

## SEMESTER I

**15NB01 NUMBER THEORY AND QUANTITATIVE TECHNIQUES**  
Vide Information Technology 15NN01

**15NB02 OBJECT ORIENTED PROGRAMMING**  
Vide Information Technology 15NN02

**15NB03 DATA STRUCTURES AND ALGORITHMS**  
Vide Information Technology 15NN03

**15NB04 NETWORKING TECHNOLOGY**  
Vide Information Technology 15NN04

**15NB05 BIOMETRIC TECHNOLOGIES**

**3 0 0 3**

**BIOMETRIC FUNDAMENTALS AND STANDARDS:** Definition, Biometrics versus traditional techniques, Characteristics, Key biometric processes: Verification - Identification - Biometric matching, Performance measures in biometric systems, Assessing the privacy risks of biometrics - Designing privacy sympathetic biometric systems, Different biometric standards, Application properties. (9)

**PHYSIOLOGICAL BIOMETRICS:** Facial scan, Ear scan, Retina scan, Iris scan, Finger scan, Automated fingerprint identification system, Palm print, Hand vascular geometry analysis, Knuckle, DNA, Dental, Cognitive Biometrics - ECG, EEG. (10)

**BEHAVIOURAL BIOMETRICS:** Signature scan, Keystroke scan, Voice scan, Gait recognition, Gesture recognition, Video face, Mapping the body technology. (8)

**USER INTERFACES:** Biometric interfaces: Human machine interface - BHMI structure, Human side interface: Iris image interface - Hand geometry and fingerprint sensor, Machine side interface: Parallel port - Serial port - Network topologies, Case study: Palm Scanner interface. (9)

**BIOMETRIC APPLICATIONS:** Categorizing biometric applications, Application areas: Criminal and citizen identification – Surveillance - PC/network access - E-commerce and retail/ATM, Costs to deploy, Issues in deployment, Biometrics in medicine, cancellable biometrics. (9)

**Total L: 45**

### REFERENCES:

1. Anil K Jain, Patrick Flynn and Arun A Ross, "Handbook of Biometrics", Springer, USA, 2010.
2. John R Vacca, "Biometric Technologies and Verification Systems", Elsevier, USA, 2009.
3. Samir Nanavati, Michael Thieme and Raj Nanavati, "Biometrics – Identity Verification in a Networked World", John Wiley and Sons, New Delhi, 2003.
4. Paul Reid, "Biometrics for Network Security, Pearson Education, New Delhi, 2004.
5. Reid M. Bolle et al, "Guide to Biometrics, Springer", USA, 2004.
6. David D Zhang, "Automated Biometrics: Technologies and Systems", Kluwer Academic Publishers, New Delhi, 2000.

**15NB51 DATA STRUCTURES LABORATORY**  
Vide Information Technology 15NB51

**15NB61 INDUSTRY VISIT AND TECHNICAL SEMINAR**

**0 0 2 1**

The student will make atleast two technical presentations on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of the semester covering the

various aspects of his/her presentation together with the observation in industry visits. A quiz covering the above will be held at the end of the semester.

**Total P:30**

## SEMESTER II

### 15NB06 APPLIED CRYPTOGRAPHY

**3 0 0 3**

**INTRODUCTION:** Modern cryptography, Historical ciphers and cryptanalysis, Security attacks, services and mechanisms, OSI security architecture. (6)

**SYMMETRIC TECHNIQUES:** Substitution ciphers, Transposition ciphers, Characteristics of good ciphers Data Encryption Standard (DES), Advanced Encryption Standard (AES), Blowfish, Block cipher modes of operation, Stream cipher: RC5. (9)

**ASYMMETRIC TECHNIQUES:** Basics of number theory, Principles of public key cryptosystems, RSA Algorithm, Key management, Diffie-Hellman key exchange algorithm, Elliptic Curve Cryptography (ECC), Case study: eCash, PAKE protocol. (9)

**HASH FUNCTIONS:** Introduction, Applications, Requirements and security, Secure Hash Algorithm (SHA), RACE Integrity Primitives Evaluation Message Digest (RIPEMD-160). (7)

**MESSAGE AUTHENTICATION:** Authentication requirements, Authentication functions, Message Authentication Codes (MAC), Hash-based Message Authentication Code (HMAC) (7)

**DIGITAL SIGNATURES:** Digital Signatures, Authentication Protocols, Digital Signature Standard (DSS), Elgamal, Schnorr, Applications. (7)

**Total L: 45**

#### REFERENCES:

1. William Stallings, "Cryptography and Network Security – Principles and Practice", Prentice Hall, New Delhi, 2011.
2. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, New Delhi, 2011.
3. Alfred J Menezes, Paul C van Oorschot and Scott A.Vanstone, "Handbook of Applied Cryptography", CRC Press, New York, 2010.
4. Wenbo Mao, "Modern Cryptography - Theory and Practice", Pearson Education, New Delhi, 2013.
5. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", John Wiley and Sons, New York, 2009.

### 15NB07 BIOMETRIC IMAGE PROCESSING

**3 0 0 3**

**INTRODUCTION:** Digital image representation, Fundamental steps in image processing, Elements of digital image processing system, Image sensing and acquisition, Sampling and quantization, Basic relationship between pixels, Transformation technology: Fourier transform - Discrete cosine transform. (9)

**IMAGE ENHANCEMENT:** Spatial domain methods: Basic gray level transformations - Histogram equalization - Smoothing spatial filter - Sharpening spatial filters - Laplacian, Frequency domain methods: Smoothing and sharpening filters – Ideal - Butterworth - Gaussian filters. Image Segmentation: Point- Line and edge detection - Thresholding - Global and multiple thresholding, Region splitting and merging, Boundary following. (9)

**MORPHOLOGICAL IMAGE PROCESSING:** Fundamental concepts and operations, Dilation and Erosion, Compound operations, Morphological filtering, Basic morphological algorithms, Grayscale morphology. (5)

**2D AND 3D FACE BIOMETRICS:** Global face recognition techniques: Principal component analysis - Face recognition using PCA - Linear discriminant analysis - Face recognition using LDA, Local face recognition techniques: Geometric techniques - Elastic graph matching techniques, Hybrid face recognition techniques. 3D FACE IMAGE: Acquisition, Preprocessing and normalization, 3D face recognition. (9)

**HAND AND IRIS BIOMETRICS:** Characterization by minutiae extraction: Histogram equalization, Binarization, Skeletonization, Detection of minutiae, Matching, Performance evaluation, Preprocessing of iris images: Extraction of region of interest - Construction of noise mask – Normalization - Features extraction and encoding - Similarity measures between two iris codes. (8)

**FUSION IN BIOMETRICS:** Multi-biometrics, Levels of fusion: Sensor level - Feature level - Rank level - Decision level fusion - Score level fusion. (5)

**Total L:45**

**REFERENCES:**

1. Rafael C Gonzalez, Richard E Woods and Steven L Eddins, "Digital Image Processing", Pearson Education, New Delhi, 2013.
2. Amine Nait Ali and Regis Fournier, "Signal and Image Processing for Biometrics", John Wiley and Sons, UK, 2012.
3. Arun A Ross, Karthik Nandakumar and Jain A K, "Handbook of Multi-biometrics", Springer, New Delhi 2011.
4. Oge Marques, "Practical Image and Video Processing using MATLAB", John Wiley and Sons, New Jersey, 2011.

## 15NB08 CYBER SECURITY AND INVESTIGATIONS

**3 2 0 4**

**INTRODUCTION:** Computer Security, Threats, Vulnerabilities, Controls, Attacks, Identification and Authentication, Privacy, Countermeasure - Project lifecycle: Project phases - Resource estimates - Project planning - Acquisition - Deployment phase - Tuning - Deployment issues -Maintenance: Design and Testing. (8+5)

**ATTACKER TECHNIQUES:** Tunneling and fraud techniques, Threat infrastructure, Exploitation: Techniques to gain a foothold - Misdirection, Reconnaissance and disruption methods, Malicious codes: Self-replicating codes - Evading detection and elevating privileges - Stealing information and exploitation (7+5)

**DEFENSE AND ANALYSIS TECHNIQUES:** Memory forensics: Importance - Capabilities - Framework - Dumping physical memory - Installing and using volatility - Finding hidden process - Volatility analyst pack, Honey pots, Malicious code naming and automated analysis system – DNS , Firewalls (8+5)

**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, Detection mechanism, Signatures, Traffic analysis, Intrusion detection (7+5)

**CYBERCRIME:** Nature and scope, Classification, Social engineering, Internet hacking and cracking, Flooding, Software piracy, Phishing, Online frauds and offenses, Identity theft. (8+5)

**CYBER LAWS AND ACTS:** IT Act: Concepts – Sections, Digital laws and legislation, Law enforcement roles and responses, Basics of Indian evidence act: IPC - CrPC - Electronic communication privacy act, Legal policies. (7+5)

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

**REFERENCES:**

1. Charles P. Pfleeger and Shari Lawrence Pfleeger, "Analyzing Computer Security – A threat/vulnerability / Counter measure approach", Pearson, New Delhi, 2014.
2. James Graham, Richard Howard and Ryan Olson, "Cyber Security Essentials", CRC Press, USA, 2011.
3. Paul E Proctor, "The Practical Intrusion Detection Handbook", Prentice Hall, USA, 2007.
4. Bernadette H Schell and Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004.
5. Vivek Sood, "Cyber Law Simplified", Tata McGraw Hill, New Delhi, 2008.

## 15NB09 DIGITAL FORENSICS

**3 2 0 4**

**INTRODUCTION:** System Forensics, Overview of Computer Crime, Types of Computer Crime, Sources of Cybercrime threats, Challenges of Cyber Forensics, System Forensic Technologies: How businesses use Forensics, Common Forensic Tools. (9+6)

**COMPUTER EVIDENCE:** Handling Digital Crime Scene: Fundamental Principles - Preparation - Preservation, Forensic Evidence Collection: Storage formats - RAID Data acquisition - Seizing and Protecting evidence, Data Recovery: Disk structure and recovery techniques - Data Backup and Recovery. (9+6)

**NETWORK FORENSICS:** Network Basics, Network related attacks, Standard Procedures for Network Forensics, Using Network Tools: Unix Tools, Packet Sniffers. (9+6)

**DIGITAL EVIDENCE ON OPERATING SYSTEMS:** Windows: File systems - Data recovery - Log files - Registry - Internet traces - Program analysis, UNIX: Evidence acquisition boot disk - File systems - Overview of tools - Log files - File system traces and Internet traces. (9+6)

**E-MAIL AND MOBILE DEVICE FORENSICS:** Email Forensics: Role of email in investigation - Investigating E-mail Crimes and Violations - E-mail Servers, Mobile Device Forensics: Fundamentals - Types of Evidence Acquisition Procedures - Mobile Device Forensic Tools. (9+6)

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

**REFERENCES:**

1. Bill Nelson, Amelia Phillips and Einfinger Stuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2013.
2. John R Vacca and K Rudolph, "System Forensics, Investigation, and Response", Jones and Bartlett Learning, USA, 2011.
3. Eogen Casey, "Digital Evidence and Computer Crime", Elsevier, USA, 2011.
4. Marie-Helen Maras, "Computer Forensics: Cybercriminals, Laws and Evidence", Jones and Bartlett Learning, USA, 2012.
5. Cory Altheide and Harlan Carvey, "Digital Forensics with Open Source Tools", Elsevier, USA, 2011.

## 15NB10 PATTERN RECOGNITION

**3 0 0 3**

**REPRESENTATION:** Introduction to pattern recognition, Data sets for pattern recognition, Pattern representation, Cluster representation, Feature extraction, Analysis, Feature selection, Applications of pattern recognition. (7)

**NEAREST NEIGHBOUR BASED CLASSIFIERS:** Nearest neighbor algorithm, Variants of the NN algorithm, Use of the nearest neighbor algorithm, Branch and bound algorithm, Data reduction, Prototype selection. (8)

**BAYES CLASSIFIER:** Introduction, Continuous features, Minimum error rate classification, Classifiers, Discriminant functions and decision surfaces, Normal density and its discriminate function, Discrete features, Estimation of probabilities. (8)

**HIDDEN MARKOV MODELS:** Markov models for Classification, Hidden Markov models: HMM parameters - Learning HMMs, Classification using HMMs. (8)

**DECISION TREES:** Introduction, Decision trees for pattern classification, Construction of decision trees, Splitting at the nodes, Over fitting and pruning. (7)

**CLUSTERING:** Hierarchical Algorithms- Divisive clustering - Agglomerative clustering, Partitional clustering, Clustering large data sets. (7)

**Total L:45**

**REFERENCES:**

1. Richard O Duda, Peter E Hart and David G Stork, "Pattern Classification", Wiley India, New Delhi, 2010.
2. Narasimha Murty M and Susheela Devi V, "Pattern Recognition: An Algorithmic Approach", University Press, India, 2011.
3. Sergios Theodoridis and Konstantinos Koutroumbas, "Pattern Recognition", Elsevier, New Delhi, 2011.
4. Christopher M Bishop, "Pattern Recognition and Machine Learning", Springer, USA, 2011.

## 15NB52 BIOMETRIC IMAGE PROCESSING LABORATORY

**0 0 4 2**

1. Image transformation
2. Image enhancement

3. Image segmentation
4. Morphological image processing
5. Feature extraction and recognition
6. Mini Project

**Total P:60**

### **SEMESTER III**

#### **15NB53 SECURITY AND PENETRATION TESTING LABORATORY**

**0 0 4 2**

1. Foot printing
2. Port scanning
3. Windows and Linux Enumerations
4. Hacking web applications
5. Hacking web servers
6. Network hacking
7. Database hacking
8. Sniffer tools
9. Antivirus Programming
10. Password cracking

**Total P:60**

#### **15NB71 PROJECT WORK - I**

**0 0 6 3**

- Identification of a real life problem in thrust areas
- Developing a mathematical model for solving the above problem
- Finalization of system requirements and specification
- Proposing different solutions for the problem based on literature survey
- Future trends in providing alternate solutions
- Consolidated report preparation of the above

**Total P:90**

### **SEMESTER IV**

#### **15NB72 PROJECT WORK - II**

**0 0 28 14**

The project involves the following:

**Preparing a project – brief proposal including**

- Problem Identification
- A statement of system / process specifications proposed to be developed (block Diagram / Concept tree)
- Cost benefit analysis
- Time Line of activities

**A report highlighting the design finalization [based on functional requirements & standards (if any) ]**

**A presentation including the following:**

- Implementation Phase (Hardware / Software / both)
- Testing & Validation of the developed system
- Learning in the project

**Consolidated report preparation**

**Total P:420**

## ELECTIVE THEORY COURSES

(Six to be opted out of which two may be an open elective from other M.E/M.Tech programmes)

### 15NB21 COMPUTER VISION

3 0 0 3

**INTRODUCTION:** Motivation, Difficulty, Image analysis tasks, Image representations, Image digitization, Image properties, Color images, Cameras. (9)

**DATA STRUCTURES:** Levels of image data representation - Traditional image data structures - Hierarchical data structures. (3)

**TEXTURE:** Statistical texture description, Syntactic texture description methods, Hybrid texture description methods, Texture recognition method applications. (9)

**OBJECT RECOGNITION:** Knowledge representation, Statistical pattern recognition, Neural nets, Syntactic pattern recognition, Recognition as graph matching, Optimization techniques in recognition, Fuzzy systems. (8)

**3D VISION:** 3D vision: Tasks - Basics of projective geometry - Scene construction from multiple views, Uses: Shape from X - Full 3D objects - 3D model based vision - 2D view based 3D representation. (9)

**MOTION ANALYSIS:** Differential motion analysis methods, Optical flow, Analysis based on interest points, Detection of specific motion patterns, Video Tracking, Motion models to aid tracking. (7)

**Total L:45**

#### REFERENCES:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Cengage Learning, New Delhi, 2014.
2. Wesley E. Snyder and Hairong Qi, "Machine Vision", Cambridge University Press, USA, 2010.
3. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer-Verlag, London, 2011.
4. Rafael C Gonzalez, Richard E Woods, Steven L Eddins, "Digital Image Processing", Pearson Education, New Delhi, 2009.

### 15NB22 DATA MINING

Vide Information Technology 15NN07

### 15NB23 INFORMATION ETHICS AND LAWS

3 0 0 3

**COMPUTER ETHICS:** Introduction, Acts versus rules, Utilitarianism, Critique of utilitarianism, Virtue ethics, Analogical reasoning in computer ethics, Moral and legal issues, Power relationships, Professional issues and responsibilities. (8)

**PRIVACY:** Privacy protection and law, Key privacy and anonymity issues, Email privacy, Workplace spying, Privacy as individual good, Contextual integrity, Social good essential for democracy. (7)

**INTERNET CRIME:** Ethics for IT workers, Implementing trustworthy computing, Democracy and Internet, Global perspective, Proposals for better privacy protection, Freedom of expression. (7)

**PROPERTY RIGHTS:** Intellectual property rights, Current legal protection, Philosophical basis and analysis of property, Digital IPR, Protecting property rights. (8)

**PROFESSIONAL ETHICS IN COMPUTING:** Characteristics of professions, Formal organization, Autonomy, Codes of ethics, Culture of computing, Professional relationships. (7)

**DIGITAL LAWS:** Law and order in the Internet, Online crime, Democratic values in Internet, Hackers ethics, Sociotechnical security, Free expression, Overarching and future issues. (8)

**Total L:45**

## REFERENCES:

1. Deborah G. Johnson, "Computer Ethics, Pearson Education", New Delhi, 2009.
2. George W Reynolds, "Ethics in Information Technology", Cengage Learning, USA, 2012.
3. Catherine Holland, Vito Canuso III, Diane Reed, Sabin Lee, Andrew Kimmel and Wendy Peterson, "Intellectual Property: Patents", Trademarks, Copyrights and Trade Secrets, McGraw Hill Education, New Delhi, 2010.
4. Jolly B S, "Law, Ethics and Communication", McGraw Hill Education, New Delhi, 2012.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey and Terron Williams, "Gray Hat Hacking - The Ethical Hackers Handbook", McGraw Hill Education, New Delhi, 2011.

## 15NB24 OPERATING SYSTEM AND ITS SECURITY

3 0 0 3

**INTRODUCTION:** Operating system services, Types of operating systems, Operating System Structures. (4)

**PROCESS AND MEMORY MANAGEMENT:** Processes, CPU scheduling approaches, Interprocess communication, Synchronization, Deadlocks, Swapping, Virtual memory, Page replacement algorithms. (10)

**DEVICE AND FILE MANAGEMENT:** I/O hardware, I/O software, Disks, Disk scheduling algorithms, File systems: Files and directories - Access methods - Allocation methods. (8)

**SECURITY ISSUES:** Protection in General Purpose Operating Systems: protected objects and methods of protection, Memory and address protection, Control of access to general objects, File protection mechanism, User authentication. (8)

**DESIGNING TRUSTED OPERATING SYSTEMS:** Trusted system, Security policies, Models of security, Design elements, Security features, Kernelized Design, Virtualization, Layered Design, Assurance: Flaws-Methods- Evaluation. (8)

**CASE STUDY:** Linux/Unix Security, Windows Security, Mobile Security, Virtualization Security. (7)

**Total L:45**

## REFERENCES:

1. Silberschatz A, Galvin P and Gagne G, "Operating Systems Concepts", John Wiley and Sons, New York, 2013.
2. William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, New Delhi, 2014.
3. Deitel H M, "Operating System", Pearson Education, New Delhi, 2011.
4. Charles P Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", Prentice Hall, New Delhi, 2011.
5. Michael Palmer, "Guide to Operating Systems Security", Cengage Learning, New Delhi, 2011.
6. Trent Jaeger, "Operating System Security Synthesis Lectures on Information Security", Privacy, and Trust , Morgan and Claypool, USA, 2008.

## 15NB25 SPEECH PROCESSING

3 0 0 3

**MECHANICS OF SPEECH:** Speech signal, Speech stack, Discrete time signals and systems, Digital filters, Sampling, Process of speech production, Short time Fourier representation of speech, Acoustic phonetics. (7)

**TIME DOMAIN METHODS:** Short time analysis of speech, Energy and magnitude, Zero crossing rate, Autocorrelation function, Average magnitude difference function. (8)

**FREQUENCY DOMAIN METHODS:** Discrete-time and short time Fourier analysis, Spectrographic displays, Overlap addition method of synthesis, Filter bank summation method of synthesis, Implementation using FFT, Time decimated filter banks, Two channel filter banks. (8)

**HOMOMORPHIC AND CEPSTRUM SPEECH PROCESSING:** Homomorphic systems for convolution, Homomorphic analysis of the speech model, Computing the short time cepstrum and complex cepstrum of speech, Homomorphic filtering of natural speech, Cepstrum analysis of all-pole models, Cepstrum distance measures. (7)

**LINEAR PREDICTIVE ANALYSIS:** Basic principles, Computation of the gain for the model of linear predictive analysis, Frequency domain interpretations of linear predictive analysis, Solution of the Linear Predictive Code (LPC) equations, Prediction error signal, Relation of LPC to lossless tube models. (8)

**ESTIMATION OF SPEECH PARAMETERS:** Median smoothing and speech processing, Speech background/silence discrimination, Bayesian approach to voiced/unvoiced/silence detection, Pitch period estimation, Formant estimation, Automatic Speech Recognition System. (7)

**Total L:45**

**REFERENCES:**

1. Rabiner L R and Schaffer R W, "Theory and Applications of Digital Speech Processing", Prentice Hall, New Delhi, 2011.
2. Rabiner L R, and Schaffer R W, "Digital Processing of Speech Signals", Pearson Education, New Delhi, 2004.
3. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", John Wiley and Sons, Singapore, 2004.
4. Quatieri T F, "Discrete Time Processing of Speech Signals", Pearson Education, New Delhi, 2005.

## 15NB26 SOFT COMPUTING

**3 0 0 3**

**NEURAL NETWORKS:** Human brain, Model of an artificial neuron, Neural network architectures, Characteristics, Learning methods. (5)

**SUPERVISED LEARNING:** Back propagation networks, Single layer and multi layer perceptron networks, ADALINE, MADALINE, Radial basis function network. (7)

**UNSUPERVISED LEARNING:** Competitive learning networks - Kohonen self organizing networks - Hebbian learning - Principal component networks - Hopfield networks. (9)

**FUZZY LOGIC:** Fuzzy vs Crisp sets, Operations, Properties, Relations, Fuzzy systems: Crisp logic vs Fuzzy logic, Fuzzy rule based systems, Defuzzification methods, Fuzzy Inference Systems: Mamdani fuzzy models – Sugeno fuzzy models. (8)

**GENETIC ALGORITHMS:** Basic concepts, Biological background, Creation of offsprings, Working principle, Encoding, Fitness function, Reproduction, Applications of genetic algorithms. (8)

**ADVANCED TECHNIQUES:** Simulated Annealing, Tabu search, Ant Colony Optimization(ACO), Particle Swarm Optimization(PSO). (8)

**Total L:45**

**REFERENCES:**

1. Laurene Fausette, "Fundamentals of Neural Networks", Pearson Education, New Delhi, 2008.
2. Rajasekaran S and Vijayalakshmi Pai G A, "Neural Networks", Fuzzy Systems and Genetic Algorithms, Prentice Hall, New Delhi, 2012.
3. Timothy Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, Singapore, 2000.
4. Zimmermann H J, "Fuzzy Set Theory and its Applications", Allied Publishers, New Delhi, 1999.
5. David E Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, New Delhi, 2007.
6. Xinjie Yu, Mitsuo Gen, "Introduction to Evolutionary Algorithms", Springer, New York, 2010.

## 15NB27 INFORMATION THEORY AND CODING

**3 0 0 3**

**INFORMATION ENTROPY FUNDAMENTALS:** Relation between information and probability, mutual and self information, information entropy, Shannon's theorem, Code design, Shannon-Fano coding, Huffman coding, Implementation of Huffman code. (8)

**DATA AND VOICE CODING:** Context dependent coding, arithmetic codes, overall efficiency consideration. Voice coding, PCM, ADPCM, Delta Modulation and adaptive delta modulation, linear predictive coding, sub-band coding. (10)

**IMAGE AND VIDEO COMPRESSION:** Direct cosine transform, quantization loss, loss estimation, JPEG components and standards Inter frame, coding, motion compensation techniques, MPEG-2 standards, Introduction to MPEG-4. (9)



**BLOCK CODES:** Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC. (9)

**CONVOLUTIONAL CODES :** Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding. (9)

**Total L: 45**

**REFERENCES:**

1. Cover T M and Thomas J A, "Elements of Information Theory", John Wiley and Sons, 2013.
2. Simon Haykin, "Communication Systems", Wiley India New Delhi, 2009.
3. Khalid Sayood, "Introduction to Data Compression", Morgan Kaufmann, 2012.
4. Daniel J. Costello and Shu Lin, "Error Control Coding", Pearson India, 2010.

## 15NB28 SECURITY IN CLOUD COMPUTING

**3 0 0 3**

**INTRODUCTION:** Basics of distributed concepts, Grid computing: Architecture - Virtual organization - Web services vs grid services, Grid vs cloud computing, Roots of cloud computing, Deployment models, Service models, Refactoring. (5)

**ARCHITECTURAL FRAMEWORK:** SPI framework, Cloud deployment models: Public cloud - Private cloud - Hybrid cloud, Expected benefits. (5)

**VIRTUALIZATION:** Types, Provisioning and manageability, Migration, Provisioning in the cloud context, Management of virtual machine: Anatomy of cloud infrastructures - Scheduling techniques for advance reservation of capacity. (5)

**SOFTWARE SECURITY FUNDAMENTALS:** Objectives, Cloud security services, Design principles, Secure cloud software requirements, NIST 33 security principles, Cloud security alliance, Infrastructure security: Network level - Host level - Application level, Data storage security: Aspects of security - Data mitigation - Provider data security. (9)

**SECURITY MANAGEMENT AND RISK ISSUES:** Security management: Standards - Security management in cloud, CIA triad, Privacy and compliance risks, Threats to infrastructure, Data and access control, Cloud service provider risks. (10)

**SECURITY CHALLENGES AND ARCHITECTURE:** Security policy implementation: Regulatory policy - Advisory policy - Informative policy, Virtualization security management: Virtual threats, VM security recommendations, VM specific security techniques, Trusted cloud computing, Identity management and access control: Passwords - Tokens - Memory cards - Smart cards - Biometrics - Single sign-on - Autonomic security. (11)

**Total L: 45**

**REFERENCES:**

1. Rajkumar Buyya, James Broberg and Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", John Wiley and Sons, New Jersey, 2011.
2. Danielle Ruest and Nelson Ruest, "Virtualization: A Beginners Guide", Tata McGraw Hill, New Delhi, 2009.
3. Ronald L Krutz and Russel Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley India, New Delhi, 2010.
4. Tim Mather, Subra Kumaraswamy and Shahed Latif, "Cloud Security and Privacy", O'Reilly Publishers, USA, 2009.
5. John W Rittinghouse and James F Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, Boca Rato, 2010.
6. Ben Halpert, "Auditing Cloud Computing – A Security and Privacy Guide", John Wiley and Sons, New Jersey, 2011.

## 15NB29 DIGITAL WATERMARKING AND STEGANOGRAPHY

3 0 0 3

**INTRODUCTION:** Watermarking, Information hiding, Importance of digital watermarking, Applications, Properties, Evaluating watermarking systems, Models of water marking, Communications, Communication based models, Geometric models, Detection by correlation. (7)

**MESSAGE CODING AND SIDE INFORMATION:** Mapping messages into message vectors, Error correction coding, Detecting multi-symbol watermarks. Informed embedding, Watermarking using side information, Dirty paper codes. (8)

**ROBUST WATERMARKING:** Approaches, Redundant embedding, Spread spectrum coding, Embedding in perceptually significant coefficients and coefficients of known robustness, Inverting distortions in the detector, Robustness to Valumetric Distortions, Temporal and geometric distortions. (7)

**WATERMARK SECURITY:** Security requirements, Watermark security and cryptography, Attacks. Content authentication: Exact authentication, Selective authentication, Localization, Restoration. (8)

**STEGANOGRAPHY:** Introduction, Importance, Applications, Properties, communication, Notation and terminology, Information theoretic foundations, Practical steganographic methods, Minimizing the embedding impact. (7)

**STEGANALYSIS:** Steganalysis scenarios, Detection, Forensic steganalysis, Influence of the cover work, Significant steganalysis algorithms, Blind steganalysis. (8)

**Total L:45**

### REFERENCES:

1. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich and Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, New York, 2010.
2. Frank Y Shih, "Digital Watermarking and Steganography: Fundamentals and Techniques", CRC Press, Boca Raton, 2012.
3. Naskar R and Chakraborty R S, "Reversible Digital Watermarking: Theory and Practices", Morgan Claypool, USA, 2014.
4. Ram Kumar and Singh Amit Asthana, "Steganography: A New Technique to Hide Information Within Image File", Lambert Academic Publishing, Germany, 2012.

## 15NB30 DISTRIBUTED SYSTEMS AND SECURITY

3 0 0 3

**INTRODUCTION:** Characteristics of distributed systems, Types of distributed system, Examples of distributed systems, Different distributed architectures, Challenges in designing distributed system, System models, Distributed computing environment. (5)

**COMMUNICATION:** Client server model, Message ordering and group communication, Remote Procedure Call (RPC): Basic operation - Parameter passing - Dynamic binding - Failures - Implementation issues - RPCs in heterogeneous environment, Remote Method Invocation (RMI). (7)

**SYNCHRONIZATION:** Clock synchronization, Physical clocks, Logical clocks, Election algorithms, Mutual exclusion, Deadlocks. (6)

**SECURITY:** Secure channels, Access control, Security management, Example: Kerberos - SESAME - Electronic payment systems. (8)

**SECURITY ENGINEERING AND TECHNOLOGIES:** Secure development lifecycle process, Security engineering process, Security requirements, Architecture and design, Secure coding and testing, Security issues, Common security technique. (9)

**THREATS AND VULNERABILITIES:** Host level: Eavesdropping - Job faults - Resource starvation - Overflow - Injection attacks, Infrastructure level: Network - Storage – Application. (10)

**Total L: 45**

### REFERENCES:

1. Sukumar Ghosh, "Distributed Systems: An Algorithmic Approach", Taylor and Francis Group, USA, 2015.
2. Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, New Delhi, 2009.

3. Abhijit Belapurkar and et al, "Distributed Systems Security: Issues, Processes and Solutions", John Wiley and Sons, UK, 2009.
4. George Coulouris and et al, "Distributed Systems Concepts and Design", Pearson Education, New Delhi, 2012.
5. Andrew S Tanenbaum and Maarten Van Steen, "Distributed Systems Principles and Paradigms", Pearson Education, New Delhi, 2008.
6. Pradeep K. Sinha, "Distributed Operating Systems: Concepts And Design", PHI Learning Private Limited, New Delhi, 2007.

## 15NB31 DATABASE DESIGN AND ITS SECURITY

**3 0 0 3**

**INTRODUCTION:** Data models, Structure of relational databases, Components of management system, Database languages, SQL standard, Database users and administrators. (7)

**RELATIONAL DBMS:** Design issues, Normal forms, Transforming E-R diagram to relations, Integrity constraints, Query processing and optimization. (8)

**TRANSACTION PROCESSING:** Transaction concept, Concurrent execution, Isolation, Serializability, Concurrency control: Lock based - Timestamp based - Validation based protocols, Multi-version schemes, Deadlock handling. (8)

**DATABASE SECURITY:** Security models, Physical and logical security, Security requirements, Reliability and integrity, Sensitive data, Inference, Multilevel databases and multilevel security: Access control - Mandatory - Discretionary, Security architecture and issues, Security of outsourced databases. (8)

**SECURITY MECHANISMS:** User Identification/Authentication, Memory Protection, Resource Protection, Control Flow Mechanisms, Isolation Security Functionalities, Trusted Computer, System Evaluation Criteria. SQL injection: SQL injection attack - web application and sql injection - prevention. (7)

**DATABASE AUDITING:** Auditing overview, environment, process, objectives, classification and types, benefits and side effects of auditing, usage of database activities, creating DLL triggers, auditing database activities with oracle. (7)

**Total L: 45**

### REFERENCES:

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2. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, 2010.
3. Ron Ben Natan, "Implementing Database Security and Auditing", Elsevier Digital Press, Burlington, 2009.
4. Hassan Afyouni A, "Database Security and Auditing: : Protecting Data Integrity and Accessibility", Cengage Learning, New Delhi, 2013.
5. Gertz ,M and Jajodia, S," Handbook of Database Security- Applications and Trends", Springer, New York, 2008.

## 15NB32 WIRELESS SECURITY

**3 0 0 3**

**INTRODUCTION:** Mobile Cellular Networks, IEEE Wireless Networks, Mobile Internet Networks. (5)

**WIRELESS THREATS:** Kinds of security breaches, Eavesdropping, Communication Jamming, Radio Frequency (RF) interference, Covert wireless channels, Denial of Service (DOS) attack, Spoofing, Theft of services, Traffic Analysis, Cryptographic threats. (7)

**WIRELESS LAN SECURITY:** Wireless transmission media, WLAN standards, Threats, Countermeasures, Wireless Transport Layer: Secure Socket Layer, Wireless Transport Layer Security, Wireless Application Protocol (WAP): Security Architecture, WAP Gateway. (8)

**SECURITY IN MOBILE NETWORKS:** 3G Security: Universal Mobile Telecommunication System (UMTS) infrastructure, UMTS security, Security in next generation mobile networks: VOIP, IP multimedia subsystem, 4G standards and security. (8)

**BLUETOOTH SECURITY:** Specifications, Piconets, Bluetooth security architecture, Scatternets, Security at the baseband layer and link layer, Frequency hopping, Security manager, Authentication, Encryption, Threats to Bluetooth security. (8)

**SECURITY IN AD-HOC AND SENSOR NETWORKS:** Ad-hoc Network applications, Routing protocols, Attacks to routing protocols, Security mechanism. Wireless Sensor Network: Attacks and countermeasures, Prevention mechanisms. (9)

**Total L: 45**

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1. Hakima Chaouchi and Maryline Laurent Maknavicius, "Wireless and Mobile Network Security", John Wiley and Sons, Inc, USA, 2009.
2. Nichols and Lekka, "Wireless Security-Models, Threats and Solutions", Tata McGraw – Hill, New Delhi, 2006.
3. Merritt Maxim and David Pollino, "Wireless Security", Osborne/McGraw Hill, New Delhi, 2005.
4. William Stallings, "Cryptography and Network Security - Principles and Practice", Prentice Hall, New Delhi, 2011.

**13NB33 SECURITY IN INTERNET OF THINGS**

**3 0 0 3**

**INTRODUCTION:** Overview, Flavor of the IOT, The "Internet" of "Things", Technology, Enchanted objects, Making of Internet of Things, Design Principles for Connected Devices (7)

**MOBILE PLATFORM:** Android security: Development and debugging - IPC mechanisms - Intent based attacks - NFC based attacks - Information leakage - Security model - Security tools, Windows mobile security: Device architecture - kernel architecture - local data storage, Web OS security. (8)

**HACKING EXPOSED WIRELESS:** 802.11 hacking: Basics - Chipsets and linux drivers - Modern chipsets and drivers - Cellular data cards - GPS, Attacking 802.11 Wireless Networks: Basic types - WEP key recovery attacks - Keystream recovery attacks against WEP, RFID security, ZIGBEE: Introduction - Layers - Rules in the design of ZigBee security - Eavesdropping attacks - Encryption attacks. (8)

**HACKING EXPOSED MOBILE:** Mobile eco system, Mobile risk model, Hacking the cellular network: Basic cellular network functionality - Attacks and countermeasures - New world of IP, iOS: Overview - Jail breaking - Hacking other iphones, Mobile malware: Android – iOS - Android vs. iOS (7)

**MOBILE SERVICES:** Bluetooth Security: Overview - Architecture - Security features - Threats to Bluetooth devices and networks - Vulnerabilities, SMS Security: Overview - MMS - Application attacks, Mobile Geo-location: Methods - Implementation – Risks (7)

**TESTING TOOLS:** Manifest explorer - Package play - Intent sniffer - Intent fuzzer - pySimReader - WML browser - User agent switcher - FoxyProxy - TamperData - Live http headers - Web developer - Firebug - Wireshark - Tcpdump - Scap - WebScarab - Gizmo (8)

**Total L:45**

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1. Himanshu Dwivedi, Chris Clark and David Thiel, "Mobile Application Security", Tata Mc Graw Hill, New Delhi, 2010.
2. Kris Jamsa, "Cloud Computing-SaaS, Paas, IaaS, Virtualization, Business Models, Mobile, Security, and More", Jones and Barlett Learning, New Delhi, 2014.
3. Johnny Cache, Joshua Wright and Vincent Liu, "Hacking Exposed Wireless: Wireless Security Secrets and Solutions", Tata McGraw Hill, New Delhi, 2010.
4. Neil Bergman, Mike Stanfield, Jason Rouse and Joel Scambray, "Hacking Exposed: Mobile Security Secrets and Solutions", McGraw Hill, New Delhi, 2013.

**ONE CREDIT COURSES**

**For the detailed syllabi of the electives and one credit courses offered by other departments refer to the syllabi of M.E- Automotive Engineering offered by Automobile Engineering Department.**