuzzy Cognitive Maps – Learning algorithms: Non linear Hebbian Learning – Data driven NHL - Hybrid learning (10)

Total L: 45

TEXT BOOKS:
1. S.Rajasekaran, G.A.Vijayalakshmi Pai , "Neural Networks, Fuzzy Logic and Evolutionary Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd, 2017.
2. Samir Roy , "Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms", 1st Edition, PHI / Pearson Education, 2013.

REFERENCES:
1. George J. Klir, Ute St. Clair, Bo Yuan , "Fuzzy Set Theory: Foundations and Applications", Prentice Hall, 1997.
2. S.N.Sivanandam, S.N.Deepa , "Principles of Soft Computing", 2nd Edition, Wiley India Pvt Ltd, 2011.
3. David E. Goldberg , "Genetic Algorithm in Search Optimization and Machine Learning", Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura , "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Education India, 1991.

19Z021 SOFTWARE DEFINED NETWORKS

3 0 0 3

INTRODUCTION : History and Evolution of Software Defined Networking (SDN) - IETF Forces - Active Networking. - Control and Data Plane Separation: Concepts, Advantages and Disadvantages - OpenFlow protocol - South Bound Architecture - North Bound Architecture (9)

NETWORK FUNCTION VIRTUALIZATION : Concepts - Applications - Existing Network Virtualization Frameworks - Mininet based examples. - Control Plane - Overview - Existing SDN Controllers including Floodlight and OpenDaylight projects - Customization of Control Plane - Switching Implementation using SDN Concepts (10)

DATA PLANE : Software-based and Hardware-based Approaches - Programmable Network Hardware - Programming SDNs: Northbound Application Programming Interface - Current Languages and Tools - Composition of SDNs (8)

SOFTWARE DEFINED NETWORKS FOR THE INTERNET-OF-THINGS : Challenges - Understanding the nature of IoT traffic flows in different use cases- - A software defined end-to-end IoT Infrastructure - Resource provisioning in the IoT Multinetwork environments - Addressing scalability and security issues- Adding SDN automation and verification in IoT infrastructure. (9)

USE CASES OF SDNS : Data Centers - Internet Exchange Points, - Backbone Networks - Home automation Systems - Industrial automation Systems and Smart grids. (9)

Total L: 45

TEXT BOOKS:

1. Thomas D. Nadeau, Ken Gray , "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", O'Reilly Media, 2013.
2. Paul Goransson and Chuck Black , "Software Defined Networks: A Comprehensive Approach", June, Morgan Kaufmann, 2014.

REFERENCES:

1. Vivek Tiwari , "SDN and OpenFlow for Beginners", ASIN, 2013.
2. Fei HU , "Network Innovation through OpenFlow and SDN: Principles and Design", CRC Press, 2014.
3. Sriram Subramanian, SreenivasVoruganti , "Software-Defined Networking (SDN) with Open Stack", Pact Publishing, India, 2016.
4. Ken Gray Thomas Nadeau , "Network Function Virtualization", Elsevier, 2016.

19Z022 SOFTWARE PROJECT MANAGEMENT

3 0 0 3

INTRODUCTION TO PROCESS MANAGEMENT : The Management Spectrum - The People - The Product - TheProcess - The Project - Process Improvement - CMM and its variants. (9)

PROJECT PLANNING, SCHEDULING AND TRACKING : The Project Planning Process - Software Scope and Feasibility - Basic concepts in Project scheduling - Defining a Task Set for the Software Project - Defining a Task Network - Scheduling - Earned Value Analysis. (9)

RISK MANAGEMENT AND CONTRACT MANAGEMENT : Reactive Vs Proactive Risk Strategies - Software Risks - Risk Identification - Risk Projection - Risk Mitigation - Monitoring - Management - RMMM Plan - Introduction - Types of Contracts - Stages in Contract Management - Typical terms of a Contract - Contract Management - Acceptance. (9)

SOFTWARE MAINTENANCE : Introduction - Maintenance Processes - Problem Reporting - Problem Resolution - Software Quality Assurance activities for Maintenance - People issues in maintenance and support – Software maintenance from customer perspective - Global Maintenance teams. (9)

PEOPLE MANAGEMENT : Introduction - Understanding behavior - Organizational Behavior: A Background - Selecting the Right Person for the Job - Motivation - Working in Groups - Becoming a Team - Decision Making - Leadership - Organizational Structures. (9)

Total L: 45

TEXT BOOKS:

1. Mike Cotterell, Bob Hughes , "Software Project Management", Tata McGraw-Hill, 2010.
2. Gopalaswamy Ramesh , "Managing Global Software Projects", Tata McGraw-Hill, 2003.

REFERENCES:

1. Robert K Wysocki, Robert Beck Jr, David B Crane , "Effective Project Management, Traditional, Agile, Extreme", John Wiley & Sons Inc, 2011.
2. Watts S. Humphrey , "Managing the Software Process", Addison-Wesley Professional, 2002.
3. Pressman R S , "Software Engineering - A Practitioner's Approach", 8th Edition, Tata McGraw-Hill Book Company, 2014.
4. Ian Sommerville , "Software Engineering", Pearson Addison Wesley, Boston, 2017.

19Z023 SOFTWARE TESTING AND QUALITY ASSURANCE

3 0 0 3

TESTING FUNDAMENTALS : Objectives and Principles - Fundamental Test Process - Test Levels - Establishing a Testing Policy - Structured Approach to Testing - Test Factors - Developing Risk Matrix - Steps in Software Testing Process (9)

TESTING TECHNIQUES : Review of Black box and White box testing techniques - Testing for Web applications - Content Testing - User Interface Testing - Regression Testing - Usability Testing - Accessibility Testing (9)

TEST AUTOMATION AND MANAGEMENT : Test Planning - Management - Execution - Reporting - Software Test Automation - Design and Architecture for Automation - Generic Requirement for Test Tool/Framework - Selection of Test Tool - Challenges in Automation. (9)

SOFTWARE MEASUREMENT AND METRICS : Introduction - Measurement During Software Life Cycle Context - Measurement Principles - Defect Metrics - Classification of Software Metrics - Requirements Related Metrics - Product Metrics - Process Metrics - Metrics for Software Maintenance - Measurements and Process Improvement. (9)

SOFTWARE QUALITY ASSURANCE : Software Quality Challenges - Components of Quality Assurance System -SQA Activities - Development of Quality Plans - TMM - Trends in Software Quality (9)

Total L: 45

TEXT BOOKS:

1. Gopalaswamy Ramesh and Srinivasan Desikan , "Software Testing: Principles and Practices", Pearson Education, New Delhi, 2018.
2. Alan C Gillies , "Software Quality Theory and Management", 2nd Edition, Thomson, 2014.

REFERENCES:

1. Roger Pressman S , "Software Engineering: A Practitioners", 7th Edition, Tata McGraw Hill, New Delhi,, 2015.
2. Nina S Godbole , "Software Quality Assurance Principles and Practice", Narosa Publishing house, 2006.
3. Milind Limaye , "Software Quality Assurance", Tata McGraw Hill, New Delhi, 2011.
4. William E Perry , "Effective Methods of Software Testing", John Wiley and Sons, New Delhi, 2006.

19Z024 STORAGE MANAGEMENT

3 0 0 3

BASICS OF STORAGE SYSTEMS : Information Storage - Evolution of Storage Technology and Architecture - Data Center Infrastructure - Key Challenges in managing Information - Information Life cycle - Case Study - Data Center Environment: - Application - DBMS - H o s t - Connectivity - Storage Media - RAID: - Implementation - Array Components - Techniques - Levels - RAID Comparison - Hot Spares - Intelligent Storage System: - Components of an Intelligent Storage System - Types of Intelligent Storage Systems (9)

STORAGE NETWORKING TECHNOLOGIES : Introduction to DAS and SCSI - SAN: - Evolution - Components - Connectivity Options - Ports - FC Architecture - Fabric Services - Switched Fabric Login Types - Zoning - FC Topologies - SAN Based Virtualization: - Block Level - VSAN - IP SAN: - ISCSI - Introduction to FCIP - FCIP Protocol Stack - FCIP Topology - FCIP Performance and Security - FCOE: - I/O Consolidation Using FCoE - Components - Benefits (9)

NAS, OBJECT BASED STORAGE AND CAS : N AS: - Benefits - File Systems and Network File Sharing - Components - I/O Operations - Implementations - File Sharing Protocols - Factors Affecting NAS Performance - File Level Virtualization - Object Based Storage: - Object-Based Storage Architecture - Components of OSD - Object Storage and Retrieval in OSD - Benefits - Common Use Cases for Object-Based Storage - CAS: - Fixed Content and Archives - Types of Archives - Features and Benefits of CAS - CAS Architecture - Object Storage and Retrieval in CAS - Examples - Unified Storage: - Components of Unified Storage - Data Access from Unified Storage (10)

BUSINESS CONTINUITY, BACKUP AND REPLICATION TECHNOLOGIES : Introduction: - Information Availability - BC Terminology - Planning Life cycle - Failure Analysis - Business Impact Analysis - Technology Solutions - Backup and Restore: - Purposes - Methods - Architecture - Operations - Topologies - Targets - De-Duplication - Local Replication: - Terminology - Uses of Local Replicas - Replica Consistency - Local Replication Technologies - Restore and Restart Considerations - Remote Replication: - Modes - Technologies - Three Site Replication (10)

STORAGE SECURITY : Information Security Framework - Risk Triad - Security Domains - Security Implementations in SAN - Security Implementations in NAS - Security Implementations in IP SAN (7)

Total L: 45

TEXT BOOKS:

1. Somasundaram G, Alok Shrivastava , "ISM - Storing, Managing and Protecting Digital Information in classic virtualized and cloud environment", EMC Education Services, John Wiley & Sons, India, 2012.
2. Robert Spalding , "Storage Networks: The Complete Reference", Tata McGraw Hill, New Delhi, 2006.

REFERENCES:

1. Meeta Gupta , "Storage Area Network Fundamentals", Pearson Education, New Delhi, 2002.
2. Gerald J Kowalski, Mark T Maybury , "Information Storage and Retrieval Systems: Theory and Implementation", BS Publications, New Delhi, 2009.
3. Marc Farley Osborne , "Building Storage Networks", Tata McGraw Hill, New Delhi, 2001.
4. Pankaj Sharma , "Information Storage & Management", 2nd Edition, S.K. Kataria & Sons, India, 2012.

19Z025 UNIX INTERNALS

3 0 0 3

UNIX SYSTEM STRUCTURES : Architecture of Unix Operating System - Introduction to System Concepts - Kernel - Kernel Data Structures - Buffer Cache - Buffer Header - Structure of Buffer Pool - Retrieval of Buffer Cache - Reading and Writing Disk Blocks. (7)

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)

SYSTEM CALLS : Open - Read - Write - File and Record Locking - Lseek - Close - File Creation - Creation of Special Files - Changing Directory and Root - Changing Owner and Mode - Pipes - Mounting and Unmounting File System - Link - Unlink - File System Maintenance. (8)

PROCESSES : Process States and Transitions - Context of a Process - Saving the Context of the Process - Manipulation of the Process Address Space - Signals - Invoking Other Programs - Changing the Size of a Process - System Boot and Init Process - Process Creation - Process Termination - Process Scheduling - Interprocess Communication - Process Tracing - System V IPC - Sockets. (12)

MEMORY MANAGEMENT : Swapping - Allocation of Swap Space - Fork Swap - Demand Paging - Data Structures for

Demand Paging - Swap Process In and Out - Page Stealing - Page Aging and Page Fault. (9)

Total L: 45

TEXT BOOKS:
1. Maurice J Bach , "The Design of the UNIX Operating Systems", 1st Edition, Pearson Education, India, 2006.
2. Brian W. Kernighan, Rob Pike , "The Unix Programming Environment", 1st Edition, Pearson Education, India, 2015.

REFERENCES:
1. Uresh Vahalia , "UNIX Internals: The New Frontiers", 2nd Edition, Pearson Education, India, 2009.
2. Richard Stevens , "UNIX Network Programming - Volume I", 2nd Edition, Pearson Education, India, 2009.
3. Berny Goodheart, James Cox , "The Magic Garden Explained: The Internals of the Unix System V Release 4", Prentice Hall International, Inc, 1994.
4. Jerry Peek, Grace Todino, John Strang , "Learning the UNIX Operating System", 5th Edition, Shroff Publishers Pvt. Ltd, 2002.

19Z026 USER INTERFACE DESIGN

3 0 0 3

FOUNDATIONS OF HCI : The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices — Memory — Processing; Interaction: — Frameworks — Ergonomics — Styles — Elements — Interactivity- Paradigms. (8)

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

GUIDELINES IN HCI : Principles to Support Usability - HCI Golden Rules - Shneiderman's Eight Golden Rules - Norman's Seven Principles - Norman's Model of Interaction. (8)

DESIGN PROCESS : UI Design Process - Task Oriented Design - Object Oriented Design - CSCW UI Design - Case Studies. (10)

WEB AND MOBILE UI : Designing Web Interfaces — Drag & Drop -Direct Selection-Contextual Tools-Overlays-Inlays and Virtual Pages-Process Flow - Mobile User Characteristics - Mobile Devices: Taxonomy - Anatomy – Mobile Design Principles - Mobile UI Design Patterns. (10)

Total L: 45

TEXT BOOKS:
1. Dix A, Finlay J, Abowd G D, Beale R , "Human Computer Interaction", 3rd Edition, Pearson Education, USA, 2005.
2. Linda Mcaulay , "HCI for Software Designers", Thompson Computer Press, USA, 1998.

REFERENCES:
1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Niklas Elmqvist, Nicholas Diakopoulos , "Designing the User Interface: Strategies for effective HCI", 6th Edition, Pearson, USA, 2017.
2. Barbara Ballard , "Designing the Mobile User Experience", John Wiley & Sons, Ltd, USA, 2007.
3. Bill Scott, Theresa Neil , "Designing Web Interfaces", 1st Edition, O'Reilly Media, Inc, USA, 2009.
4. Jenifer Tidwell , "Designing Interfaces", 2nd Edition, O'Reilly Media, Inc, Canada, 2011.

19Z027 XML AND WEB SERVICES

3 0 0 3

XML TECHNOLOGY : Benefits – XML Documents - Well-Formed XML – Validation - DTD - XML Schemas - Relax NG- Schematron. (10)

XML PROCESSING: Parsing XML — Updating XML - Extracting Data from XML - XPATH - Xquery - XSLT. (10)

WEBSERVICES : Architecture - Messaging - Service Description - Service Discovery - Service Transport Security. (8)

WEBSERVICES IMPLEMENTATION : SOAP Protocol - WSDL - UDDI - Web Service Clients and Service Invocation - WS-* Standards. (8)

REST BASED WEB SERVICES : Principles - Comparison with SOAP - XML Based Web Services - Design and Implementation of REST Services - Resource Oriented Architecture - best practices. (9)

Total L: 45

TEXT BOOKS:
1. Ron Schmelzer et al , "XML and Web Services", Pearson Education, 2008.
2. Sandeep Chatterjee, James Webber , "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004.

REFERENCES:
1. Fawcett J, Danny Ayers, Liam R.E.Quin , "Beginning XML", 5th Edition, Wrox, 2012.
2. Hansen MD , "SOA Using Java Web Services", Prentice Hall, USA, 2007.
3. Martin Kalin , "Java Web Services: Up and Running", O'Reilly Media, USA, 2013.
4. Richardson L, Ruby S , "Restful Web Services", O'Reilly, USA, 2008.

19Z028 WIRELESS NETWORKS

3 0 0 3

WIRELESS LOCAL AREA NETWORKS : Introduction to Wireless LANs - WLAN Equipment - Topologies - Technologies - IEEE 802.11 WLAN - Architecture and Services - Physical Layer - MAC Sub Layer – MAC Management Sub Layer. (9)

WIRELESS WIDE AREA NETWORKS : First Generation Analog - Second Generation TDMA - GS M - Network Architecture - Short Messaging Service In GSM - Second Generation CDMA - IS95 - GPRS - Third Generation Systems - WCDMA/CDMA 2000. (9)

ADHOC WIRELESS NETWORKS : Characteristics of Adhoc Networks - Classifications of MAC Protocols - Table Driven and Source Initiated On - Demand Routing Protocols - OLSR - Hierarchical Routing Protocols - CBRP – FSR- TCP over Adhoc Wireless Networks. (9)

WIRELESS SENSOR NETWORKS : Challenges for Wireless Sensor Networks - Single Node Architecture - Hardware Components - Energy Consumption of Sensor Nodes - Singlehop versus Multihop Networks - Sensor Network Applications. (9)

SATELLITE COMMUNICATION AND GLOBAL POSITIONING SYSTEM : Introduction to Satellite Communication - Satellite Parameters and Configuration - Communication with a Satellite - Different Types of Satellite - Design and Principle of Operation of GPS - Satellite Segment - Control Segment - User Segment. (9)

Total L: 45

TEXT BOOKS:

1. William Stallings , "Wireless Communications and Networks", 2nd Edition, Pearson Education, 2009.
2. Holger Karl, Andreas Willig , "Protocol and Architecture for Wireless Sensor Networks,", John Wiley, 2010.

REFERENCES:

1. Jochen Schiller , "Mobile Communications", Pearson Education, New Delhi, 2008.
2. Vijay K Garg , "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2010.
3. Siva Ram Murthy C, Manoj B S , "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall, 2006.
4. Dr.D.C.Agarwal , "Satellite Communications", 7th Edition, Khanna Publishers, 2015.

19Z029 SOCIAL AND ECONOMIC NETWORK ANALYSIS

3 0 0 3

GRAPH THEORY IN NETWORK ANALYSIS: Representing Networks - Graphs and Networks - Paths and Cycles - Components and Connected subgraphs - Neighborhood - Degree and Network Density - Eigenvectors and Eigenvalues - Degree Distributions - Cliquishness, Cohesiveness, and Clustering – Centrality. (7)

NETWORK DYNAMICS: The Small-World Phenomenon: Six Degrees of Separation - Decentralized Search- Power Laws - Rich-Get-Richer Models - The Long Tail - The Problem of Ranking - Link Analysis Using Hubs and Authorities – PageRank (8)

SOCIAL NETWORK ANALYSIS: Triadic Closure - The Strength of Weak Ties - Homophily- Affiliation - Betweenness Measures and Graph Partitioning- Communities and Blocks - Methods for Identifying Community Structures - Stochastic Block Models and Communities - Maximum-Likelihood Estimation of Communities (10)

CASCADING BEHAVIOR IN NETWORKS: Introduction to game theory - Best Responses and Dominant Strategies - Nash Equilibrium - Multiple Equilibria: Coordination Games - Diffusion in Networks – Epidemics - The SIR Epidemic Model - The SIS Epidemic Model. (10)

ECONOMIC NETWORK ANALYSIS: Auctions: Types of Auctions - Second-Price Auctions - Matching Markets: Bipartite Graphs and Perfect Matching - Sponsored Search Markets: Advertising Tied to Search Behavior - Advertising as a Matching Market – The VCG principle - Equilibria of the Generalized Second-Price Auction. (10)

Total L: 45

TEXT BOOKS:

1. Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2016.
2. Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2015.

REFERENCES:

1. Jure Leskovec, AnandRajaraman,Jeff Ullman, ,"Mining of Massive Datasets", Cambridge University Press,2014.
2. Charu C Agarwal, "Social Networks Data Analytics", Springer, USA, 2011.
3. John Scott, Peter J. Carrington, "Sage Handbook of Social Network Analysis", SAGE Publications, 2011
4. Valente, Thomas, "Social Networks and Health: Models, Methods and Applications. New York: Oxford University Press, 2010

19Z030 CLOUD COMPUTING

3 0 0 3

INTRODUCTION TO CLOUD COMPUTING: The Vision of Cloud Computing - Defining a Cloud - A Cloud Computing Reference Model - Characteristics and Benefits - Challenges Ahead - Historical Developments - Building Cloud Computing Environments - Study of Cloud computing platforms and Technologies on cloud environment like Google Cloud. (9)

VIRTUALIZATION: Introduction - Hypervisors - Main Categories of Virtualization: Full - Para - Application Server - Application - Network - Storage - Service. Benefits of Virtualization - Cost of Virtualization - Virtualization Drawbacks – Case study: Foundational Infrastructure Tasks in cloud computing environmentlike Google Cloud. (9)

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. (10)

CLOUD APPLICATIONS: Scientific Applications - Gene Expression Data Analysis for Cancer Diagnosis - Business and Consumer Applications - Social Networking - Media Applications – Case Study: Handling data and performing Artificial Intelligence tasks in cloud computing environmentlike Google Cloud. (9)

CLOUD COMPUTING INFRASTRUCTURE: Introduction to Dockers – Deploying, maintaining and scaling containerized applications using cloud infrastructure - Cloud storage – Identity Access Management – Cloud monitoring - Case Study: Build and Secure Networks in in cloud computing environmentlike Google Cloud. (8)

Total L: 45

TEXT BOOKS:

1. RajkumarBuyya , Christian Vecchiola, ThamaraiSelvi, “Mastering Cloud Computing”, Tata McGraw Hill Education Private Limited, New Delhi, 2017.
2. Ted Hunter, Steven Porter, LegorieRajan PS, “Building Google Cloud Platform Solutions: Develop scalable applications from scratch and make them globally available in almost any language”, Packt Publishing Limited, ISBN: 1838647430, March 2019.

REFERENCES:

1. EkabaBisong, “Building Machine Learning and Deep Learning Models on Google Cloud Platform”, Apress, ISBN: 978-1-4842-4470-8, 2019.
2. KC Tung, “Learn TensorFlow Enterprise: Build, manage, and scale machine learning workloads seamlessly using Google's TensorFlow Enterprise”, Packt Publishing, 2020.
3. Anand Deshpande, Manish Kumar, Vikram Chaudhari, “Hands-On Artificial Intelligence on Google Cloud Platform: Build intelligent applications powered by TensorFlow, Cloud AutoML, BigQuery, and Dialogflow”, ISBN-13: 978-1789538465, Packt Publishing, 2020.
4. Diane Barrett and Gregory Kipper, “Virtualization and Forensics: A Digital Forensic Investigators Guide to Virtual Environment”, Elsevier, USA, 2010.
5. David S Linthicium, “Cloud Computing and SOA Convergence in Your Enterprise”, Pearson, USA, 2010.

ONE-CREDIT COURSES

19ZF01 GAME PROGRAMMING

1 0 0 1

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

GAME DESIGN:DESIGN PROCESS: Storyboard - Brainstorming - Research - Game Play Rules Game Balancing - Fair Game - Design Document - Game Coverage - Theory of Fun - Project Management. (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)

GRAPHICS: Coordinate System - Polygons - Meshes - Transformations - Texture Mapping - Camera Lights - Shader Programming - 2D Vs 3D Programming - (2)

LAB WORK: Game Creation Practicals with Unity Engine. (5)

Total L: 15

TEXT BOOKS:

1. Roger E Pedersen , "Game Design Foundations", 1st Edition, Wordware Publishing Inc, United States of America, 2009.
2. Alan S , "Introduction to Game Programming with C++", 1st Edition, BPB Publications, United Kingdom, 2007.
3. Radha Shankarmani, Saurabh Jain and Gaurang Sinha , "Game Architecture and Programming", 1st Edition, Wiley India Pvt Ltd, India, 2011.

19ZF02 DESIGN OF DATABASE QUERY COMPILER

1 0 0 1

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

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

COST ESTIMATION AND JOIN ORDERING : The Role of Statistics - Query Optimizer Strategies - Restricting the Search Space for Join Orders - Estimating Cost of Joins. (5)

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

Total L: 15

TEXT BOOKS:

1. Margaret, Bernard, Bachu, Eshwar , "Database systems with case studies", 1st Edition, PHI learning, India, 2015.

19ZF03 TEST AUTOMATION USING OPEN SOURCE TOOLS

1 0 0 1

SELENIUM - BASICS : Introduction. Selenium Components, Introduction to IDE, Test scripts creation using IDE.Converting IDE Generated Scripts to Web Driver Code, Best practices for Maven and Eclipse (3)

WEBDRIVER : Introduction to Locators. Types of Locators, Web Driver scripts, Web Driver Methods - Get, Find Element, Close; Web Element Methods – Send Keys, Clear, Click, Wait types and window maximize, Fetching more than one Web Element. Browser Verifications – get Title, get Current Url, Interacting with Edit, Button, Checkbox, Link, Radio button, Dropdown (5)

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:

1. Rex Allen Jones II , "Absolute Beginner (Part 1) Java 4 Selenium WebDriver", Createspace Independent Publishing Platform, United States, 2016.
2. Prashanth Sams , "Selenium Essentials", Packt Publishing, 2015.

REFERENCES:

1. Mark Collin , "Mastering Selenium Webdriver", Packt Publishing Limited, 2015.
2. Satya Avasarala , "Selenium Web Driver Practical Guide", Packt Publishing Limited, 2014.

19ZF04 IOT FOR TELECOMMUNICATION SYSTEMS

1 0 0 1

WIRELESS AND IOT COMMUNICATION FUNDAMENTALS : End to End wireless communications (layers, evolution,IP based networks) standard forums (IETF, 3GPP), roles of forums, examples - 2G and 3G network core, call flows, architecture - 4G: Evolution from 3G, current status - Cellular IoT standards: LTE-M, LTE-NB, EC- GPRS, and CleanSlate IOT (4)

IOT SYSTEM DESIGN : IOT use case: representing usecase, design, test scenarios - Raspberry Pi fundamentals - GUI design for Device/Sensor management and analytics, GUI testing,automation - Communication Protocol design (One or more of the wireless Protocols): callflows, information elements, protocol testing, library design for encoding/decoding - Database design for storing sensor information : sql vs. nosql, graph db,correlation, queries, report (5)

IOT SYSTEM IMPLEMENTATION : Sensor programming (Based on Pi framework): activating, init, extracting data, controlling - GUI programming: hands on with stub based backend - Protocol abstractions: stub based programs on protocol testing (client server based), with opensource SW - Testing: Methods, metrics, integration testing, sub- system testing (3)

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

TEXT BOOKS:

1. StefaniaSesia, Matthew Baker, IssamToufik , "LTE : The UMTS Long Term Evolution - From Theory to Practice", 2nd Edition, Wiley publications, 2011.
2. ArshdeepBahga, Vijay Madisetti , "Internet of Things (A Hands-on-Approach)", VPT publishers, 2014.

19ZF05 OPENSTACK AND DOCKER

1 0 0 1

OPENSTACK FUNDAMENTALS : OpenStack Architecture, Controllers and Compute services, Virtual Machine deployment, Identity Management, Image and Instance management, Object Storage, Containers Vs Virtual Machines, Openstack as Microservices. (4)

OPENSTACK VIRTUALISATION : Types of Virtualization, Application virtualization, Storage virtualization, Network virtualization and Container virtualization (3)

OPENSTACK DOCKER : Docker Architecture, Installing Docker for Openstack, Docker images and repositories, Running Docker, Case study: Deploying any application with docker in Openstack (8)

Total L: 15

TEXT BOOKS:

1. Dan Radez , "Open Stack Essentials", 2nd Edition, Packt Publishing Ltd, Birmingham, UK, 2016.
2. James Thumbull , "The Docker Book: Containerization is the new virtualization", Kindle Edition, 2019.

19ZF06 BLOCKCHAIN

1 0 0 1

INTRODUCTION TO BLOCKCHAIN : What is blockchain - Why is it so revolutionary, Blockchain as a layered approach to application design - Issues with Centralization - Benefits of decentralization. (2)

CRYPTOGRAPHY & BLOCKCHAIN DESIGN : How is blockchain designed - What is the role of cryptography - types of cryptography - unkeyed, symmetric key, asymmetric key encryption, digital signatures, merkle trees, block structure, chain of blocks, understanding mining and how it secures blockchains. (3)

CONSENSUS ALGORITHMS : Why do you need consensus - Classical consensus algorithms - Modern Consensus Algorithms – Proof Of Work - Proof of Stake - Advantages & Disadvantages of consensus algorithms. (3)

SMART CONTRACTS, DAPPS : Difference between basic blockchains and smart blockchains - Ethereum, the first programmable blockchain - Smart contracts & how they enable trust - DApps what are they - How to write smart contracts (5)

USE CASES, PRESENT & FUTURE OF BLOCKCHAIN : Types of blockchains - Permissionless, Permissioned, Consortium - Use cases - How blockchain is being applied today to solve real problems - Synergy with AI/ML, IoT, Current state of blockchains - Issues with blockchains today - solutions to issues - Sharding - Proof of Stake. (2)

Total L: 15

TEXT BOOKS:

1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda , "Beginning Blockchain - A Beginner's guide to Building Blockchain Solutions", 1st Edition, Apress, India, 2019.
2. Peter Lipovyanov , "Blockchain for Business", 1st Edition, Packt, USA, 2019.
3. Koshik Raj , "Foundations of Blockchain", 1st Edition, Packt, India, 2019.

19ZF07 ETHEREUM DEVELOPMENT

1 0 0 1

INTRODUCTION TO ETHEREUM: What is Ethereum - Brief history of Ethereum - smart contracts and Decentralized Applications.Key concepts, installations: Network Topology - Key concepts - Address, Accounts, Wallets, Concept of Gas, Gas limits -Toolchain installation. (5)

PROGRAMMING SMART CONTRACTS & DEBUGGING : Solidity programming - data types, address, visibility modifiers, mappings, arrays, modifiers, keywords, functions, events, returning multiple values - using Remix IDE, debugging - writing unit tests (5)

CODE WALKTHROUGHS, POPULAR TOKEN STANDARDS : code walkthroughs in various sample applications ERC-20, ERC-721, ERC223 Token standards. (4)

FUTURE OF ETHEREUM : Proof of Stake - Casper FFG/Ghost protocol - Sharding - Enterprise Blockchain, Modern transactional programming languages (1)

Total L: 15

REFERENCES:

1. Brenn Hill, Samanyu Chopra, Paul Valencourt, Narayan Prusty , "Blockchain Developer's Guide", Packt Publishers, 2018.
2. Debajani Mohanty , "Ethereum for Architects and Developers: With Case Studies and Code Samples in Solidity", 1st Edition, Apress, 2018.
3. Andreas M. Antonopoulos, Gavin Wood , "Mastering Ethereum", 1st Edition, O'Reilly Publications, 2018.
4.

19ZF08 WEB DEVELOPMENT AND CONFIGURATION MANAGEMENT USING PYTHON

1 0 0 1

OVERVIEW OF PYTHON : Introduction of Python - Difference between Python2 & Python3 - Features of Python - Python IDEs and Code Editors - Python Modules and Packages, OOPS. (2)

GUI DEVELOPMENT USING PYTHON : TKinter - Introduction - Import Module - How to use This Section- Explanation of TCL/TK - Handy Reference - Application Development in TKinter - Simple Game Development using Pygame. (3)

WEB DEVELOPMENT USING PYTHON : Web Development using Flask Framework - Create Virtual Environment - Minimal Application - Jinja Templates - Testing Application - Web Development using Django Framework - Deployment Model Layer - Template layer - Development Process - Admin interface - Minimal Site. (5)

CONFIGURATION MANAGEMENT WITH ANSIBLE : Ansible Introduction - Inventory & Configuration - Ansible Module - Executing Simple Ad-hoc Command Ansible Playbook - Simple Play Creation - Executing Playbook - Deploy Application Using Playbook - module Creation Using Python. (5)

Total L: 15

REFERENCES:

1. Alan D. Moore , "Python GUI Programming with Tkinter", Packt Publishing, 2018.
2. Martin C. Brown , "The Complete Reference (Python)", McGraw Hill, 2018.
3. RedHat Manual. , "Configuration management with Ansible", 2018.

19ZF09 FULL STACK DEVELOPMENT

1 0 0 1

DESIGN THINKING : Software Engineering for Digital transformation, Putting design thinking to work, Agile Software development methodologies, Engineering culture in New Age companies like Spotify Squad framework (3)

DEVOPS : DevOps overview, Engineering Skills, Ecosystem, Sample use-case for using DevOps, Version control with Git, Continuous Integration with build, test, deploy (6)

FULL STACK COMPETENCY : Full Stack developer, MEAN Stack, SMAC technologies. (6)

Total L: 15

TEXT BOOKS:

1. User Stories Applied: For Agile Software Development, 1st Edition, Pearson, Boston, 2004.
2. Andrew Stellman, Jennifer Greene , "Learning Agile", 1st Edition, O'Reilly Media, CA, 2015.

ENGLISH

19GF01 INTERPERSONAL AND ORGANIZATIONAL COMMUNICATION

1 0 0 1

INTRA ORGANIZATIONAL COMMUNICATION : Communication Networks in an Organization; Intra- organizational communication (2)

INTER ORGANIZATIONAL COMMUNICATION : Flow Nomenclature; Workplace diversity and intercultural aspects of communication (2)

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)

Total L: 15

REFERENCES:

1. Bagchi Subroto , "The Professional", Penguin Publications, UK, 2011.

2. PMBOK guide , "A Guide to the Project Management Body of Knowledge", Project Management Institute Inc, USA, 2013.

19GF02 HUMAN VALUES THROUGH LITERATURE

1 0 0 1

PROSE : Kalam's vision of college education in Wings of fire - Emerson's advocation of independence of Human will in Self-reliance - Harmony in Education-views of Betrand Russel (4)

POETRY : Maintaining Human relations in Robert Frost's Mending Wall - Quest for identity and freedom in Kamala Das's An Introduction (2)

DRAMA : Statesmanship and friendship in Girish Karnad's Tughlaq (3)

ONE-ACT PLAY : The theme of love in Chekhov's The Bear (3)

SHORT STORY : Empathy in Somerset maugham's Mr. Know-all - Family bond in Anita Desai's Devoted son (3)

Total L: 15

TEXT BOOKS:

1. Faculty - Department of English , "Course materials", PSG College of Technology, Coimbatore, 2019.

REFERENCES:

1. Abrams M .H, Harpham , "A Glossary of Literary Terms", Cengage, Boston, 2015.

2. Scholes R, et.al. , "Elements of Literature", IV, Indian Rpt. OUP, New Delhi, 2013.

HUMANITIES

19OFA1 EXPORT – IMPORT PRACTICES

1 0 0 1

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:

1. Ramagopal C , "Export Import Procedures - Documentation and Logistics", New Age International, 2014.

2. Cherian and Parab , "Export Marketing", Himalaya Publishing House, New Delhi, 2008.

3. Parul Gupta , "Export Import Management", MC-Graw Hill, 2017.

4. Justin Paul, Rajiv Aserkar , "Export Import Management", Oxford, 2013.

19OFA2 INSURANCE - CONCEPTS AND PRACTICES

1 0 0 1

INTRODUCTION TO INSURANCE AND RISK MANAGEMENT : Origin, History, Nature and Scope of insurance – Meaning, types and significance of risk. (3)

INSURANCE LAWS AND REGULATIONS : Insurance Act, IRDA Act, Consumer Protection Act, Ombudsman Scheme. (2)

INSURANCE UNDERWRITING AND RISK MANAGEMENT : Meaning of underwriting and underwriter, guidelines and steps in

the process of underwriting – characteristics, significance and principles of risk management. (4)

FINANCIAL ASPECTS OF INSURANCE MANAGEMENT : Role and functions of financial institutions, determination of premium for various insurance products. (3)

SETTLEMENT OF INSURANCE CLAIMS : Documents needed during various claims, Factors affecting insurance claims (3)

Total L: 15

REFERENCES:

1. Scott Harrington, Gregory Niehaus , "Risk Management and Insurance", McGraw Hill Education, 2017.
2. George E Rejda , "Principles of Risk Management & Insurance", Pearson Education, 2017.
3. John Hull , "Risk Management & Financial Institution", John Wiley and Sons, 2018.
4. Arjun Mittal, D D Chaturvedi , "Insurance and Risk Management", Scholar Tech Press, 2017.

19OFA3 PUBLIC FINANCE

1 0 0 1

INTRODUCTION: Nature and Scope of public finance – Principles of taxation. (2)

PUBLIC REVENUE AND TAXATION: Sources of Revenue – Tax and non-tax revenue – Classification of Taxes, GST. (4)

PUBLIC EXPENDITURE: Importance – Types – Causes of increase in public expenditure – Effects of public expenditure in India. (3)

DEFICIT FINANCING AND BUDGET: Sources of public debt – Debt redemption – Budget – Types – Preparation of Budget in India. (3)

FEDERAL FINANCE: Centre-State financial relations – Finance commissions. (3)

TOTAL: 15

REFERENCE BOOKS:

1. Richard A Musgrave and Peggy B Musgrave, “Public Finance in Theory and Practice” – Tata McGraw Hill Education, New Delhi, 2004.
2. Bhatia H.L, “Public Finance” – Vikas Publishing House, 29th Edition, New Delhi, 2012.
3. David N Hyman, “Public Finance: A contemporary application of theory and policy”, Cengage Publication, 11th Edition, Noida, 2014.
4. Santhosh Dalvi and Krishnan Venkatasubramanian, “An introduction to Goods and Service Tax: The biggest tax reform in India”, CCH Publisher, New Delhi, 2015.

19OFA4 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

1 0 0 1

INVESTMENT ENVIRONMENT : Financial Markets - Classification - Financial Instruments – Security Trading. (2)

TYPES OF SECURITIES : Trading – Orders, Margin Trading – Clearing and Settlement Procedures. (5)

SECURITY ANALYSIS I : Industry Analysis –Estimation of Rates of Return. (2)

SECURITY ANALYSIS II : Company Analysis — Estimation of Rates of Return. (2)

PORTFOLIO MANAGEMENT : Measuring Risk and Returns and Treatment in Portfolio Management. (4)

Total L: 15

REFERENCES:

1. William F Sharpe, Gordon J. Alexander, Jeffery V Bailey , "Investments", Prentice Hall, 2012.
2. Prasanna Chandra , "Investment Analysis and Portfolio Management", TATA McGraw Hill Publishing, 2011.

3. Ranganathan , "Investment Analysis and Portfolio Management", Pearson, 2004.

4. Bhalla V K , "Investment Management", TATA McGraw Hill Publishing, 2011

19OFA5SOCIAL ENTREPRENEURSHIP

1 0 0 1

INTRODUCTION TO SOCIAL ENTREPRENEURSHIP: Social Entrepreneur - Meaning, qualities and skills. Social Entrepreneurship – Characteristics, process and ecosystem – Case Studies. (3)

SOURCES OF FUNDING FOR SOCIAL ENTREPRENEURSHIP: The Social Entrepreneurship Frame work. Start-ups and funding - Internal and External. Schemes for social entrepreneurship. (4)

STRATEGIES IN SOCIAL ENTREPRENEURSHIP: Industry and Market Analysis, Business planning, concepts of value creation,new ideas and risk taking. (4)

PROSPECTS AND PROBLEMSIN SOCIAL ENTREPRENEURSHIP: Opportunities for Social entrepreneurs, an overview of legal structure, tax structure and other liabilities. (4)

TOTAL: 15

REFERENCE BOOKS:

1. S.S.Khanka, “Creativity and Innovation in Entrepreneurship”, Sultan Chand & Sons, 2021.

2. C. Paramasivan, “Social Entrepreneurship”, New Century Publications, 2016.

3. Robert A. Philips Margret Bonefiel Ritesh Sharma, “Social entrepreneurship, the next big business opportunity”, Global Vision Publishing House, 2011.

4. Drucker, Peter, “Innovation and Entrepreneurship”, Harper Business, 2006.