

## B.TECH INFORMATION TECHNOLOGY

### SEMESTER - VII

#### 19I701 CLOUD COMPUTING

3 0 0 3

**INTRODUCTION:** Roots of cloud computing, Cloud characteristics, Deployment models - private, public, hybrid and community, Service models - SaaS, PaaS, IaaS, BaaS, Challenges of cloud computing - security risks and threats, Microservices. (9)

**VIRTUALIZATION:** Basics of Virtualization, Types of virtualization, Benefits, Provisioning and manageability, Migration, Emulation, Virtualization environment, Study on virtualization tool, Linux Container - Docker, Kubernetes, Serverless computing. (9)

**CLOUD DATA STORAGE:** Storage system architecture, Storage as a Service, Cloud storage landscape, Hybrid storage networking technologies: NAS and SAN - Configuration, File System: GFS, HDFS, Programming Model: Map reduce paradigm and its applications, Bigtable+GFS, Hbase+HDFS+HIVE, Amazon Simple Storage Service(S3). (9)

**QUALITY OF SERVICE:** Interoperability, Scalability, SLA management: Types - Lifecycle - Automated policy management in cloud, Identity management, billing and accounting, Fault tolerance, API's to interact with cloud, secure access to cloud software services. (9)

**CLOUD COMPUTING FRAMEWORK:** Amazon AWS, Microsoft Windows Azure, Google App Engine, OpenStack, Jelastic, iCloud, Live Mesh. (9)

**Total L: 45**

#### TEXT BOOKS:

1. Ian Foster and Dennis B Gannon, "Cloud Computing for Science and Engineering", MIT Press, Massachusetts, 2017.
2. RajkumarBuyya, James Broberg and AndrzejGoscinski, "Cloud Computing: Principles and Paradigms", Wiley India Pvt Ltd, New Delhi, 2017.

#### REFERENCES:

1. Mathew Portnoy, "Virtualization Essentials", Wiley India Pvt Ltd, New Delhi, 2017.
2. Thomas Erl, ZaighamMahmood and Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Pearson Education, Chennai, 2017.
3. Anthony T Velte, Toby J Velte and Robert Elsenpeter, "Cloud Computing — A Practical Approach", McGraw Hill Education (I) P Ltd, Chennai, 2017.
4. Kris Jamsa , "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security, and More", Jones and Bartlett, New Delhi, 2014.

#### 19I702 CRYPTOGRAPHY

3 0 0 3

**INTRODUCTION:** Groups, Euclidean algorithm, Extended euclidean algorithm, Fermat's and Euler's theorem, Security services, Threat model, Security attacks, Characteristics of good ciphers, Shannon ciphers and perfect secrecy, Cryptanalysis: Linear and differential cryptanalysis. (9)

**SYMMETRIC CIPHERS:** Substitution ciphers, Transposition ciphers, Symmetric versus asymmetric techniques, Block versus stream ciphers, Symmetric cipher model, Data Encryption Standard, Advanced Encryption Standard, Block cipher modes of operation, Use of random numbers, Pseudorandom number generators, Stream ciphers, RC5. (9)

**ASYMMETRIC CIPHERS:** Principles of public key cryptosystems, Encryption, Key exchange, RSA, Diffie-Hellman, Fields and finite fields, ElGamal, Elliptic curve cryptography. (9)

**HASH FUNCTIONS AND MESSAGE AUTHENTICATION:** Requirements and applications of hash functions, Message Digest, Secure Hash Algorithm, Authentication requirements, Authentication functions, Message Authentication Codes, Hash based MAC- Block cipher based MAC: Data Authentication Algorithm and Cipher-based Message Authentication Code. (9)

**DIGITAL SIGNATURE:** Properties and requirements, Elgamal digital signature scheme, Schnorr digital signature scheme, Digital Signature Standard, Basics of Post-Quantum Cryptography. (9)

**Total L: 45**

#### TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Pearson, Chennai, 2018.
2. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", McGraw Hill Education, Chennai, 2017.

**REFERENCES:**

1. Bernard L Menezes and Ravinder Kumar, "Cryptography, Network Security, and Cyber Laws", Cengage Learning India, New Delhi, 2018.
2. Douglas R Stinson, "Cryptography - Theory and Practice", CRC Press, Boca Raton, 2015.
3. Atul Kahate, "Cryptography and Network Security", McGraw Hill Education, New Delhi, 2016.
4. Wenbo Mao, "Modern Cryptography", Pearson, New Delhi, 2013.

**19I710 SOFTWARE TESTING LABORATORY****0 0 4 2****LIST OF EXPERIMENTS:**

1. Develop an e-commerce application by creating user stories and Agile Methodology.
2. Challenges of Testing and writing Manual Test cases for an e-commerce application.
3. Create Test plan document an e-commerce application
4. Build Requirement Traceability Matrix for an e-commerce Application
5. Web application manual testing and automated testing using SELENIUM Automation Tool.
6. Test database using automation tool DbFit/Apache JMeter.
7. Track the defects of a web application using tracking tool JIRA
8. Implement Load testing for a web application.
9. Implement Unit Testing, System Testing and Regression testing for an application.
10. Develop Software Test Metrics for the given application.

**Total P: 60****REFERENCES:**

1. Sadeep Desai and Abhishek Srivastava, "Software Testing: A Practical Approach", 2nd Edition, PHI, Delhi, 2016.
2. Raghavendra Prasad MG, "Learning Selenium Testing Tools", 3rd Edition, PACKT, Birmingham, UK, 2015.
3. Ravi Sagar, "Mastering JIRA", PACKT, Birmingham, UK, 2015.

**19I720 PROJECT WORK I****0 0 4 2**

The project work I involves the following:

- Identification of Real World problems
- System Requirement Analysis and Specification
- Developing a Model and Solution for the identified Problem
- Consolidated Report Preparation and Presentation

**Total P:60****SEMESTER - VIII****19I820 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 & Validation
  - Results and future work
- Consolidated report based on standards

**Total P:120**

## PROFESSIONAL ELECTIVES

### 19I001 BIG DATA ANALYTICS

3 0 0 3

**INTRODUCTION:** Big Data Overview, Evolution of Big Data, Definition of Big Data, Challenges with Big Data - State of practice in Analytics, Key roles for New Big Data Ecosystem, Data Analytics Lifecycle Overview, Examples for Big Data Analytics. (9)

**MAP REDUCE:** HDFS Overview, Hadoop and Spark, Map Reduce Programming Basics, Analyzing the data with Hadoop: Java MapReduce - Developing Map Reduce Application. (9)

**DATA ANALYTICS:** Map reduce solution: Market Basket Analysis, K-means Clustering, Naïve Bayes, Implementation in Spark - KNN Classification, Logistic Regression, streaming data analytics. (9)

**TECHNOLOGY AND TOOLS:** Hadoop Ecosystem: PIG - Data Storage: Value of Relational Databases - The emergence of NoSQL, Aggregate Data Models: Key value - Document Data Models - Column Family Stores - Hbase. (9)

**DATA ANALYTICS USING PYTHON AND APPLICATIONS:** Data Loading, Storage and File Formats - Python Libraries: NumPy - pandas - Scikit - Plotting and Visualization, Recommendation Systems, Time series Analysis, Text Analysis. (9)

**Total L: 45**

#### TEXT BOOKS:

1. EMC Education services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons, Indiana, 2015.
2. Mahmoud Parsian, "Data Algorithms: Recipes for Scaling Up with Hadoop and Spark,", O'Reilly Publishers, USA, 2015.

#### REFERENCES:

1. Tom White, "Hadoop: The Definitive Guide", 4<sup>th</sup> Edition, O'Reilly, USA, 2015.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, USA, 2017.
3. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley, USA, 2014.
4. Pramod J. Sadalage, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison Wesley, New Delhi, 2012.

### 19I002 COMPILER DESIGN

3 0 0 3

**INTRODUCTION:** Language Processors, Structure of a Compiler, Syntax-Directed Translator. (9)

**LEXICAL ANALYZER:** The Role of the Lexical Analyzer, Input Buffering, Specification and Recognition of Tokens - The Lexical-Analyzer Generator, Finite Automata, Regular Expressions to Automata, Design of a Lexical-Analyzer Generator. (9)

**SYNTAX ANALYZER:** Context-Free Grammars, Top-Down Parsing, Bottom-Up Parsing, LR Parsing. (9)

**INTERMEDIATE CODE GENERATION:** Variants of Syntax Trees, Three-Address Code, Types and Declarations - Translation of Expressions, Type Checking, Control Flow, Back patching, Switch-Statements, Intermediate Code for Procedures. (9)

**RUN TIME ENVIRONMENT:** Storage Organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack - Heap Management, Garbage Collection - Trace-Based Collection - Short-Pause Garbage Collection - Code Generator: Design - DAG - A Simple Code Generator Algorithm. (9)

**Total L: 45**

#### TEXT BOOKS:

1. Alfred V Aho, Ravi Sethi and Jeffrey D.Ullman, "Compilers Principles, Techniques and Tools", 2<sup>nd</sup> Edition, Pearson Education, New Delhi, 2013.
2. Raghavan V, "Principles of Compiler Design", McGraw Hill, New Delhi, 2017.

#### REFERENCES:

1. Dhamdhare D M, "Compiler Construction Principles and Practice", Macmillan India Ltd, New Delhi, 2008.
2. Jean Paul Tremblay and Paul G Serenson, "The Theory and Practice of Compiler Writing", McGraw Hill, New Delhi, 2009.
3. Dick Grone, Kees van Reeuwijk, Henri E. Bal, Cerial J.H. Jacobs and Koen Langendoen, "Modern Compiler Design", 2<sup>nd</sup> Edition, John Wiley, 2016.
4. Sudha Sadasivam G., "Compiler Design", Scitech Publications (India) Private Limited, Chennai, 2010.

## 19I003 COMPUTER VISION

3 0 0 3

**IMAGE FORMATION:** Geometric Camera Models, Intrinsic and Extrinsic Parameters, Geometric Camera Calibration - Linear and Non - linear approach, Light and Shading - Inference from shading, Modelling Interreflection, Human Color Perception. (9)

**EARLY VISION:** Linear Filters - Convolution, Fourier Transforms, Sampling and Aliasing, Filters as Templates, Correlation, Local Image Features - Computing the Image Gradient, Gradient - Based Edge Detectors, Orientations, Texture - Local Texture Representations using Filters, Shape from Texture. (9)

**MID-LEVEL VISION:** Segmentation by Clustering: Basic Clustering Methods - The Watershed Algorithm - Segmentation Using K-means, Grouping and Model Fitting - Fitting Lines with Hough Transform, Fitting Curved Structures, Tracking - Tracking by Detection, Tracking Translations by Matching, Tracking Linear Dynamical Models with Kalman Filters. (9)

**HIGH-LEVEL VISION:** Registration, Registering Rigid and Deformable Objects, Smooth Surfaces and their Outlines - Contour Geometry, Koenderink's Theorem, The Bitangent Ray Manifold, Object Matching using Interpretation Trees and Spin Images, Classification, Error and Loss. (9)

**OBJECT DETECTION AND RECOGNITION:** Detecting Objects in Images - The Sliding Window Method, Face Detection, Detecting Humans, Boundaries and Deformable Objects, Object Recognition - Categorization, Selection, Applications - Tracking People, Activity Recognition. (9)

**Total L: 45**

### TEXT BOOKS:

1. Forsyth and Jean Ponce David A, "Computer Vision: A Modern Approach", 2<sup>nd</sup> Edition, Pearson Education Limited, London, 2015.
2. Szeliski and Richard, "Computer vision: algorithms and applications", Springer Science & Business Media, New York, 2010.

### REFERENCES:

1. Hau and Chen Chi, "Handbook of pattern recognition and computer vision", 5<sup>th</sup> Edition, World Scientific, Singapore, 2015.
2. Muhammad Sarfraz, "Computer Vision and Image Processing in Intelligent Systems and Multimedia Technologies", IGI Global, Pennsylvania, 2014.
3. Theo Gevers, ArjanGijssenij, Joost van de Weijer and Jan-Mark Geusebroek, "Color in Computer Vision: Fundamentals and Applications", Wiley, New Jersey, 2012.
4. Kale, K. V, Mehrotra S.C and Manza. R.R., "Advances in Computer Vision and Information Technology", IK International Pvt Ltd, New Delhi, 2013.

## 19I004 CYBER PHYSICAL SYSTEMS

3 0 0 3

**INTRODUCTION:** Concepts - Design challenges - Mobile cyber physical systems - Design principles – Physical system controls - Intelligence application of HDP - HMM in recognition of dynamic hand gestures. (9)

**MODELING:** Introduction to models of computation - Languages and tools for system design - Physical System Modeling on cognitive Unmanned Aerial vehicle - Concurrent models of computation - Continuous time model – A causal model - Mixed model - Hybrid systems. (9)

**SENSOR BASED CYBER PHYSICAL SYSTEMS:** Wireless Sensor and Actuator Networks for Cyber Physical Systems - Applications - Community Sensing - Wireless Embedded/Implanted Micro Systems - Architecture and Security - Application of Machine Learning in monitoring - Robotics. (9)

**CIVILIAN APPLICATIONS:** Energy efficient building Cyber Physical System for Smart Grid Applications - Cyber Physical System for transportation applications - Video communications - Drones - Digital Manufacturing/Industry 4.0. (9)

**HEALTH CARE APPLICATIONS:** CPS to improve health care - Augmented cognition for Intelligent Rehabilitation - Using Wiimote and Kinect for Cognitive Rehabilitation - Functional near - IR Spectroscopy for Auto rehabilitation. (9)

**Total L: 45**

### TEXT BOOKS:

1. Fei Hu, "Cyber-Physical Systems: Integrated Computing and Engineering Design", CRC Press, London, 2013.
2. Rajeev Alur, "Principles of Cyber Physical Systems", MIT Press, Cambridge, 2015.

### REFERENCES:

1. E. A. Lee and S. A. Seshia, "Introduction to Embedded Systems, A Cyber -Physical Systems Approach", 2<sup>nd</sup> Edition, MIT Press, Cambridge, 2017.

2. Rolf Drechsler and Ulrich Kühne, "Formal Modeling and Verification of Cyber-Physical Systems", Springer, Germany, 2015.
3. Stefan Posald, "Ubiquitous Computing: Smart Devices, Environments and Interactions", John Wiley Sons Ltd, New Delhi, 2009.
4. Maya Dimitrova and Hiroaki Wagatsuma, "Cyber-Physical Systems for Social Applications", IGI Global, Japan, 2019.

## 19I005 CYBER SECURITY

**3 0 0 3**

**NETWORK AND SECURITY CONCEPTS:** Information assurance - Basic cryptography - DNS - Firewalls - Virtualization, Microsoft windows security principles, Creating a managed network, Defining the boundaries of trust, Implementing the network security function- Cyber Laws. (9)

**ATTACKER TECHNIQUES:** Tunneling and fraud techniques, Threat infrastructure, Exploitation: Techniques to gain a foothold - Misdirection, Reconnaissance and disruption methods, Malicious code: Self-replicating codes - Evading detection and elevating privileges - Stealing information and exploitation. (9)

**PHYSICAL SECURITY:** Plan, Design for physical protection, Incorporating physical security into the information protection scheme, Physical access control, Implementing the measures to control access, Process evaluation, Case study: Aadhaar - Banking - Credit cards. (9)

**INTRUSION DETECTION:** Network vs Host based detection, Anatomy and process, Network based and host based intrusion detection systems: Architecture - Detection engine - Operational concept - Benefits and challenges, Honey pots. (9)

**DETECTION TECHNOLOGY:** Overview, Detection mechanism, Signatures, Traffic analysis, Intrusion detection project life cycle: Project phases - Resource estimates - Project planning - Acquisition - Deployment phase - Tuning - Deployment issues - Maintenance. (9)

**Total L: 45**

### TEXT BOOKS:

1. James Graham, Richard Howard and Ryan Olson, "Cyber Security Essentials", Auerbach Publications, USA, 2016.
2. Dan Shoemaker and Arthur Conklin, "Cyber Security: The Essential Body of Knowledge", Cengage Learning, USA, 2012.

### REFERENCES:

1. Paul E Proctor, "The Practical Intrusion Detection Handbook", Prentice Hall, USA, 2007.
2. Edward G Amoroso, "Cyber Security", Silicon Press, USA, 2006.
3. Ankit Fadia and Manu Zacharia, "Network Intrusion Alert: An Ethical Hacking Guide to Intrusion Detection", Thomson Course Technology, USA, 2010.
4. Alfred Basta, Nadine Basta and Ravinder Kumar, "Cyber Security and Cyber Laws", Cengage, New Delhi, 2018.

## 19I006 DEEP LEARNING

**3 0 0 3**

**INTRODUCTION:** Motivation for deep learning, Machine learning Basics: Learning algorithms - Capacity, Overfitting and Underfitting - Hyperparameters and Validation Sets - Estimators, Bias and Variance - Supervised and Unsupervised Machine Learning Algorithms - Building a Machine Learning Algorithm - Challenges in Machine Learning. (7)

**DEEP FEEDFORWARD NETWORKS:** Perceptron - Perceptron Learning Rule - Multi layer Perceptron - Gradient based learning - Architectural design - Activation Functions - Back-propagation for Multi Layer Perceptron- Deep Networks - Data Representation - Regularization: Parameter Regularization - Parameter Sharing and Parameter Tying - Data Augmentation - Dropout - Early Stopping - Optimization algorithms - Stochastic, Barch, Mini-Batch Methods - Adaptive learning rates: Adagrad, RMSprop. (11)

**CONVOLUTION NEURAL NETWORKS:** Architecture - Pooling - Convolution and its variants - State of art models - AlexNet, LeNet, ResNet - Case Study: Train Convolutional Neural Network for MNIST Digit Recognition. (9)

**SEQUENCE MODELING:** Recurrent Neural Networks (RNN) - Finding Gradients in Recurrent Neural Networks - Backpropagation Through Time - Bi-directional RNN - Challenges in Training RNN - LSTM (Long Short Term Memory) - Gated RNN - Case Study: Recognize the sentiments in a text. (9)

**DEEP GENERATIVE MODELS:** Learning in Unsupervised Setting - Principal Component Analysis - Autoencoders: Sparse, Denoising - Generative Models - Variational Autoencoder - Generative Adversarial Networks. (9)

**Total L: 45**

### TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, USA, 2017.
2. S. Lovelyn Rose, L. Ashok Kumar and D. Karthika Renuka, "Deep Learning using Python", Wiley, New Delhi, 2019.

**REFERENCES:**

1. Josh Patterson and Adam Gibson, "Deep Learning: A practitioner's approach", O'Reilly, USA, 2017.
2. Francois Chollet, "Deep Learning using Python", Manning Publications, USA, 2017.
3. Yusuke Sugomori, Bostjan Kaluza, Soares and Alan M. F. Souza, "Deep Learning: Practical Neural Networks with Java", PACKT Publishing, UK, 2017.
4. N D Lewis, "Deep Learning made easy with R: A Gentle Introduction for Data Science", Createspace Independent Publishing Platform, USA, 2016.

**19I007 DIGITAL IMAGE PROCESSING****3 0 0 3**

**FUNDAMENTALS:** Digital image processing steps, Components of an image processing system, Image sampling and quantization, Basic relationships between pixels, Image Acquisition and sensing, Google Photos. (6)

**IMAGE TRANSFORM:** Need for image transform, 2-D Discrete Fourier transform, Properties, Discrete wavelet transform, Hadamard transform, Discrete cosine transform, Karhunen-Loeve (KL) transform. (10)

**IMAGE ENHANCEMENT AND MORPHING:** Intensity transformation functions, Histogram processing, Histogram equalization, Spatial filtering: Fundamentals - Smoothing and sharpening using spatial filters, Filtering in the frequency domain: Smoothing and sharpening using frequency domain filters, Introduction of morphological image processing. (10)

**IMAGE SEGMENTATION:** Point, Line and edge detection, Thresholding, Region based segmentation: Region growing - Region splitting and merging, Representation and description: Chain codes – Shape numbers. (10)

**IMAGE COMPRESSION:** Lossy and lossless compression, Coding redundancy, Spatial and temporal redundancy, Image compression models, Huffman coding, Run length coding. (9)

**Total L: 45****TEXT BOOKS:**

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", 3<sup>rd</sup> Edition, Pearson Education, New Delhi, 2017.
2. Anil K Jain, "Fundamentals of Digital Image Processing", PHI Learning, New Delhi, 2019.

**REFERENCES:**

1. Annadurai S, Shanmugalakshmi R, "Fundamentals of Digital Image Processing", Pearson Education, New Delhi, 2011.
2. William K Pratt, "Digital Image Processing", 4th Edition, Wiley India, New Delhi, 2011.
3. Alasdair McAndrew, "Introduction to Digital Image Processing with MATLAB", Cengage Learning, New Delhi, 2011.
4. Bhabatosh Chanda and Dwijesh Dutta Majumder, "Digital Image Processing and Analysis", 2nd Edition, PHI Learning, New Delhi, 2011.

**19I008 DISTRIBUTED COMPUTING****3 0 0 3**

**INTRODUCTION:** Characterization of distributed systems, System models: Architectural models – Fundamental models, Distributed Computing Environment. (9)

**COMMUNICATION IN DISTRIBUTED ENVIRONMENT:** Inter process communication, Application Program Interface for the Internet protocols, External data representation and marshaling, Client/server communication, Group communication, Remote Procedure Call communication. (9)

**DISTRIBUTED ALGORITHMS:** Clocks, Event and Process states, Clock synchronization, Event ordering, Logical time and logical clocks, Distributed Mutual Exclusion, Election algorithms, Consensus problems. (9)

**DISTRIBUTED TRANSACTIONS:** Flat and nested distributed transactions, Concurrency control, Actor model, Distributed deadlocks, Replication, Fault tolerance. (9)

**DISTRIBUTED OBJECTS TECHNOLOGY:** Distributed objects and remote invocation, Directory and discovery services, Case study: Synchronous and Asynchronous Remote Procedure Call – Common Object Request Broker Architecture - JAVA Remote Method Invocation - Component Object Model/Distributed Component Object Model - Simple Object Access Protocol - Java Enterprise Edition and Enterprise Computing, RESTful Application Program Interface, Service-Oriented Architecture and Cloud Computing. (9)

**Total L: 45****TEXT BOOKS:**

1. George Coulouris and Jean Dollimore, "Distributed Systems Concept and Design", 5<sup>th</sup> Edition, Pearson Education, England, 2017.

2. Andrew S Tanenbaum and Marteen van steen, "Distributed Systems Principles and Paradigms", Prentice Hall of India, New Delhi, 2015.

**REFERENCES:**

1. Tanenbaum A S and Van Steen M, "Distributed Systems", 3<sup>rd</sup> Edition, Pearson Education, England, 2017.
2. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", 5<sup>th</sup> Edition, Prentice Hall of India, New Delhi, 2011.
3. Kshemkalyani, Ajay D., and Mukesh Singhal, "Distributed computing: principles, algorithms, and systems", 2<sup>nd</sup> Edition, Cambridge University Press, United Kingdom, 2011.
4. Maarten van Steen and Andrew S. Tanenbaum, "Distributed Systems", Create space Independent Publishing Platform, USA, 2017.

## 19I009 GRAPHICS AND MULTIMEDIA

**3 0 0 3**

**INTRODUCTION TO GRAPHICS:** Video Display Devices, Raster-Scan systems, Random-Scan Systems, Graphics Monitors and workstations, Input Devices, Graphics Software. (9)

**MULTIMEDIA:** Overview, Uses of multimedia, Text, Images, Sound, Animation, Video. (9)

**MULTIMEDIA TOOLS:** Text Editing and Word Processing Tools, OCR Software, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image-editing Tools, Sound-editing Tools, Animation, Video and Digital Movie tools. (9)

**DATA COMPRESSION:** Source entropy and hybrid coding, JPEG: Image preparation - Lossy sequential DCT based mode - Expanded lossy DCT based mode - Lossless mode - Hierarchical mode, MPEG: Video encoding - Audio encoding - Data stream, H.261: Image Preparation - Data stream, DVI, Data Optimization. (9)

**MULTIMEDIA OPERATING SYSTEMS:** Real time OS, Resource management, Process management, File systems, Database systems: Multimedia Database Management System (MDBMS) - Characteristics of an MDBMS - Data analysis - Data structure - Operations on data - Integration in a database model. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Ralf Steinmetz and Klara Nahrstedt , "Multimedia: Computing, Communications and Applications", Pearson, New Delhi, 2012.
2. Donald D.Hearn and M.Pauline Baker , "Computer Graphics", 3<sup>rd</sup> Edition, Pearson, New Delhi, 2017.

**REFERENCES:**

1. Ranjan Parekh, "Principles of Multimedia", Tata McGraw Hill, New Delhi, 2017.
2. John F Koegel Buford, "Multimedia Systems", Addison Wesley, New York, 2009.
3. Gokul S, "Multimedia Magic", BPB Publications, New Delhi, 2008.
4. Fred Halsall, "Multimedia Communication, Application Networks, Protocols and Standard", Addison Wesley, New Delhi, 2009.

## 19I010 HEALTHCARE INFORMATICS

**3 0 0 3**

**INTRODUCTION:** Health information technology and health informatics, Language of biomedical informatics: data - information & knowledge; standards and vocabularies, Information systems and Applications for the delivery of Healthcare, Role of IT, Infrastructure challenges. (9)

**ELECTRONIC HEALTH RECORDS:** Evidence based Practice Models, Practice based Evidence: Features and Challenges, Relationship of EBP and PBE, Knowledge transformation, Knowledge discovery, Knowledge building, EHR Component Model, System Integration and Interoperability, Networking Systems, EHR Benefits, Key Issues. (9)

**CLINICAL DECISION SUPPORT SYSTEMS:** Mathematical foundations of Decision Support Systems, Decision support types, Impact, Clinical Decision Support Standards, Design and Implementation Issues, Decision Rules and Expressions, Guidelines and Workflow Models. (9)

**DATA SCIENCE AND ANALYTICS:** Data science in Healthcare, Characteristics of Big Data, Benefits of Data Science for Clinical Research, Approached to Analyses, Knowledge discovery and Mining: Dataset Retrieval, Preprocessing clinical, text and structured data, Sampling and Partitioning, Model Evaluation, Model Deployment. (9)

**ETHICAL ISSUES IN HEALTH INFORMATICS:** Legal Issues, Federal Regulations and Accreditation, Billing Issues related to EHR use, Importance of Information Security, Current Security Vulnerabilities and Challenges: Internal, External Events, Managing Security Risks: Administrative, Technical, Physical Control. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Hoyt R.E., Yoshihashi A.K. and Bailey N.J, "Medical informatics: A practical guide for healthcare and informatics technology professionals", 6<sup>th</sup> Edition, Lulu.com, North Carolina, 2014.
2. Nelson, Ramona and Nancy Stagers, "Health Informatics - E-Book: An Interprofessional Approach", 2<sup>nd</sup> Edition, Elsevier Health Sciences, China, 2016.

**REFERENCES:**

1. Shortliffe E. H. and Cimino, J. J, "Biomedical Informatics: Computer Applications in Health Care and Biomedicine", 4th Edition, Health Informatics, New York, 2014.
2. Greenes Robert A., "Clinical decision support: the road to broad adoption", 2<sup>nd</sup> Edition, Academic Press, Cambridge, 2014.
3. Gordon D. Brown, Timothy B. Patrick and Kalyan Pasupathy, "Health Informatics: A Systems Perspective", Health Administration Press, Chicago, 2013.
4. Coiera E., Magrabi F. and Sintchenko V, "Guide to Health Informatics", 3<sup>rd</sup> Edition, CRC Press, Florida, 2015.

**191011 HUMAN COMPUTER INTERACTION**

**3 0 0 3**

**HUMANS IN HCI:** Perceptual - Motor Interaction: Implications for Human - Computer Interaction, Human Information Processing: An Overview for Human - Computer Interaction, Mental Models in Human - Computer Interaction, Task Loading and Stress in Human - Computer Interaction, Choices and Decisions of Computer Users. (9)

**COMPUTERS IN HCI:** Input Technologies and Techniques, Sensor and Recognition - Based Input for Interaction, Visual Displays, Haptic Interface, Non-speech Auditory and Cross modal Output, Network-Based Interaction, Wearable Computers, Design of Fixed, Portable, and Mobile Information Devices. (9)

**REQUIREMENTS SPECIFICATION:** User Experience Requirements Analysis within the Usability Engineering Lifecycle, Task Analysis, Contextual Design, Grounded Theory Method in Human-Computer Interaction and Computer-Supported Cooperative Work, An Ethnographic Approach to Design Module. (9)

**DESIGN AND DEVELOPMENT:** Putting Personas to Work, Prototyping Tools and Techniques, Scenario-Based Design, Participatory Design. (9)

**APPLICATION/DOMAIN SPECIFIC DESIGN:** Human-Computer Interaction in Health Care, Motor Vehicle-Driver Interfaces, Human - Computer Interaction in Aerospace, Human-Computer Interaction for Kids Module, Emerging Phenomena in HCI: Augmenting Cognition in HCI, Social Networks and Social Media. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Andrew sears, Julie A Jacko and Lawrence Erlbaum, "The Human Computer Interaction Hand Book: Fundamentals, Evolving Technologies and Emerging Applications", CRC Press, USA, 2008.
2. John Helen Sharp, Yvanno Rogers and Jenny preece, "Interaction Design: Beyond Human Computer Interaction", Wiley, USA, 2011.

**REFERENCES:**

1. Ben Shneiderman, "Designing the User Interfaces Strategies for Effective Human Computer Interaction", Pearson, New Delhi, 2009.
2. Alan Dix, Janet Finlay, Gregory D Abowd and Russell Beale, "Human Computer Interaction", Pearson, New Delhi, 2012.
3. Jan Noyes and Chris Baber, "User Centered Design of Systems", Springer, Germany, 2013.
4. Don Norman, "The Design of Everyday Things", Perseus Books Group, New York, 2013.

**191012 INFORMATION ETHICS**

**3 0 0 3**

**INTRODUCTION:** Definition of ethics, Ethics in business world: Corporate social responsibility - Improving corporate ethics - Creating an ethical work environment, Ethical considerations in decision making, Ethics in information technology. Utilitarianism, Intrinsic and instrumental value, Acts Vs. rules, Critique of utilitarianism, Deontological theory, Rights, Rights and social contract theory, Virtue ethics, Analogical reasoning in computer ethics. (9)

**PRIVACY:** Privacy protection and the law: Information privacy -Privacy laws, applications and court rulings, Key privacy and anonymity issues: Data breaches - Electronic discovery - Consumer profiling - Workplace monitoring, Advanced surveillance technology. (9)

**INTELLECTUAL PROPERTY:** Copyrights, Patents, Trade secrets, Key intellectual issues, Ethics of IT organizations: Keyethicalissuesfororganization-Contingentworkers- Outsourcing- Whistleblowing- Greencomputing. (9)

**PROFESSIONAL ETHICS IN COMPUTING:** Formal organization - Autonomy - Codes of ethics - The culture of computing, Professional relationships: Employer - employee - Client-professional - Other stakeholders- professional -



Professional-professional - Conflicting responsibilities, A legal perspective on professionalism in computing: Licensing - Selling software. (9)

**COMPUTER AND INTERNET CRIME:** Types of exploits - Types of perpetrators - Federal laws for prosecuting computer attacks, Implementing trustworthy computing: Risk assessment - Establishing a security policy - Educating employees and contract workers - Prevention - Detection - Response. (9)

**Total L: 45**

**TEXT BOOKS:**

1. George Reynolds, "Ethics in Information Technology", Thomson Asia Pvt. Ltd, Chennai, 2015.
2. Deborah G Johnson, "Computer Ethics", Pearson Education, New Delhi, 2009.

**REFERENCES:**

1. Giannis Stamatellos, "Computer Ethics - A Global Perspective", Jones and Bartlett Publishers, Canada, 2008.
2. Deborah E Bouchoux, "Intellectual Property: The law of Trademarks, Copyrights, Patents, and Trade Secrets" McGraw Hill Education, New Delhi, 2012.
3. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 2<sup>nd</sup> Edition, Tata McGraw Hill, New Delhi, 2006.
4. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.

## 19I013 INTELLIGENT SYSTEMS

**3 0 0 3**

**INTRODUCTION:** Approaches to IS Developments, Key Events and a History of Artificial Intelligence/Intelligent System, Characteristics of Intelligent System Problems, Turing Test, Representation in Intelligent System, Tools for Representation, Semantic Web, Structuring the Representation, Ontology Concepts and Tools, Expert System. (9)

**PRODUCTION SYSTEM:** Logic-Based Underpinnings of Rule-Based Chaining systems, Implementing Rule-Based Chaining, OO Representation, Production systems, Production Systems to Distributed, Autonomous Agents, Basic Agent Structures and Types of Agents. (9)

**FUZZY LOGIC:** Fuzzy System Concepts, Fuzzy System Structure, Design Procedure, Application Example, Exploring Uncertainty and Fuzzy Concepts with C Language Integrated Production System (CLIP) (8)

**BIOLOGICALLY-INSPIRED COMPUTING AND IS:** Relationship of IS to ANNs, Biology and ANN Building Blocks, Recurrent Networks and IS Applications: Basic Parameters and Recurrent Network Design-CAM Applications, Self-Organizing Systems: Self-Organization via Clustering-The c-Means Algorithm- Self-Organizing Feature Maps. (10)

**COGNITIVE INTELLIGENCE:** Three Faces of Cognitive Processes, The PASS Model, Cognitive Remediation, Intelligence as a Cognitive Process, The Brain and Psychometrics: PASS to CAS, Interventions: From PASS/CAS to Remediation, Modernization of PASS. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Robert J, Schalkoff, " Intelligent Systems Principles, Paradigms and Pragmatics", Jones and Bartlett Publishers, United Kingdom, 2011.
2. Timothy Papadopoulos, Rauno K. Parrila, John R. Kirby "Cognition, Intelligence, and Achievement", Academic Press, 2014

**REFERENCE BOOKS:**

1. Kosko B, "Neural Networks and Fuzzy Systems: A dynamical system approach to machine intelligence", Prentice Hall of India, 2009.
2. G.J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic Theory and Applications", Prentice Hall of India, 2009.
3. Timothy S. Ross, "Fuzzy Logic with engineering applications", Wiley India Pvt. Ltd., 2011.
4. R Beale and T Jackson, "Neural Computing, An Introduction", Adam Hilger, 1990.
5. Rao V.B and Rao H.V., "C++, Neural Networks and Fuzzy Logic", BPB Publications, 2003.

## 19I014 MACHINE LEARNING

**3 0 0 3**

**MATHEMATICAL BASICS:** Definition of learning systems, Goals and applications of machine learning, Statistical decision theory, Learning versus design, Feasibility of learning, Training versus testing, Labeled versus unlabeled dataset, Error, Noise, Theory of generalization, Hypothesis class, Vapnik-Chervonenkis (VC) dimension, Bias, Variance, Learning curve, Under-fitting and over-fitting. (11)

**SUPERVISED LEARNING:** Learning a class from examples, Learning multiple classes, Dimensions of a supervised machine learning algorithm, Discriminant functions, Probabilistic generative models, Probabilistic discriminative models, Logistic regression, Linear regression, Perceptron Learning Algorithm. (11)

**UNSUPERVISED LEARNING:** Clustering, Expectation maximization (EM) for soft clustering, Semi-supervised learning with

EM using labeled and unlabeled data. (8)

**REINFORCEMENT LEARNING:** Model-free reinforcement learning: Q Learning, Algorithm for learning Q, Convergence, Updating sequences strategies, Model based learning: Value iteration-Policy iteration, K-Armed bandit – elements. (8)

**ADVANCED LEARNING APPROACHES:** Ensemble learning: Boosting, Bagging, Bayesian Networks, Basic sampling methods, Markov Chain Monte Carlo. (7)

**Total L: 45**

**TEXT BOOKS:**

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

**REFERENCES:**

1. Abu Mostafa Y S, MagdonIsmail M, Lin H T, "Learning from Data", AML Book Publishers, New York, 2012.
2. Ethem Alpaydm, "Introduction to Machine Learning", 3rd Edition, PHI, New Delhi, 2015.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical learning", 2nd Edition, Springer, New York, 2009.
4. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, Cambridge, 2012.

### 19I015 MODELLING AND SIMULATION

**3 0 0 3**

**INTRODUCTION:** Advantages and Disadvantages of simulation - Areas of application - System environment - Components of a system - Discrete and continuous system - Model of a system, Types of models - Steps in a simulation study, Simulation Examples: Simulation of Queueing Systems - Simulation of Inventory Systems. (9)

**MATHEMATICAL AND STATISTICAL MODELS:** Statistical Models in simulation: Terminology and Concepts - Discrete Distribution - Continuous Distribution - Poisson Process, Estimation of statistical parameters, Queueing Models: Characteristics - Queueing Notation - Long run measures of performance of queueing system - Steady-State Behavior of Infinite-Population Markovian Models - Steady-State Behavior of Finite-Population Models. (9)

**RANDOM NUMBER:** Random Number Generation: Properties of Random Numbers - Generation of Pseudo- Random Numbers - Techniques for Generating Random Numbers - Tests for Random Numbers, Random-Variate Generation: Inverse-Transform Technique - Acceptance-Rejection Technique - Special Properties. (9)

**ANALYSIS OF SIMULATION DATA:** Input Modeling: Estimation of parameters - Fit tests of distributions - Data collection - Identifying the Distribution with Data - Multivariate and Time - Series Input Models, Verification and Validation of Simulation Models: Model-Building, Verification, and Validation - Verification of Simulation Models - Calibration and Validation of Models. (9)

**SIMULATION OF COMPUTER SYSTEMS:** Simulation Tools: Process Orientation - Event Orientation, Model Input: Modulated Poisson Process - Virtual-Memory Referencing - High level computer system simulation, CPU simulation, Memory Simulation, Monte Carlo simulation, Simulation softwares: NS-3 - OpenSim - SageMath - Tortuga, Simulation in testing. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Jerry Banks and John Carson, "Discrete Event System Simulation", 4<sup>th</sup> Edition, PHI, USA, 2017.
2. Pushpa Singh and Narendra Singh, "Modeling and Simulation", S.K.Kataria and sons, New Delhi, 2012.

**REFERENCES:**

1. Geoffrey Gordon, "System Simulation", 2<sup>nd</sup> Edition, PHI, USA, 2012.
2. Frank L. Severance, "System Modeling and Simulation", Wiley, England, 2005.
3. Averill M. Law and W.David Kelton, "Simulation Modeling and Analysis", 3<sup>rd</sup> Edition, McGraw Hill, New York, 2011.
4. Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice", Wiley-Interscience, USA, 2015.

### 19I016 MULTI-CORE COMPUTING

**3 0 0 3**

**FUNDAMENTALS OF COMPUTER DESIGN:** Classes of Computers - Trends in technology, power, energy and cost, Dependability-Quantitative Principles of Computer Design, Pipelining: Basic Concepts and Hazards. (9)

**INSTRUCTION LEVEL PARALLELISM:** ILP concepts - Compiler Techniques for Exposing ILP - Dynamic Branch Prediction-Dynamic Scheduling-Multiple instruction Issue-Hardware Based Speculation-Static scheduling- Multi-threading-Limitations of ILP - VLIW and EPIC. (9)

**DATA-LEVEL PARALLELISM:** Vector Processor - SIMD extensions - Graphics Processing units - Large scale multiprocessors and scientific applications. (9)

**THREAD LEVEL PARALLELISM:** Symmetric and Distributed Shared Memory Architectures - Performance - Synchronization - Models of Memory Consistency - Case studies. (9)

**MEMORY AND STORAGE SYSTEMS:** Optimization of Cache Performance and Memory Technology, Types of Storage Devices - Buses - RAID - Reliability, Availability and Dependability - I/O Performance Measure. (9)

**Total L: 45**

**TEXT BOOKS:**

1. John L Hennessey and David A Patterson, "Computer Architecture A Quantitative Approach", 6th Edition, Morgan Kaufmann Elsevier, USA, 2019.
2. Kai Hwang and Faye Briggs, "Computer Architecture and Parallel Processing", Mc Graw-Hill International Edition, New Delhi, 2016.

**REFERENCES:**

1. Kai Hwang and Naresh Jotwani, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", 2<sup>nd</sup> Edition, Mc Graw-Hill International Edition, New Delhi, 2013.
2. Dezso Sima, Terence Fountain and Peter Karsuk, "Advanced Computer Architectures: A Design Space Approach", Pearson, New Delhi, 2017.
3. Muhammad Yasir Qadri and Stephen J.Sangwine, "Multicore Technology: Architecture, Reconfiguration, and Modelling", CRC Press, USA, 2017.
4. Yan Solihin, "Fundamentals of Parallel Multicore Architecture", CRC Press, Taylor & Francis Group, USA, 2016.

## 19I017 NATURAL LANGUAGE PROCESSING

**3 0 0 3**

**INTRODUCTION:** Origin of NLP - Language - Grammar - Processing Indian Languages - NLP Applications - Information Retrieval - Grammar-based Language Models - Statistical Language Model. (9)

**MORPHOLOGY AND PART OF SPEECH TAGGING:** Linguistic essentials, Lexical syntax, Morphology and Finite State Transducers, Part of speech Tagging, Rule-Based Part of Speech Tagging, Markov Models: Hidden Markov models, Transformation based Models, Maximum Entropy Models. (9)

**SYNTAX PARSING:** Syntax Parsing, Grammar formalisms and tree banks, Parsing with Context Free Grammars, Features and Unification, Statistical parsing and probabilistic CFGs (PCFGs) - Lexicalized PCFGs. (9)

**SEMANTIC ANALYSIS:** Semantic Analysis, Lexical semantics, Word-sense disambiguation, Supervised and Unsupervised Approaches, Compositional semantics Semantic Role Labeling and Semantic Parsing, Discourse Analysis. (9)

**APPLICATIONS:** Named entity recognition and relation extraction - IE using sequence labeling - Machine Translation (MT), Basic issues in MT - Statistical translation - word alignment - phrase-based translation - Question Answering. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Tanveer Siddiqui and U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, New Delhi, 2008.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 3<sup>rd</sup> Edition, Prentice Hall, USA, 2014.

**REFERENCES:**

1. James Allen, "Natural Language Understanding", 2<sup>nd</sup> Edition, Benjamin /Cummings publishing company, CA, USA, 2003.
2. Bates M and Weischedel RM, "Challenges in natural language processing", Cambridge University Press, New York, USA, 2006.
3. Bharati A., Sangal R and Chaitanya V, "Natural language processing: a Paninian perspective", PHI, New Delhi, 2000.
4. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", O'Reilly Media, USA, 2009.

## 19I018 NETWORK SECURITY

**3 0 0 3**

**NETWORK SECURITY:** Threats in networks, Network security controls, Intruders, Intrusion detection, Password management, Malicious software, Firewalls: Need - Characteristics - Types - Firewall basing - Firewall location and configurations. (9)

**AUTHENTICATION AND IP SECURITY:** Kerberos, X.509 Authentication Service, Public Key Infrastructure, IP security overview, IP security policy, Encapsulating Security Payload (ESP), Combining security associations, Key Management,

VPN. (9)

**WEB SECURITY:** Web security considerations, Secure Socket Layer (SSL), Transport Layer Security (TLS), HTTPS, Secure Shell (SSH), Secure DNS, Phishing. (9)

**ELECTRONIC MAIL SECURITY:** Store and forward, Security services, Establishing keys, Privacy, Authentication of the source, Message integrity, Non-Repudiation, Proof of submission and delivery, Pretty Good Privacy (PGP), Secure/Multipurpose Internet Mail Extension (S/MIME), Email spamming. (9)

**WIRELESS NETWORK SECURITY:** IEEE 802.11 wireless LAN overview, IEEE 802.11i wireless LAN security, Wireless Application Protocol (WAP), Wireless Transport Layer Security (WTLS), WAPend-to-end security. (9)

**Total L: 45**

**TEXT BOOKS:**

1. William Stallings, "Cryptography and Network Security - Principles and Practice", 7<sup>th</sup> Edition, Pearson Education, USA, 2018.
2. Atul Kahate, "Cryptography and Network Security", 4<sup>th</sup> Edition, McGraw Hill Education, New Delhi, 2018.

**REFERENCES:**

1. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 3<sup>rd</sup> Edition, McGraw Hill Education, New Delhi, 2017.
2. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C", 2<sup>nd</sup> Edition, Wiley, New Delhi, 2017.
3. Charles P Fleeger, Shari Lawrence P Fleeger and Jonathan Margulies, "Security in Computing", 5<sup>th</sup> Edition, Prentice Hall, New Delhi, 2018.
4. Bernard L Menezes and Ravinder Kumar, "Cryptography, Network Security, and Cyber Laws", Cengage Learning India, Noida, 2018.

## 19I019 OPTIMIZATION TECHNIQUES

**3 0 0 3**

**LINEAR PROGRAMMING:** Graphical method, Simplex method, Revised simplex method, Duality in linear programming, Sensitivity analysis, Transportation and assignment problems. (9)

**NONLINEAR PROGRAMMING:** Unconstrained optimization techniques: Direct search methods - Descent methods, Constrained optimization: Random search methods - Complex method. (9)

**PERT/CPM:** Network representation, Critical path computation, Crashing, PERT calculations, Resource analysis in network scheduling. (9)

**DECISION ANALYSIS AND GAMES:** Decision making under certainty: Analytic hierarchy process, Decision making under risk, Decision making under uncertainty, Game theory: Basic terminologies - Optimal solution of two-person zero-sum games - Solution of mixed strategy games. (9)

**DYNAMIC PROGRAMMING:** Formulation of Multi stage decision problem - Characteristics - Concept of sub- optimization and the principle of optimality - Formulation of Dynamic programming - Backward and Forward recursion - Computational procedure. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Hamdy A Taha, "Operations Research: An Introduction", 9<sup>th</sup> Edition, Pearson Education, Noida, 2018.
2. Singaresu S Rao, "Engineering Optimization: Theory and Practice", 4<sup>th</sup> Edition, New Age International, New Delhi, 2016.

**REFERENCES:**

1. Frederick S Hillier and Gerald J Lieberman, "Introduction To Operations Research: Concepts And Cases", 10<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2018.
2. Sharma J K, "Operations Research: Theory and Applications", 6<sup>th</sup> Edition, Laxmi Publications Pvt Ltd, New Delhi, 2017.
3. Hedge R K, "Operations Research Theory and Applications", Sapna Book House, New Delhi, 2014.
4. Jon Kleinberg and Eva Tardos, "Algorithm Design", Pearson Publications, Chennai, 2018.

## 19I020 SECURE CODING

**3 0 0 3**

**INTRODUCTION:** Security Concepts, Common String Manipulation Errors and Vulnerabilities - Stack overflow, Heap overflow - Off-by-one vulnerabilities, Integer Vulnerabilities, Memory management errors - Format string vulnerabilities - Concurrency and File I/O - Race conditions, Rules and recommendations of SEI CERT C and CERT Java coding

Standards - Code obfuscation. (9)

**THREAT MODELLING:** Identifying the threats by using attack trees and rating threats using DREAD, Defense in depth and principle of least privilege - Compiler security features, Static Analysis. (9)

**DATABASE AND WEB APPLICATION SECURITY:** OWASP top 10 flaws, Cross Site Scripting (XSS) and its types-persistent and non-persistent attack, XSS Countermeasures - Injection flaws and remedies, CSRF, Clickjacking - Mitigation Techniques - Web application hacker's methodology. (9)

**SECURE SOFTWARE DEVELOPMENT PRINCIPLES:** Secure Software Development Cycle (S-SDLC) - Security Requirements Engineering- Use/Misuse case, Secure by design, default and deployment (SD3) Practices, DevSecOps. (9)

**TESTING SECURE APPLICATIONS:** Security code overview, Secure software installation, Building the Security Test Plan, Software Assurance overview, - Testing threat categories, Assessing Risk, Secure Testing Methodologies - Attacking Dependencies, Attacking through the User Interface, Attacking Design, Attacking Implementation. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Robert C. Seaford, "Secure Coding in C and C++", 2<sup>nd</sup> Edition, Pearson Education Inc., USA, 2013.
2. Michael Howard and David LeBlanc, "Writing Secure Code", Microsoft Press, USA, 2015.

**REFERENCES:**

1. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2<sup>nd</sup> Edition, John Wiley & Sons, USA, 2011.
2. John Viega and Matt Messier, "Secure Programming Cookbook for C and C++", O'Reilly Media, USA, 2003.
3. Mark G Graff and Kenneth R Van Wyk, "Secure Coding: Principles and Practices", O'Reilly Media, USA, 2003.
4. Robert C. Seacord, "The CERT C Coding Standard: 98 Rules for Developing Safe, Reliable, and Secure Systems", 2<sup>nd</sup> Edition, Addison-Wesley Professional, USA, 2014.

## 19I021 SOFT COMPUTING

**3 0 0 3**

**NEURAL NETWORKS:** Introduction, Architectures, Basic models of ANN, Supervised learning network: Perceptron networks, Adaline, Madaline, Back propagation networks. (9)

**ASSOCIATIVE MEMORY AND ART:** Autocorrelators, Heterocorrelators, Exponential BAM, Adaptive resonance theory: ART1, ART2 and its Applications. (9)

**FUZZY LOGIC:** Fuzzy set theory: Crisp Sets, Fuzzy sets, Crisp relations and Fuzzy relations, Fuzzy systems: Crisp logic, Predicate logic, Fuzzy logic, Rule based system, Defuzzification methods. (9)

**GENETIC ALGORITHMS:** Genetic operators: Selection - Crossover - Reproduction - Mutation, Fitness function, Genetic programming, Applications. (9)

**EVOLUTIONARY ALGORITHMS:** Basic concepts, Single and multi-objective optimization, Evolutionary strategies and programming, Multi-modal function optimization, Applications. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Rajasekaran S and Vijayalakshmi Pai G A, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", PHI Learning, New Delhi, 2014.
2. Kalyanmoy Deb, "Multi-objective optimization using Evolutionary Algorithms", John-Wiley and Sons, New York, 2009.

**REFERENCES:**

1. Laurene Fausette, "Fundamentals of Neural Networks", Pearson Education, New Delhi, 2012.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", 2<sup>nd</sup> Edition, Wiley-India, Mumbai, 2014.
3. Eiji Mizutani, Chuen Tsai Sun and Jyh Shing Roger Jang, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", Pearson Education, New Delhi, 2012.
4. Bart Kosko, "Neural Networks and Fuzzy Systems - A Dynamical Systems Approach to Machine Intelligence", PHI Learning, New Delhi, 2012.

## 19I022 SOFTWARE PROCESS MANAGEMENT

**3 0 0 3**

**INTRODUCTION:** Software Measurement Objective, Scope of Software Metrics, Basics of Measurement - Measurement and Models -Scales and Scale Types, Classifying Software Measures. (9)

**DATA COLLECTION AND ANALYSIS:** Goal - Question - Metric Paradigm, Defining Good data, Quality Terminologies: Fault - Failure - Defect, Data collection Forms and Tools, Data Analysis Techniques - Box Plots, Bar charts, Control Charts, Scatter plots. (9)

**EFFORT, COST ESTIMATION AND RISK MANAGEMENT:** Effort estimation techniques - COCOMO - Basic COCOMO - Intermediate COCOMO - Detailed COCOMO - Cost estimation techniques - Resource Estimation techniques, Risk management - Causes of risks, Risk Categories, Risk Analysis. (9)

**PROCESS MANAGEMENT AND CONTROL:** Framework for Management and control - Collection of data Project termination - Visualizing progress - Cost monitoring - Earned Value Analysis- Project tracking - Change control - Software Configuration Management - Managing contracts - Contract Management. (9)

**SOFTWARE TESTING:** Problems with traditional development model - Verification and Validation - Test strategy and planning - Test Automation - Test Reporting - Test Artifacts. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Ashfaque Ahmed, "Software Project Management — A Process driven approach", CRC Press Taylor & Francis Group, USA, 2015.
2. Norman Fenton and James Bieman, "Software Metrics: A Rigorous and Practical Approach", CRC Press, Taylor & Francis Group, USA, 2014.

**REFERENCES:**

1. Walker Royce, "Software Project Management", 6<sup>th</sup> Edition, Addison-Wesley, USA, 1998.
2. Gopalaswamy Ramesh, "Managing Global Software Projects", 14<sup>th</sup> Edition, McGraw Hill Education, New Delhi, 2015.
3. Jurgen Munch, Ove Armburst and Martin Soto, "Software Process Definition and Management", Springer Publication, Berlin, 2012.
4. Robert K. Wysocki, "Effective Software Project Management", Wiley Publication, USA, 2014.

## **191023 SOFTWARE QUALITY ASSURANCE**

**3 0 0 3**

**INTRODUCTION:** SQA Definitions and Concepts: Software Quality and Software Quality Assurance, Software Product, Principles of SQA, Software Errors, Faults and Failures, The causes of errors, SQA VS Software Quality Control, SQA and Software Engineering, Software Quality Factors: McCall's Classic model, ISO/IEC25010 model and other alternative models, Software Compliance, Software Quality Challenges. (9)

**SQA COMPONENTS AND PROJECT LIFE CYCLE:** Software quality assurance activities - Verification & Validation - Reviews - Software testing - Software testing implementations - Quality of software maintenance - Pre-Maintenance of software quality components - Quality assurance tools - CASE tools for software quality. (9)

**SOFTWARE QUALITY INFRASTRUCTURE:** Procedures and work instructions - Templates - Checklists - 3S development - Staff training and certification, Corrective and preventive actions - Configuration management - Software change control - Configuration management audit - Documentation control - Storage and Retrieval. (9)

**SOFTWARE QUALITY MANAGEMENT & METRICS:** Project process control - Computerized tools - Software quality metrics - Objectives of quality measurement - Process metrics - Product metrics - Implementation - Limitations of software metrics - Cost of software quality - Classical quality cost model - Extended model - Application of cost model. (9)

**QUALITY ASSURANCE MODELS AND TRENDS:** Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model, Quality Assurance Trends, Software Process - PSP and TSP, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs. (9)

**Total L: 45**

**TEXT BOOKS:**

1. Nina S Godbole, "Software Quality Assurance: Principles and Practice", 2<sup>nd</sup> Edition, Alpha Science International Ltd, Pune, 2016.
2. Claude Y.Laporte and Alian April, "Software Quality Assurance", Wiley Publication, USA, 2018.

**REFERENCES:**

1. Alan C. Gillies, "Software Quality: Theory and Management", 3<sup>rd</sup> Edition, International Thomson Computer Press, UK, 2011.
2. Basu, Anirban, "Software Quality Assurance, Testing and Metrics", 3<sup>rd</sup> Edition, PHI Learning, New Delhi, 2015.
3. Solis Tech, "Quality Assurance – Software Quality Assurance Made Easy", Solis Tech, 2015.
4. Daniel Galin, "Software Quality Assurance", Pearson Publication, New Delhi, 2009.

## 19I024 SWARM INTELLIGENCE

3 0 0 3

**INTRODUCTION:** Fundamentals of problems: Optimization - Modeling - Simulation, Search problems, NP problems, Sources of Inspiration: Swarm Intelligence algorithms - Non Swarm Intelligence algorithms, Biological foundations of Swarm Intelligence. (9)

**COMPUTING ALGORITHMS:** Particle Swarm Optimization: Swarms - Operating Principles - Algorithm - Neighborhood Topologies, Variations, Ant Colony Optimization: Ant Foraging Behavior - Theoretical Considerations - Algorithm - Variations, Introduction to Artificial Bee Colony Optimization, Applications: N-Queens problem - Knapsack problem. (9)

**RECENT COMPUTING ALGORITHMS:** Bat Algorithm: Basics - Variants, Artificial Fish Swarm: Fish Swarm Optimization - variants, Firefly algorithm: Introduction - Variants, Introduction to Flower Pollination algorithm, Applications: Scheduling, Shortest path. (9)

**LOCAL SEARCH AND HYBRID ALGORITHMS:** Simulated annealing, Tabu search, Cuckoo Search: Cuckoo Search Algorithm - Cuckoo search variants, Hybrid algorithms, Application: Minimum spanning tree problem – Travelling Salesman Problem. (9)

**MULTIOBJECTIVE OPTIMIZATION:** Principles of multi objective optimization, Dominance and Pareto Optimality, Methods: Non- Elitist multi objective Algorithms, Elitist multi objective algorithms. (9)

**Total L: 45**

### TEXT BOOKS:

1. Aboul Ella Hassanien and Eid Emary, "Swarm Intelligence: Principles, Advances, and Applications", CRS Press, Boca Raton, 2018.
2. Eiben A.E and Smith J.E, "Introduction to Evolutionary Computing", 2<sup>nd</sup> Edition, Springer, New York, 2015.

### REFERENCES:

1. Neumann, Frank, and Carsten Witt, "Bioinspired Computation in Combinatorial Optimization: Algorithms and their Computational Complexity", Springer, New York, 2010.
2. Satchidananda Dehuri, Alok Kumar Jagadev and Mrutyunjaya Panda, "Multi-objective Swarm Intelligence: Theoretical Advances and Applications", Springer, New York, 2015.
3. Kalyanmoy Deb, "Multi-objective optimization using evolutionary algorithms", John Wiley & Sons, USA, 2010.
4. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", John Wiley & Sons, USA, 2007.

## 19I025 SYSTEM SOFTWARE

3 0 0 3

**SYSTEM ARCHITECTURE:** System software and machine architecture, Simplified Instructional Computer (SIC), CISC machines, RISC machines, Evolution of components of programming system. (9)

**ASSEMBLERS:** Basic assembler functions, Machine dependent assembler features, Machine independent assembler features, Assembler design. (9)

**COMPILERS AND INTERPRETERS:** Aspects of compilation, Memory allocation, Compilation of expressions, Compilation of control structures, Lexical analysis, Syntax analysis, Code optimization, Interpreters, Case study: Debug monitors - Editors. (9)

**MACRO PROCESSORS:** Macro instructions, Features of macro facility, Implementation of two-pass and single - pass algorithms, Implementation of macro calls within macros and within an assembler. (9)

**LOADERS AND LINKERS:** Loader functions - Absolute Loader - Bootstrap Loader - Machine dependent loader features - Relocation - Program Linking - Data Structures - Machine independent loader - Automatic Library Search Design options - Linkage Editors - Dynamic Linking. (9)

**Total L: 45**

### TEXT BOOKS:

1. Leland L Beck, "System Software - An Introduction to Systems Programming", 3<sup>rd</sup> Edition, Pearson Education, New Delhi, 2002.
2. John J Donovan, "Systems Programming", Tata McGraw Hill, New Delhi, 2017.

### REFERENCES:

1. Richard Anthony, "Systems Programming: Designing and Developing Distributed Applications", Morgan Kaufmann Publisher, USA, 2015.
2. Alfred V Aho, Ravi Sethi and Jeffrey D Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education, New Delhi, 2011.
3. Dhamdhare D M, "System Programming", Tata McGraw Hill, New Delhi, 2011.
4. Nithyashri J, "System Software", Tata McGraw Hill, New Delhi, 2010.

## 191026 TCP/IP AND SOCKET PROGRAMMING

3 0 0 3

**INTERNETWORKING:** Concepts, Architecture, Internet addresses: IP address classes - Subnetting - Variable Length Subnetting - Supernetting - Subnet mask, CIDR, ARP, RARP, Migrating from IPv4 to IPv6, Features of IPv6, IPv6 header format. (9)

**NETWORK MANAGEMENT OVER TCP:** Simple Network Management Protocol (SNMP), Management Information Base (MIB), Agent, Manager, Traps, Configuration management, Fault management, Performance management, Security management, Account management, Internet management. (9)

**SECURITY MANAGEMENT:** Network Layer Security - IP Security - Virtual Private Network, Transport Layer Security - Secure Socket Layer, Application Layer Security - PGP - S/MIME, Firewalls. (9)

**SOCKET INTERFACE:** I/O paradigm and Network I/O, Creating a socket, Inheritance and termination, Connecting sockets to destination address, Obtaining information about networks, protocols and host. (9)

**SOCKET PROGRAMMING APPLICATIONS:** TCP echo client server, UDP echo client server, Implementation of TCP/IP in Windows Embedded CE operating system, Voice over IP, Internet security. (9)

**Total L: 45**

### TEXT BOOKS:

1. Behrouz A Forouzan, "TCP/IP Protocol Suite", 4<sup>th</sup> Edition, Tata McGraw Hill, Chennai, 2017.
2. Douglas E Comer, "Internetworking with TCP/IP - Principles, Protocols and Architecture", 6<sup>th</sup> Edition, Pearson, New Delhi, 2013.

### REFERENCES:

1. Brandon Rhodes and John Goerzen, "Foundations of Python Network Programming", 3<sup>rd</sup> Edition, Apress, India, 2014.
2. Richard Stevens W and Stephen A Rago, "Advanced Programming in the UNIX Environment", 3<sup>rd</sup> Edition, Addison Wesley, London, 2013.
3. Lydia Parziale, David T Britt and Chuck Davis, "TCP/IP 3/X: TCP/IP Tutorial and Technical Overview", 8<sup>th</sup> Edition, Vervante, 2006.
4. Charles M. Kozierok, "The TCP/IP Guide: A Comprehensive, Illustrated Internet Protocols Reference", San Francisco, 2019.

## 191027 LINUX INTERNALS

3 0 0 3

**INTRODUCTION TO THE LINUX KERNEL:** Evolution of Linux OS, Versions of Linux, Obtaining the kernel source, Kernel source tree, Building the kernel, No libc or Standard Headers, GNU C, Synchronization and Concurrency, Importance of portability. (9)

**PROCESS SCHEDULING AND MANAGEMENT:** Process, Process descriptor and task structure, Process Creation, Implementation of threads, Process Termination, Process Scheduler, Policy, Scheduling Algorithm, Scheduling implementation. (9)

**MEMORY MANAGEMENT:** Pages, Zones, Getting Pages, kmalloc, vmalloc, Slub layer, Page cache and page writeback - Linux page cache, Buffer cache. (9)

**USER KERNEL INTERFACING AND EXECUTION CONTEXTS:** Syscalls, System call handler, System call implementation, System call context, Interrupts, Interrupts handler, Top Halves vs Bottom Halves, Registering - Writing-Implementing an interrupt handler, /proc interrupts, Interrupt control, Bottom Halves, Softriqs. (9)

**FILE SYSTEMS, BLOCK LAYER AND DEVICE DRIVERS:** Virtual file system, Block I/O Layer - Anatomy of a block device, Buffer and buffer heads, I/O scheduling, Device and Modules-Device Types, Modules, Device model. (9)

**Total L: 45**

### TEXT BOOKS:

1. Robert Love, "Linux Kernel Development", 3<sup>rd</sup> Edition, Pearson Education Inc, Indiana, USA, 2010.
2. Daniel P. Bovot and Marco Cesati, "Understanding the Linux Kernel", 3<sup>rd</sup> Edition, O'Reilly Media, Inc, USA, 2005.

### REFERENCES:

1. Jonathan Corbet, Alessandro Rubini and Greg Kroah-Hartman, "Linux Device Drivers", 3<sup>rd</sup> Edition, O'Reilly Media, Inc, CA, USA, 2009.
2. Raghu Bharadwaj, "Mastering Linux Kernel Development", Packt Publishing, UK, 2017.
3. K.C.Wang, "Systems Programming in Unix/Linux", Springer, Switzerland, 2018.
4. Mohn Lal Jangir, "Linux Kernel and Device Driver Programming: A Simpler Approach to Linux Kernel", University Science Press, New Delhi, 2014.



## 19I028 WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE

3 0 0 3

**SOA INTRODUCTION:** Common Characteristics and principles of SOA, Comparison of SOA with client server and Distributed architectures, Technical and business benefits of SOA, Service Layers, Applications using SOA. (9)

**RESTFUL SERVICES:** REST Architectural principles, SOAP Vs REST, RESTful Key elements, RESTful Methods, Java RESTful Web Services API, REST Implementation: Building Web Service using JAX - RS, Django RESTful Web Services. (9)

**SOAP COMMUNICATION:** XML SOAP Building Blocks, SOAP Message Structure, SOAP Envelope Element, SOAP Attachments, UDDI, WSDL, SOAP Implementation: Building Web Service using JAX - WS, SOAP, UI Testing. (9)

**WEB SERVICES AND MICROSERVICES:** Role of Web services, Web services protocol stack, Communication model, Micro services -Adopting Micro services in SOA, Architectural Benefits, Deriving Business Value, Define and Apply Goal oriented Layered Approach, Design Process, Docker and Microservices, Role of Service Discovery, Applications of Microservices. (9)

**WS SECURITY:** WS overarching concern, Core concepts, Challenges, Threats and remedies, Securing the communication layer, Message level security, OAUTH2.2, WS security framework, WS security policy, WS trust, WSsecure conversation, Data level security, XML encryption, XML signature. (9)

**Total L: 45**

### TEXT BOOKS:

1. Greg Lomow and Eric Newcomer, "Understanding SOA with Web Services", Pearson Education, New Delhi, 2013.
2. Sanjay Patni, "Pro RESTful APIs: Design, Build and Integrate with REST, JSON, XML and JAX-RS", Springer, USA, 2017.

### REFERENCES:

1. Eric Newcomer, "DjangoRESTful Web Services", PACKT Publishing, Birmingham, UK, 2018.
2. IrakliNadareishvili, Ronnie Mitra and Matt McLart, "Microservice Architecture: Aligning Principles, Practices, and Culture", O'Reilly Media, New Delhi, 2016.
3. Jobinesh Purushothaman, "RESTful Java Web Services", PACKT Publishing, Birmingham, UK, 2015.
4. Mike Rosen, Boris Lublinsky, Kevin T. Smith and Marc. J. Balcer, "Applied SOA: Service Oriented Architecture and Design Strategies", 2<sup>nd</sup> Edition, Wiley, Indianapolis,USA, 2012.

## 19I029 GEO DATABASE AND INFORMATION SYSTEMS

3 0 0 3

**SPATIAL DATA MODELS AND DATA ANALYSIS:** Introduction to Geographical Information Systems (GIS) - GIS and Information Systems - Components of a GIS. Spatial Data Models: Basic spatial concepts - Raster Data Structures - Raster Data Compression - Vector Data Structures - TIN and GRID data models. Data Analysis: Vector Data Analysis tools - 3D data collection and utilization. (9)

**SPATIAL DATABASE MANAGEMENT SYSTEM (SDBMS):** Spatial Storage and Indexing: indexing - Spatial Indexing - Grid files - R Tree - Concurrency support - Spatial Join index - Database recovery techniques. Design And Development of Spatial Data Base System (SDBMS): Exploring Spatial Geometry - Organizing spatial data - Spatial data relationships and functionalities - Tools. (9)

**SPATIAL DATABASE FOR PUBLIC HEALTH AND DISEASE MAPPING:** Health Datasets, Disease Registries - Geolocating Health Data - Data Security and Privacy Issues. Disease Mapping: Spatial patterns of disease - endemic and epidemic zonation - tests for spatial clustering and fragmentation - Applications of Remote Sensing and GIS in disease mapping. (9)

**LOCATION AND ALLOCATION STRATEGIES:** Location of health centres and service areas: P-median scenarios - Network analysis and services - emergency services and alternative locations - allocation of health resources - allocation of service areas and optimality - improving access to socio economic and geographical contexts – Case study . (9)

**WEB-GIS AND APPLICATIONS:** Sharing disease data and web - Ontology requirements and applications - Open source service environments - methods of XML aid OGC services - Natural Resource Management - Navigation Management - Vehicle tracking and fleet management - Marketing and Business applications. (9)

**Total L: 45**

### TEXTBOOKS:

1. Ian Heywood, Sarah Cornelius and Steve Carver, "An Introduction To Geographical Information Systems", Pearson Education, Pearson Education, United Kingdom, 2011
2. Massimo Craglia and Ravi Maheswaran, "GIS in Public Health Practice", CRC Press LLC, United Kingdom, 2019.

**REFERENCES:**

1. Goodchild, M. F., Maguire, D. J., Rhind, D. W. and Longley, P. A., "Geographic Information Science and Systems", Wiley, United States, 2015.
2. Kang - Tsung Chang, "Introduction to Geographic Information Systems", McGraw-Hill Education, United Kingdom, 2018.
3. Voisard, A., Rigaux, P. and Scholl, M. "Spatial Databases: With Application to GIS", Elsevier Science, United Kingdom, 2002.
4. Ellen K. Cromley, Sara L and McLafferty, "GIS and Public Health", Guilford Publications, Second Edition, United Kingdom, 2012.

**19I030 KNOWLEDGE REPRESENTATION AND REASONING**

**3 0 0 3**

**INTRODUCTION:** Knowledge bases systems, Need for reasoning, Role of logic, Facts, Entailments, Skolemization, Computational Intractability: Herbrand theorem, Propositional case, Implications, SAT solvers. (9)

**REASONING:** Resolution with Horn clauses, SLD resolution, SLD Derivations: Backward chaining - Forward chaining – First-order case, Production Systems: Basic operation, Production rules, Conflict resolution. (10)

**STRUCTURED DESCRIPTION:** Description language, Truth in interpretations, Normalization, Structure matching, Subsumption, Applications, Epistemic Logic and Default Reasoning: Circumscription, Minimal models, Event calculus, Default Reasoning: Default logic, Autoepistemic logic, Epistemic logic. (9)

**ONTOLOGIES:** Semantic Web, Semantic modeling, RDF, OWL, Formal Semantics, Semantic Web application architecture, Inferencing, semantic relation in SKOS, uncertainty modeling, Data Integration. (9)

**LINKED DATA:** Principle, Open data to linked open data, publishing LOD, Consuming LOD, Applications. (8)

**Total L: 45**

**TEXTBOOKS:**

1. Ronald J. Brachman and Hector J. Levesque, "Knowledge Representation and Reasoning", Elsevier, USA, 2004.
2. Franz Baader, Deborah L. McGuinness, Daniele Nardi and Peter F. Patel-Schneider, "The Description Logic Handbook: Theory, implementation, and applications", Cambridge University Press, 2010.

**REFERENCES:**

1. Michael Gelfond and Yulia Kahl, "Knowledge Representation, Reasoning, and the Design of Intelligent Agents", Cambridge University Press, USA, 2014.
2. Pascal Hitzler, Markus Krotzsch and Sebastian Rudolph, "Foundations of Semantic Web Technologies", CRC Press, New York, 2010
3. Florian Bauer and Martin Kaltenböck, "Linked Open Data: The Essentials", Monochrom, Austria, 2012.
4. Bruce Porter, Frank van Harmelen, Vladimir Lifschitz, "Handbook of Knowledge Representation", Elsevier Science, 2008.

**LANGUAGE ELECTIVES**

**19G001 COMMUNICATION SKILLS FOR ENGINEERS**

**0 0 4 2**

**COMMUNICATION CONCEPTS :**

Process of Communication  
Inter and Intrapersonal Communication  
Inter and Intrapersonal Communication Activities (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 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'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 pasttense)
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.
3. Minna Minna No Nihongo "Translation & Grammatical Notes In English Elementary", Goyal Publisher,2007.

## **ONE-CREDIT COURSES**

### **19IF01 AUGMENTED REALITY**

**1 0 0 1**

**INTRODUCTION:** Definition, Components, History, Augmented Reality Vs Virtual Reality, AR Vs QR Codes, Challenges, Opportunities. (2)

**AUGMENTED REALITY TYPES:** Working principles of Augmented Reality, Augmented Reality Methods, Display Technology, Interaction in AR Applications, Value of Augmented Reality, Next User Interface, Uses of Augmented Reality. (4)

**APPLICATION DEVELOPMENT:** Mobile Application Development,Vuforia, ARlab, DroidDR, Installing tools, Building application and deploying, Experience the application. (9)

**Total L: 15**

**REFERENCES:**

1. Greg Kipper and Joseph Rampolla, "Augmented Reality - An Emerging Technologies Guide to AR", Elsevier, USA, 2013.
2. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human factors for AR and VR", Pearson Education, USA, 2017.

### **19IF02 BLOCK CHAIN TECHNOLOGY**

**1 0 0 1**

**INTRODUCTION:** Blockchain Data structure - Hash chain, Distributed database, Index structure. (2)

**BLOCKCHAIN ARCHITECTURE:** Hashes, Transactions, Asymmetric-Key Cryptography, Addresses and Address Derivation, Private Key Storage, Ledgers, Blocks, Chaining Blocks. (3)

**BLOCKCHAIN IMPLEMENTATION:** Forking - Soft Forks, Hard Forks, Cryptographic Changes and Forks, Smart contract programming. (4)

**BLOCKCHAIN PLATFORMS:** Cryptocurrencies - Bitcoin - Litecoin - Ethereum - Ripple, Hyperledger, Ethereum. (6)

**Total L: 15**

**REFERENCES:**

1. Melanie Swan, "Blockchain - Blueprint for a New Economy", O'Reilly Media, New Delhi, 2015.
2. Narayanan, J. Bonneau, E. Felten, A. Miller and S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, USA, 2016.

### **19IF03 CYBER FORENSICS**

**1 0 0 1**

**COMPUTER FORENSICS:** Fundamentals of Computer Forensics, Computer Forensics Technology, Live data collection from Windows systems, Live data Collection from Unix systems, Data Acquisition of digital evidence from electronic media, Evidence collection and preservation, Network Forensics, Email Investigations, Mobile device forensics, Computer Forensics Analysis and Validation, Macro Threats, Information Warfare. (8)

**DATA ANALYSIS:** Data analysis Techniques: Preparation for Forensic Analysis, Restoring a Forensics Duplicate, Recovering deleted files on Windows systems, Recovering files from Unallocated space, Free space and Slack space, Writing Forensic Reports, Report Writing Guidelines. (7)

**Total L: 15**

**REFERENCES:**

1. John R. Vacca , "Computer Forensics: Computer Crime Scene Investigation", 3<sup>rd</sup> Edition, Jones & Bartlett Learning, LLC, USA, 2010.
2. Chad Steel , "Windows Forensics", Wiley Publishing Inc, Indiana, 2006.
3. Dejeay and Murugan , "Cyber Forensics", Oxford University Press, UK, 2018.

**19IF04 EDGE/FOG COMPUTING**

**1 0 0 1**

**INTRODUCTION:** IoT and New Computing Paradigms - Advantages - Hierarchy of Edge Computing - Opportunities and Challenges - Federating Edge Resources - Integration of IoT, Edge and Cloud Infrastructure - Network Slicing Management in Edge and Cloud - Optimization Problems in Edge Computing. (5)

**MIDDLEWARES:** Need for Middlewares, Design Goals - System Model - Actuators - Personal Devices - Fog Servers - Cloud Servers - Device Discovery - Edge Cloud Architecture - Lightweight Cluster Formation – Storage and Orchestration - Security Management for Edge Cloud Architecture. (5)

**DATA MANAGEMENT AND APPLICATIONS:** Edge Data Management - Life Cycle - Characteristics - Predictive Analysis with Fog Torch - Comparing iFogSim and FogTorch - Data Analytics in Edge/Fog - Prototypes and Evaluation - Applications - Exploiting Edge Computing in Health Monitoring - Smart Homes - Smart Transportation. (5)

**Total L: 15**

**REFERENCES:**

1. Rajkumar Buyya, Sathish N Srirama, "Fog and Edge Computing: Principles and Paradigms", John Wiley and Sons, USA, 2019.
2. Jie Cao, Quan Zhang, Weisong Shi, "Edge Computing: A Primer", Springer, Switzerland, 2018.

**19IF05 INDUSTRIAL AUTOMATION**

**1 0 0 1**

**INTRODUCTION:** Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA), Industrial bus systems: modbus & profibus. (4)

**AUTOMATION COMPONENTS:** Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement, Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT, DC and AC servo drives for motion control. (4)

**COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS:** Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Industrial communication systems, Data transfer techniques, Internet of things (IoT) for plant automation. (4)

**AUTOMATION USING ROBOTS:** Basic construction and configuration of robot, Pick and place robot, Welding robot. (3)

**Total L: 15**

**REFERENCES:**

1. Frank Lamp, "Industrial Automation Hands-On", McGraw Hill, USA, 2013.
2. S.K. Singh, "Industrial Instrumentation and Control", The McGraw Hill Companies, New Delhi, 2010.
3. Thomas R.Kurfess, "Robotics and Automation Handbook", CRC Press, USA, 2005.

**19IF06 MACHINE TO MACHINE COMMUNICATION**

**1 0 0 1**

**INTRODUCTION:** Machine to Machine communication, Machine to Machine Market, Machine to Machine History, Early Machine to Machine, Machine to Machine Requirement. (3)

**ARCHITECTURE:** High-Level Architectural Principles, ETSI Machine to Machine Service Architecture, Machine to Machine Optimizations, Public Mobile Networks, Role of IP in Machine to Machine. (6)

**DESIGN AND APPLICATION:** Machine to Machine Security Issues, Designing Internet of Things, Building Machine to Machine - Internet of Things systems, M2M Application: Smart Cards. (6)

**Total L: 15**

**REFERENCES:**

1. David B, Omar E and Olivier H, "M2M Communications- A System Approach", John Wiley and Sons, New Delhi, 2012.
2. Vojislav B. Mistic and Jelena Mistic , "Machine to Machine Communications: Architectures, Technology, Standards and Applications", CRC Press, New Delhi, 2014.
3. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wiley and Sons, New Delhi, 2013.

**19IF07 TILED-CHIP MULTI-CORE PROCESSORS**

**1 0 0 1**

**INTRODUCTION:** Concept of instruction pipelining, RISC 5 stage pipeline, pipeline hazards, operand forwarding, branch prediction techniques. (2)

**SCHEDULING:** MIPS pipeline for handling multi-cycle operations, static and dynamic scheduling of instructions. (2)

**THREADING:** Multithreading - fined grained and coarse grained, super pipelining, hyper threading, superscalar processors. (2)

**CACHE MEMORY:** Introduction to cache memory hierarchy in multicore processors, mapping, write strategy and basic optimizations. (3)

**DRAM CONTROLLERS:** DRAM controllers - organization and scheduling techniques. (1)

**TILED CHIP MULTICORE PROCESSORS:** Tiled Chip Multicore Processors (TCMP), Network on Chip interconnection systems, basic routing and flow control techniques, Application to Core mapping techniques in TCMP. (5)

**Total L: 15**

**REFERENCES:**

1. Hennessey and Patterson, "Computer Architecture A Quantitative Approach", 5<sup>th</sup> Edition, Elsevier, USA, 2012.
2. Bruce Jacob, Spencer W. Ng and David T. Wang, "Memory System-Cache, DRAM and Disk", Elsevier, USA, 2008.
3. William James Dally, Brian Towles, "Principles and Practices of Interconnection Networks", Elsevier, USA, 2004.

**19IF08 UNIFIED COMMUNICATION SERVICES**

**1 0 0 1**

**TECHNOLOGY OF UNIFIED COMMUNICATION:** Unified communication (UC) and unified messaging, Components, User, Business, Basics of a switching system, Data transmission in PSTNs, Switching techniques for data transmission. (4)

**CELLULAR WIRELESS NETWORKS:** Principles of cellular networks, Frequency reuse, Channel assignment strategies, Handoff strategies, SNR, SIR, TDMA, FDMA and CDMA systems, OFDM Principles, Issues in rate adaptation and interference management, Applications of mobile devices: PDAs – EDAs – Smart phones. (7)

**IP TELEPHONY AND VOIP:** Voice digitization, Data under voice, IP telephony, IPTV, US Wireless Cable Television, VoIP, VoIP protocols - H.323, MGCP, SIP, SCCP and video conferencing. (4)

**Total L: 15**

**REFERENCES:**

1. Viswanathan T, "Telecommunication Switching Systems and Networks", PHI Learning, New Delhi, 2014.
2. Theodore S Rappaport, "Wireless Communications: Principles and Practice", Pearson Education, New Delhi, 2013.
3. Marion Cole, "Introduction to Telecommunications Voice, Data and the Internet", Pearson Education, New Delhi, 2002.
4. William Stallings, "Wireless Communication and Networks", Pearson Education, New Delhi, 2004.

**19IF09 VIRTUAL REALITY**

**1 0 0 1**

**INTRODUCTION:** Overview ofVirtual Reality, Virtual Reality Hardware: Oculus Rift, Other High - End Head - Mounted Displays, Samsung Gear VR: Deluxe, Portable Virtual Reality, Google Cardboard: Low Cost VR for Smartphone, VR Input Devices, VR usage. (5)

**VR-GOOGLE CARDBOARD FOR LOW-COST MOBILE VIRTUAL REALITY:** Cardboard Basics, Cardboard Stereo Rendering and Head Tracking, Developing with the Cardboard SDK for Android and Unity, Cardboard Applications Using HTML5 and a Mobile Browser, First VR Application: About 360-Degree Panoramas, Setting Up the Project, Adding Cardboard

VR Support, creating a Gaze-and-Tap User Interface.

(10)

**Total L: 15**

**REFERENCES:**

1. Tony Parisi, "Learning Virtual Reality - Developing Immersive Experiences and Applications for Desktop, Web and Mobile", O'Reilly, USA, 2016.
2. Srushtika Neelakantam and TanayPant, "Learning Web-based Virtual Reality: Build and Deploy Web-based Virtual Reality", Apress, New Delhi, 2017.

**19IF10 5G NETWORKS**

**1 0 0 1**

**5G FUNDAMENTALS AND ARCHITECTURE:** Evolution of 5G, Need for 5G-5G RAN (Radio Access Network), Key features of 5G, Architecture: Key elements of 5G-3GPP standards for 5G radio and core. (7)

**5G KEY TECHNOLOGIES AND WIRELESS NETWORK DEPLOYMENT:** Cloud computing and NFV (Network Function Virtualization), NOMA (Non Orthogonal Multiple Access), Massive MIMO, Wireless Network Deployment: Challenges in 5G rollout - SA (Stand Alone) and NSA (Non Stand Alone) deployment. (8)

**Total L: 15**

**REFERENCES:**

1. Anwer Al-Dulaimi, Xianbin Wang and Chih-Lin I, "5G Networks: Fundamental Requirements, Enabling Technologies, and Operations Management", Wiley-IEEE Press, USA, 2018.
2. Hrishikesh Venkataraman and Ramona Trestian, "5g Radio Access Networks: Centralized Ran, Cloud Ran, And Virtualization of Small Cells", CRC PRESS, India, 2017.

**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.
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**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**

**REFERENCES :**

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.
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