

## SEMESTER - VII

### 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 - VIII

### 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 FÜR 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 onphone
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'un 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. Myrna 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. Selfintroductions: "Hajimemashite"-Demonstratives "Kore", "Sore", "Are" — Demonstrative "Kono", "Sono", "Ano"
4. Possessive noun particle "no" — Japanese apartments: Greeting your neighbor

(12)

**PARTICLE "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 someone 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 ... (Tabetai 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 of set 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 Horowitz, 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—Graph datastores—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 implementation 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-Hodgeman 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–OpenCV (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, Schütze 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 Madiseti , "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. Hennessy, 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. Manfredelli, 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 Software requirements- 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, Messaging and 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.

### REFERENCES:

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 Hebel, 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  $\omega^*$ –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 - The Process - 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. Gopaldaswamy 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. Gopaldaswamy 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 IntelligentStorage 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

**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 withUnity 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 Madiseti , "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.

**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 advocacy 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.

### **190FA3 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.

### **190FA4 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