

**MANONMANIAM SUNDARANAR UNIVERSITY**  
**TIRUNELVELI-627 012, TAMILNADU, INDIA**  
**CENTRE FOR INFORMATION TECHNOLOGY AND ENGINEERING**  
**M.Phil. INFORMATION TECHNOLOGY**  
**(CBCS-Affiliated Colleges)**

For those who joined from the Academic year 2018-2019 onwards

**SCHEME OF EXAMINATION**

<b>Sem</b>	<b>Title of the Subject</b>	<b>Hrs / week</b>	<b>Credits</b>
<b>FIRST SEMESTER</b>			
I	Research and Teaching Methodology	4	4
I	Data Sciences and Big Data Analytics	4	4
I	Project Oriented Elective Course	4	4
	<b>I Semester total credits</b>		<b>12</b>
<b>SECOND SEMESTER</b>			
II	Dissertation and Viva Voce	12	12
	<b>II Semester total credits</b>		<b>12</b>
	<b>OVERALL TOAL CREDITS</b>		<b>24</b>

## RESEARCH AND TEACHING METHODOLOGY - (60 hours)

L	T	P	C
4			4

### Preamble:

This course Includes details of research process, design and methodology. The chapter starts with definitions of the key terms used in the study. This is followed by the problem statement, objectives, and hypotheses. It details with the sampling and data collection techniques including the data analysis methods. It also explains the term ‘E-recruitment’ for this study. It also explains the methods that are carried out with the help of exploratory and confirmatory factor analysis. The focus while choosing the research design and methods was to achieve the research objectives in the best possible manner within the scope of the study and limitation.

### Unit I Introduction

Meaning of research - Objective – Motivation – research approaches - significance of research - Types of Research – Research Methods versus Methodology – Research and Scientific Method – importance of knowing how research is done - Research Process – Finding a Research Advisor/Guide - The Advisor-Advisee Relationship - Finding a Topic and Beginning Research, Getting Research Ideas (12L)

### Unit-II Research Formulation

Defining and formulating the research problem – Selecting the problem – Necessity of defining the problem – Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs, patents – web as a source – searching the web- Critical literature review – Identifying gap areas from literature review – Development of working hypothesis. (12L)

### Unit-III Research design and methods

Research design Basic Principles-Need of research design – Features of good design – important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan – Exploration, Description, Diagnosis, and Experimentation, Determining experimental and sample designs. (12L)

#### **Unit-IV – Data Collection and analysis**

Execution of the research – Observation and Collection of data – Methods of data collection – Primary data – Secondary Data – Data Presentation - Mathematical Tool for Analysis – Ethics in Research – Importance – Integrity in Research Sampling Methods-Data Processing and Analysis strategies – Data Analysis with Statistical Packages – Ethics in Research - Hypothesis-testing – Scientific Misconduct and Consequences . (12L)

#### **Unit-V – Methodology of Teaching**

Teaching - Objectives of Teaching - Phases of Teaching - Teaching Methods - Lecture Method - Discussion Method - Discovery Learning - Inquiry – Problem Solving Method - Project method - Seminar - Integrating ICT in Teaching: Individualised Instruction - Ways for Effective Presentation with Power Point - Documentation- Evaluation: Formative - Summative & Continuous and Comprehensive Evaluation - Later Adolescent Psychology: Meaning - Physical -Cognitive - Emotional - Social and Moral Development - Teaching Later Adolescents. (12L)

#### **References:**

1. "Engineering Research Methodology: A Computer Science and Engineering and Information and Communication Technologies Perspective", Krishnan Nallaperumal, [https://www.researchgate.net/publication/259183120\\_Engineering\\_Research\\_Methodology\\_A\\_Computer\\_Science\\_and\\_Engineering\\_and\\_Information\\_and\\_Communication\\_Technologies\\_Perspective](https://www.researchgate.net/publication/259183120_Engineering_Research_Methodology_A_Computer_Science_and_Engineering_and_Information_and_Communication_Technologies_Perspective)
2. Kothari, C.R, 2014. *Research Methodology: Methods and Techniques*, New age International, 3rd Edition.
3. Kavadia Gerg, Agarwal & Agarwal, 2002, Introduction to *Research Methodology*, RBSA Publishers.
4. Agarwal, B.L., 2015, *Comprehensive Research Methodology*, New age International, 1<sup>st</sup> edition.
5. Mukul Gupta, Deepa Gupta, 2011, *Research Methodology*, PHI publisher
6. Sampath, K., Panneerselvam, A. & Santhanam, S. (1984). Introduction to educational technolog. (2<sup>nd</sup> revised ed.). New Delhi: Sterling Publishers.
7. Sharma, S.R.(2003). Effective classroom teaching modern methods, tools& techniques. Jaipur: Mangal Deep.
8. Vedanayagam, E.G. (1989). Teaching technology for college teachers. New York: Sterling Publishers.

## DATA SCIENCES AND BIG DATA ANALYTICS - (60 hours)

L	T	P	C
4			4

### Preamble:

This course Includes is a continuation of the principles taught in with emphasis on statistical signal processing. It will include topics on advanced digital signal and image processing(DSIP) which are used in many diFerent felDs of application. Topics include linear pre-diction and optimal \_lter design (including Weiner and Least-Squares \_lters), adaptive \_l-tering, spectral estimation, beamforming, tomography, data compression, restoration/super-resolution, etc.

### Unit I Introduction to Data Science

Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL. (12L)

### Unit II Modeling Methods and Introduction to R

Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods - Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution. (12L)

### Unit III Introduction to Big Data:

Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce. (12L)

### Unit IV Introduction Hadoop :

Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization. (12L)

## Unit- V Hadoop Architecture :

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance. (12L)

## REFERENCES

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.
2. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014.
3. Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley & Sons, Inc., 2012. 4. W. N. Venables, D. M. Smith and the R Core Team, “An Introduction to R”, 2013.
4. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, “Practical Data Science Cookbook”, Packt Publishing Ltd., 2014.
5. Nathan Yau, “Visualize This: The FlowingData Guide to Design, Visualization, and Statistics”, Wiley, 2011.
6. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
7. [http://www.johndcook.com/R\\_language\\_for\\_programmers.html](http://www.johndcook.com/R_language_for_programmers.html)
8. <http://bigdatauniversity.com/>
9. <http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction>.
10. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
11. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.
12. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012.
13. Vignesh Prajapati, “Big Data Analytics with R and Haoop”, Packet Publishing 2013.
14. Tom Plunkett, Brian Macdonald et al, “Oracle Big Data Handbook”, Oracle Press, 2014.
15. <http://www.bigdatauniversity.com/>
16. Jy Liebowitz, “Big Data and Business analytics”,CRC press, 2013.

<b>SL.NO.</b>	<b>TITLE OF THE SUBJECT</b>
	<b>LIST OF PROJECT ORIENTED ELECTIVES (Group A)</b>
1.	Advanced Digital Signal and Image Processing
2.	Pattern Recognition and Image Analysis
3.	Artificial Neural Networks
4.	Fuzzy Logic and Engineering Applications
5.	Data Compression
6.	Robotics
7.	Modern Communication System
8.	Network Design
9.	High Performance Computing Networks
10.	Pervasive, Grid and Cloud Computing
11.	Mobile and Cellular Computing
12.	Network Programming
13.	Network Security

## GROUP A: SUBJECTS FOR ELECTIVES (60 hours)

### ADVANCED DIGITAL SIGNAL AND IMAGE PROCESSING

L	T	P	C
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#### Preamble:

This course includes details of research process. It will include topics on advanced digital signal and image processing (DSIP) which are used in many different fields of application. Topics include linear prediction and optimal filter design (including Wiener and Least-Squares Filters), adaptive filtering, spectral estimation, beamforming, tomography, data compression, restoration/super resolution, etc

#### UNIT I INTRODUCTION

Signals and signal Processing, characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signals Processing applications. Time Domain Representation of Signals & Systems- Discrete Time Signals, Operations on Sequences, Linear shift-invariant systems, Stability and Causality, Linear constant coefficient difference equations, Frequency domain representation of discrete-time systems, symmetry properties of the Fourier transform, Sampling of continuous-time systems. Z-transforms, Discrete Fourier Transform (DFT) & its properties, computation of the DFT of real sequences (10L)

#### UNIT II Digital Image Fundamentals:

Fundamental steps in Image Processing –Components of Image Processing System- Image Sampling and Quantization-Basic Relationships between Pixels. Image Enhancement in Spatial Domain: Basic Gray level Transformations-Histogram Processing- Enhancements using Arithmetic/logic Operations-Basics of Special Filtering-Smoothing Filters-Sharpener Filters. (13L)

#### UNIT III Image Enhancements in the Frequency domain

Smoothing Filters-Sharpener Filters-Homomorphic Filters - Image Restoration: Degradation model –Noise Models-Restoration in the presence of Noise- Wiener Filter. Color Image Processing : Color Fundamentals-Color Models-Basics of full Color image Processing-Color Transformations. (11L)

#### **UNIT IV Wavelets and Multi-resolution Processing:**

Image Pyramids and Sub band Coding – Wavelet Transform in one dimension- FWT. Image Compressions: Fundamentals – Image Compression models – Elements of Information Theory – Error – Free Compression – Lossy compression – Image Compression standards. (12L)

#### **UNIT V Image segmentation**

Detection of discontinuities – Edge linking and Boundary detection –Thresholding – Region Orientation Segmentation – use of motion in segmentation. Morphological Image Processing: Basic Binary morphological Operations. Basic grayscale morphological Operations. Representation and Description: Representation-Boundary Descriptors. (14L)

**Total(60L)**

#### **References:**

1. Refael C. Gonzalez & Richard E. Woods - Digital Image Processing, Addison Wesley publication corporation, 2008
2. Image Processing Analysis, and Machine Vision, Milan Sonka,
3. Alan V. Oppenheim & Ronald W. Schafer, “ Digital Signal Processing” PHI, 2002
4. Sanjit K. Mitra, “ Digital Signal Processing: A computer based approach” TMH, Second Edition, 2003.



## PATTERN RECOGNITION AND IMAGE ANALYSIS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>			<b>4</b>

### **Preamble:**

This course Includes details Computer vision techniques use the results and methods of mathematics, pattern recognition, artificial intelligence, psychophysiology, computer science and electronics to analyze pictures or digital images. The detection methods aim to find the most important visual properties or features of an object that make it distinguishable from others.

### **UNIT I Introduction:**

Machine perception, pattern recognition example, pattern Recognition systems, the design cycle, learning and adaptation - Bayesian Decision Theory: Introduction, continuous features – two categories classifications, minimum error-rate classification-zero-one loss function, classifiers, discriminant functions, and decision surfaces. (12L)

### **UNIT II Normal density**

Univariate and multivariate density, discriminant functions for the normal density-different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case. (12L)

### **UNIT III Un- supervised learning and clustering:**

Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Data description and clustering – similarity measures, criteria function for clustering - Pattern recognition using discrete hidden Markov models - Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, types of HMMs. (12L)

### **UNIT IV Continuous hidden Markov models:**

Continuous observation densities, multiple mixtures per state, speech recognition applications - Digital image models, sampling and quantization, basic relationships between pixels, image geometry. Image enhancement: Back ground, enhancement by point processing histogram processing, spatial filtering, introduction to image transforms, image enhancement in frequency domain. (10L)

## **UNIT V Image Segmentation and Edge Detection:**

Region Operations, Crack Edge Detection, Edge Following, Gradient operators, Compass and Laplace operators. Threshold detection methods, optimal thresholding, multispectral thresholding, thresholding in hierarchical data structures; edge based image segmentation- edge image thresholding, edge relaxation, border tracing, border detection, image morphology, image security. (14L)

**Total (60L)**

### **Text Books:**

1. Richard O. Duda, Peter E. Hart, David G. Stroke, Pattern Classifications, Wiley.
2. Lawrence Rabiner, Biing – Hwang Juang Fundamentals of Speech Recognition, Pearson
3. Gonzalez R.C & Woods R.E., Digital Image Processing, Addison Wesley, 1992.

### **Reference Books**

1. Jain A.K., Fundamentals of Digital Image Processing, Prentice Hall of India.
2. Reddy M.Anji, Digital Image Processing, BS Publications.

## ARTIFICIAL NEURAL NETWORKS`

L	T	P	C
4			4

### Preamble:

This course Includes the most influential development in the field of Neural networks during the last decades The back propagation procedure has been used extensively in the fields of pattern recognition, signal processing, system Modeling and stem identification where intas shown excellent performance.

### UNIT – I:

**Introduction to Neural Networks:** Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. (13L)

### UNIT- II:

**Essentials of Artificial Neural Networks:** Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules. Single Layer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model. (12L)

### UNIT- III:

**Multilayer feed forward Neural Networks:** Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements. Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function. (11L)

**UNIT IV:**

**Architecture of Hopfield Network:** Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Classical & Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. (10L)

**UNIT V:**

Fuzzy Logic System Components Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Applications Neural network applications: Process identification, control, fault diagnosis. Fuzzy logic applications: Fuzzy logic control and Fuzzy classification. (14L)

Total(60L)

**TEXT BOOK:**

1. S. Rajasekharan and G. A. Vijayalakshmpai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
2. John Yen and Reza Langan, "Fuzzy Logic: Intelligence, Control and Information", Pearson Education,2004.

**REFERENCE BOOKS:**

1. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2001.
2. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TMH, 2006.
3. James A Freeman and Davis Skapura, Neural Networks Pearson Education, 2002.
4. Timothy J. Ross, " Fuzzy Logic With Engineering Applications", McGraw-Hill Inc. 1997.

## FUZZY LOGIC AND ENGINEERING APPLICATIONS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>			<b>4</b>

### **Preamble:**

This course Includes used in numerous applications such as facial pattern recognition, air conditioners, washing machines, vacuum cleaners, antiskid braking systems, transmission systems, control of subway systems and unmanned helicopters, knowledge-based systems for multiobjective optimization of power systems.

### **UNIT I Introduction:**

background- uncertainty and imprecision-statistics and random processes-uncertainty in information-fuzzy sets and membership –chance versus ambiguity - Classical sets and fuzzy sets:- classical sets- operations on classical sets –properties of classical (crisp) sets – mapping of classical sets to functions fuzzy sets- fuzzy set operations-properties of fuzzy sets sets as points in hypercubes. (13L)

### **UNIT II Fuzzy to crisp conversions:**

lambda-cuts for fuzzy sets-lambdas-cuts for fuzzy relations-defuzzification methods. Fuzzy arithmetic, numbers, vectors and the extension principle:-extension principle crisp functions, mapping and relations functions of fuzzy sets –extension principle fuzzy transform-practical considerations fuzzy numbers- interval analysis in arithmetic –approximate methods of extension –vertex method –DSW algorithm –restricted DSW algorithm comparisons-fuzzy vectors. (14L)

### **UNIT III Classical logic and fuzzy logic:-**

classical predicate logic –tautologies –contradictions-equivalence-exclusion Or an exclusive Nor –logical proofs –deductive inferences fuzzy logic- approximate reasoning –fuzzy tautologies, contradictions equivalence and logical proofs-others forms of the implication operation-other forms of the composition operation. Fuzzy rule based systems: natural languages-linguistic hedges- rule based systems canonical rule forms- decomposition of compound rules –likelihood and truth qualification- aggregic of fuzzy rules –graphical techniques of inference. (12L)

**UNIT IV Fuzzy nonlinear simulation:**

fuzzy relational equations-partitioning-nonlinear simulation using fuzzy rule based systems – fuzzy associative memories (FAMs) - Fuzzy decision making: fuzzy synthetic evaluation –fuzzy ordering –preference and consensus-multi objective decision making-fuzzy Bayesian decision method-decision making under fuzzy states and fuzzy actions. (11L)

**UNIT V Fuzzy classification:**

Classification by equivalence relations –crisp relations-fuzzy - elations-clusters analysis-cluster validity-c-means clustering –hard c-means(HCM)-fuzzy c-means (FCM)-classification metric-hardening the fuzzy c-partition-similarity relations from clustering - Fuzzy pattern recognition:- features analysis-partitions of the features space-single sample identification0multifeature pattern recognition –image processing-syntatic recognition –formal grammar-fuzzy grammar and syntactic recognition. (10L)

Total(60L)

**Text Book:**

Fuzzy logic and Engineering applications – Timothy J.Ross,2009.

## **DATA COMPRESSION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>			<b>4</b>

### **Preamble:**

This course aims to introduce you to the main issues in data compression and common compression techniques for text, audio, image and video data and to show you the significance of some compression technologies outline important issues in data compression describe a variety of data compression techniques explain the techniques for compression of binary programmes, data, sound and image describe elementary techniques for modelling data and the issues relating to modelling.

### **UNIT I INTRODUCTION**

Types of data redundancies, Concepts of Information theory, Shannon's 1st Theorem, Importance of Multi-resolution Analysis, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform- Implementation and Importance. (14L)

### **UNIT II Compression**

Lossless - Run length coding, Huffman Coding, Applications of Huffman Coding for Text and Audio Compression, Arithmetic Coding, Comparison of Huffman and Arithmetic Coding, Binary and Arithmetic Coding (13L)

### **UNIT III Dictionary techniques**

Static Dictionary, Adaptive Dictionary, LZ coding approaches, Applications of LZ approaches for File and Image Compression. Context based techniques- Prediction with Partial Match, Move to Front Coding based on Burrows Wheeler Transform. (12L)

### **UNIT IV Quantization techniques**

Scalar Quantization, Forward and Backward Adaptive Quantization, Vector Quantization, Advantages of Vector Quantization over Scalar Quantization, The LBG algorithm (11L)

### **UNIT V Lossy Compression**

Lossy Compression and Compression Standards- Lossy predictive coding, Transform Coding, Wavelet coding, JPEG, MPEG4. (10L)

Total(60L)

## **REFERENCES**

1. Introduction to Data Compression, Fourth Edition, Khalid Sayood,2011
2. Anil K. Jain: Fundamentals of Digital Image Processing, Prentice Hall, 1989.
3. Rafael C.Gonzalez and Richard E. Woods: Digital Image Processing, Addison-Wesley, 1992
4. <http://tcs.rwth-aachen.de/lehre/Komprimierung/SS2012/ausarbeitungen/H264-PEG4.pdf>



## ROBOTICS

L	T	P	C
4			4

### **Preamble:**

This course aims Learning to program a computer is an excellent skill to have to make students more likely to get a job in the future, and earn more money in their lifetime Increases Creativity Prepare them for the future Teaching Children How to Turn Frustration into Innovation. Promoting Inclusivity.

### **UNIT-I:**

Introduction: Definition, Classification of Robots, geometric classification and control classification. Robot Elements: Drive system, control system, sensors, end effectors, gripper actuators and gripper design. (14L)

### **UNIT-II:**

Robot Coordinate Systems and Manipulator Kinematics: Robot co-ordinate system representation, transformation, homogenous transform and its inverse, relating the robot to its world. (12L)

### **UNIT-III:**

Manipulators Kinematics, parameters of links and joints, kinematic chains, dynamics of kinematic chains, trajectory planning and control, advanced techniques of kinematics and dynamics of mechanical systems, parallel actuated and closed loop manipulators. (11L)

### **UNIT-IV:**

Robot Control: Fundamental principles, classification, position, path velocity and force control systems, computed torque control, adaptive control, Seroo system for robot control, and introduction to robot vision. (10L)

### **UNIT-V:**

Robot Programming: Level of robot programming, language based programming, task level programming, robot programming synthesis, robot programming for welding, machine tools, material handling, assembly operations, collision free motion planning. Applications: Application of robot in welding, machine tools, material handling, assembly operations parts sorting and parts inspection. (13L)

Total(60L)

**TEXT/REFERENCE BOOKS:**

1. CoifetChirroza, "An Introduction to Robot Technology" Kogan Page.
2. Y. Koren "Robotics for Engineers" Mcgraw Hill.
3. K. S. Fu, R.C. Gonzalez Y& CSG Lee, "Robotics" McGraw Hill.
4. J.J. Craig, "Robotics" Addison-Wesley.
5. Grover, Mitchell Weiss, Nagel Octrey, "Industrial Robots" Mcgraw Hill.
6. Asfahl, "Robots & Manufacturing Automation" Wily Eastern.

## MODERN COMMUNICATION SYSTEM

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>			<b>4</b>

### **Preamble**

This course aims modern methods of communication have amplified the values of society, because they are useful for everyday life and offer more benefits than detriments for it. This can be argued by demonstrating three aspects of modern methods of communication in how they advance educational opportunities, how medical science has been encouraged and how mobile phones allow instant connection worldwide

### **UNIT-I: Network Evolution**

The ISDN – The Basic Rate ISDN customer's Interface: The customer's Installation layer 1, 2, 3. Primary rate ISDN access: background – signaling –evaluation of PABX signaling – International standards for inter –PABX signaling. (10L)

### **UNIT-II: Frame mode services:**

Store and Forward Switching – Data grams and Virtual Circuits - Flow and Congestion Control – New ISDN Frame mode Services – Frame Format. ISDN Customer premises Equipment and Applications: High quality speech – Music coding FACSIMILE – Photographs Video tex – Video – Audio Visual services and Embedded – Customer premises Equipment. (12L)

### **UNIT-III: ATM Network concepts and Architecture:**

ATM's position in the OSI Reference Model – B-ISDN protocol reference model – ATM functions and layers – ATM signaling principles – The ATM layer – ATM switching principles. (12L)

### **UNIT-IV: Modern Communication:**

Fundamentals of Information Handling – Information media as viewed from the Human Interface – Various facets of modern Communication systems – Composition of Modern Communication systems. (12L)

## **UNIT-V: Components of modern Communication systems:**

Home systems – Home system image – Home systems and their service Trends – Access systems for Home systems. Business Communications: Basic structure of the Office system in a single office / Plant – Basic Structure of the Office system connected to WAN's. The general structure of the office system – Actual Composition of CAN and WAN. Mobile Communication in the information society- Technical Background of Mobile Communication various Mobile Communications services – Positioning of VAN – Classification by service operation mode – Classification of VAN purpose – Classification of specific Industry service type VAN's from the added value viewpoint – New Electronic Media. Construction of Global Infrastructure: Satellite Communications systems – TV Broadcasting – Approaches to meeting new goals – Possibilities of new Broadcasting forms – Information service center systems – Automatic Interpretation telephone systems – Teleconferencing systems. (14L)

**Total(60L)**

### **TEXT BOOKS:**

1. “ISDN Explained” John M.Griffiths 2<sup>nd</sup> Edition March 1995 John Willey & sons. (Unit I & Unit II)
2. “Introduction to ATM Networking” Walter J. Goralski J. McGraw Hill Inc. (Unit III)
3. “Computers and communications” Koji Kobayashi the MID Press 1986. (A version of c and C). (Unit IV & Unit V)

## NETWORK DESIGN

L	T	P	C
4			4

### Preamble:

This course aims Network planning and design. Network planning and design is an iterative process, encompassing topological design, network-synthesis, and network-realization, and is aimed at ensuring that a new telecommunications network or service meets the needs of the subscriber and operator.

### UNIT-I:

Essentials of Probability - Probability on a Sample Space, Basic Operations on Events, Probability on Events, Other Properties, Conditional Probability, Bayes Formula, Independence, Random Variables, Random Variable as a Measurement, Probability Mass Function for a Random Variable, Cumulative Distribution Function, PMF and CDF for the 3 CoinToss Example, Expectation of a Random Variable, Important Random Variables, Bernoulli Random Variable, Binomial Random Variable, Geometric Random Variable, Poisson Random Variable, Continuous-valued Random Variables, Properties of Continuous Random Variables, Expectation of a Continuous Random Variable, Important Continuous Random Variable: Exponential, Memory less Property of the Exponential. **(10L)**

### UNIT-II:

Delay Models in Data Networks Multiplexing of Traffic on a Communication Link, Queuing Models- Little's Theorem, Little's Theorem, Probabilistic Form of Little's Theorem, Application of Little's Theorem, The M/M/1 Queuing System, Arrival Statistics, Service Statistics, Markov Chain Formulation, Deviation of the Stationary Distribution, Occupancy Distribution upon Arrival, Occupancy Distribution upon Departure, The M/M/m, M/M/ $\mu$ , M/M/m/m, AND Other Markov Systems, The M/M/m: The m-Server Case, M/M/ $\mu$ : The Infinite-Server Case, M/M/m/m: The m-Server Loss System, multidimensional Markov Chains- Applications in Circuit Switching, The M/G/1 System, M/G/1 Queues with Vacations, Reservations and Polling, Priority Queuing. **(12L)**

### UNIT-III:

Inside an IMP Queuing in the Network Layer at an IMP, Basic Single Queue Model, Applications of Queuing Analysis Outside of Networking, The Poisson Arrival Model, Properties of a Poisson Process, Inter arrival Times of a Poisson Process, The M/M/1 Queue, Aside: Queuing Notation, Aside: The D/D/1 Queue, State Analysis of an M/M/1

Queue, Balance Equations , Solving the Balance Equations, The Finite Buffer Case: M/M/1/N, Blocking Probability and the Right Size Buffer, Throughput in the Finite Buffer Case, Approximation of a Finite Buffer System by the Infinite Buffer Model, Little's Formula and Queuing Delay, Applying Little's Formula to an M/M/1 Queue, Applying the M/M/1 Results to a Single Network Link, Other Queuing Models. (14L)

**UNIT-IV:**

Network Design - Problem definition: Multipoint line layout heuristics, CMST algorithm, ESAUWilliam's algorithm, Sharma's algorithm, Unified algorithm, Bin packing, Terminal assignments, Concentrator location. (13L)

**UNIT-V:**

Network Analysis: Queuing Networks, Closed Queuing Network Example, Nodes in a Packet Switched Network (PSN), Queuing Network Model of Nodes in a PSN, Queuing Network Analysis of a PSN, performance analysis of Data Link Layer, Network layer, QoS, Network Administration: Functions and responsibilities, Network planning and implementation, Sub-netting, Bandwidth management, security issues, Tools for BW and security management, modifying network implementation. (11L)

Total(60L)

**REFERENCES:**

1. Kershenbaum A., "Telecommunication Network Design Algorithms", Tata McGraw Hill.
2. Keshav S., "An Engineering Approach to Computer Networking," Addison-Wesley,1997.
3. Bertsekas D. and Gallager R., "Data Networks,"2nd Ed., Prentice-Hall, Englewood Cliffs, N.J., 1992.
4. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill
5. Stallings W., "High Speed Networks and Internet : Performance and Quality of Service", Prentice-Hall.
6. Zacker, "Networking – The Complete Reference", Tata McGraw Hill

## HIGHPERFORMANCE COMPUTING NETWORKS

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>			<b>4</b>

### **Preamble:**

This course aims modern methods of communication have amplified the values of society, because they are useful for everyday life and offer more benefits than detriments for it. This can be argued by demonstrating three aspects of modern methods of communication in how they advance educational opportunities, how medical science has been encouraged and how mobile phones allow instant connection worldwide.

### **UNIT I - HIGH SPEED NETWORKS**

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL. High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11 (14L)

### **UNIT II - WDM OPTICAL NETWORKS**

Introduction to Optical Networks – Wavelength Division Multiplexing (WDM) – Introduction to broadcast and select networks – switch architectures – channel accessing – Wavelength routed networks – switch architectures – Routing and wavelength assignment – Virtual topology design – IP over ATM over WDM – IP over WDM. (13L)

### **UNIT III - TCP, ATM CONGESTION CONTROL AND TRAFFIC MANAGEMENT**

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control. TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management. (12L)

## **UNIT IV INTEGRATED AND DIFFERENTIATED SERVICES**

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services. **(11L)**

## **UNIT V - PROTOCOLS FOR QOS SUPPORT**

RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP. **(10L)**

Total(60L)

## **TEXT BOOK**

1. William Stallings, “HIGH SPEED NETWORKS AND INTERNET”, Pearson Education, Second Edition, 2002.

## **REFERENCES**

1. Warland& Pravin Varaiya, “HIGH PERFORMANCE COMMUNICATION NETWORKS”, Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. IrvanPepelnjk, Jim Guichard and Jeff Apar, “MPLS and VPN architecture”, Cisco Press, Volume 1 and 2, 2003
3. C. Siva Ram Murthy and Mohan Gurusamy, “WDM Optical Networks: Concepts, Design and Algorithms”, Prentice-Hall of India, 2002. (UNITs IV & V)
4. Fred Halsall, “Multimedia Communications – Applications, Networks, Protocols”, Pearson Edition, 2001. (UNIT V)



## PERVASIVE, GRID AND CLOUD COMPUTING

L	T	P	C
4			4

### Preamble

This course aims Pervasive PSQL is an ACID-compliant database management system (DBMS) developed by Pervasive Software. Cloud computing has been credited with increasing competitiveness through cost reduction, greater flexibility, elasticity and optimal resource utilization.

### UNIT-I INTRODUCTION

Pervasive Computing Infrastructure-Applications-Device Technology- Hardware, Human-Machine Interfaces, Biometrics, And Operating Systems- Device Connectivity- Protocols, Security , And Device Management-Pervasive Web Application Architecture-Access From PCs And PDAs- Access Via WAP (14L)

### UNIT-II Grids and Grid Technologies

Grids and Grid Technologies, Programming models - A Look at a Grid Enabled Server and Parallelization Techniques – Grid applications- Grid architecture – Grid architecture and relationship to other Distributed Technologies – computational and data Grids, semantic grids (13L)

### UNIT – III: Grid Management systems

Grid Management systems, security, Grid Grid-Enabling software and Grid enabling network services, Data Grid - Virtualization Services for Data Grids, Peer-to-Peer Grids - Peer-to-Peer Grid Databases for Web Service Discovery and application execution. (10L)

### UNIT-IV: Introduction to Cloud Computing

Introduction to Cloud Computing- Definition, Characteristics, Components- Cloud provider- Administering & Monitoring cloud services-benefits and limitations- Deploy application over cloud- Introduction to Cloud Technologies: SOAP, Webservices, AJAX and mashups, Virtualization Technology, Multitenant software. (13L)

## **UNIT-V: Cloud Relational databases**

Cloud Relational databases- Cloud file systems- Cloud computing security architecture- Cloud computing security challenges- Issues in cloud computing- Cloud Middleware- Mobile Cloud Computing- Inter Cloud issues. **(10L)**

Total(60L)

### **TEXT BOOK:**

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
2. Enterprise Cloud Computing by GautamShroff,Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4. Jochen Burkhardt, pervasive computing: Technology and Architecture of Mobile Internet Applications, Addison-Wesley Professional; 3<sup>rd</sup> edition, 2007

### **REFERENCES:**

1. Fran Bernm, Geoffrey Fox, Anthony Hey J.G., "Grid Computing: Making the Global Infrastructure a Reality", Wiley, USA, 2003.
2. Joshy Joseph, Craig Fallenstein, "Grid Computing", Pearson Education, New Delhi, 2004.
3. Ian Foster, Carl Kesselman, "The Grid2: Blueprint for a New Computing Infrastructure". Morgan Kaufman, New Delhi, 2004.
4. Ahmar Abbas, "Grid Computing: Practical Guide to Technology andApplications", Delmar Thomson Learning, USA, 2004.

## MOBILE AND CELLULAR COMPUTING

L	T	P	C
4			4

### Preamble:

This course aims most common example of a **cellular** network is a **mobile phone (cell phone)** network. **Cell**-sites and handsets change frequency are under **computer** control and use low power transmitters so that the usually limited number of radio frequencies can be simultaneously **used** by many callers with less interference.

### UNIT I WIRELESS COMMUNICATION FUNDAMENTALS

Introduction - Wireless transmission - Frequencies for radio transmission - Signals - Antennas - Signal Propagation - Multiplexing - Modulations - Spread spectrum - MAC - SDMA - FDMA - TDMA - CDMA - Cellular Wireless Networks. (14L)

### UNIT II TELECOMMUNICATION NETWORKS

Telecommunication systems - GSM - GPRS - DECT - Satellite Networks - Basics - Parameters and Configurations - Capacity Allocation - FAMA and DAMA - Broadcast Systems - DAB - DVB. (12L)

### UNIT III WIRELESS LAN

Wireless LAN - IEEE 802.11 - Architecture - services - MAC - Physical layer - IEEE 802.11a - HIPERLAN - Blue Tooth. (13L)

### UNIT IV MOBILE NETWORK LAYER

Mobile IP - Dynamic Host Configuration Protocol - Routing - DSDV - DSR - Alternative Metrics. (11L)

### UNIT V TRANSPORT AND APPLICATION LAYERS

Traditional TCP - Classical TCP improvements - WAP- Introduction to 4G mobile networks- Case study - Mobile multimedia networks. (10L)

**Total(60L)**

### **Text Books**

1. Jochen Schiller, “Mobile Communications”, PHI/Pearson Education, Second Edition, 2003.
2. William Stallings, “Wireless Communications and Networks”, PHI/Pearson Education, 2002.
3. Mobile cellular Telecommunications – W.C.Y.LEE, TMH, 2nd Edition, 2006.
4. Principles of mobile Communications – Gordon L. Stuber, Springer International, 2nd edition, 2007.
5. Wireless Communications – T.S.Rapport, Pearson Education, 2nd edition, 2002.

### **Reference Books**

1. Wireless mobile Communications – Lee, McGrahill, 3rd Edition, 2006.
2. Wireless Communication and networking – J.W.Mark and WeihulaZhqung, PHI, 2005.
3. Wireless Communication Technology, R.Blake, Thompson Asia, Pvt Ltd, 2004.
4. Jochen Schiller, “Mobile Communications”, PHI/Pearson Education, Second Edition, 2003.
5. William Stallings, “Wireless Communications and Networks”, PHI/Pearson Education, 2002.
6. KavehPahlavan, PrasanthKrishnamoorthy, “Principles of Wireless Networks”, PHI/Pearson Education, 2003.
7. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, New York, 2003.
8. HazysztofWesolowshi, “Mobile Communication Systems”, John Wiley and Sons Ltd, 2002.

## NETWORK PROGRAMMING

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>			<b>4</b>

### Preamble

Socket **programming** (at least as the term is normally used) is **programming** to one specific **network** API. Sockets support IP-based protocols (primarily TCP and UDP)<sup>1</sup>. **Network programming** can be done using various other APIs.

### Unit I Introduction

Introduction to Systems Programming: Files, System Files, File Formats, Buffered I/O, Directories, File System, Inodes, links, fcntl, links, locks, Device I/O, Terminal I/O, ioctl(), Files and Devices ,Signals, video I/O ,Multi-Tasking (13L)

### Unit II Processes and Inter-Process

Processes and Inter-Process Communication: timers, polling vs interrupts, environment, fork, exec, wait, environment, exit and wait, pipe, fifos, message queues, semaphore (14L)

### Unit III Network Programming:

Network Programming: Sockets, Operation, Socket types, Domains Name Binding, using Sockets, I/O Multiplexing, Client/Server Models, Connection Based Services, (11L)

### Unit IV Handling out of Band Data

Handling out of Band Data, Connectionless Services, Design issues of Concurrent and Iterative servers, Socket options (12L)

### Unit V XDR and Remote

XDR and Remote Procedure Calls, Network Programming at the level of Programming Language (can use Java or Python as case study) (10L)

Total (60L)

### TEXT BOOK:

1. Unix Network Programming, W. Richard Stevens, Prentice Hall, 1998

### REFERENCES:

1. Internetworking with TCP/IP, Volume3, Douglas Comer, Prentice Hall, 2000
2. Internetworking with TCP/IP, Volume1, Douglas Comer, Prentice Hall, 2000

## NETWORK SECURITY

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>			<b>4</b>

### **Preamble**

Network security is any activity designed to protect the usability and integrity of your network and data. It includes both hardware and software technologies. Effective network security manages access to the network

### **Unit I Introduction:**

Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST -128, RC2, Characteristics of Advanced Symmetric block ciphers. (11L)

### **Unit II Conventional Encryption:**

Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation. Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography. (10L)

### **Unit III Number theory:**

Number theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's - Theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, discrete logarithms. Message authentication and Hash functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. (12L)

### **Unit IV Hash and Mac Algorithms:**

Hash and Mac Algorithms: MD File, Message digests Algorithm, Secure Hash Algorithm, RIPEMD- 160, and HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, X.509 directory Authentication service, Electronic Mail Security: Pretty Good Privacy, S/MIME. (13L)

## **Unit V IP Security:**

IP Security: Over view, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management, Web Security: Web Security requirements, secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats, Fire Walls: Fire wall Design Principles, Trusted systems.

(14L)

Total (60L)

### **Text Books**

1. William Stallings, Cryptography & Network Security: Principles and Practice, Pearson.
2. Stallings William, Network Security Essentials (Applications and Standards), Pearson Education.

### **Reference Books**

1. Maiwald Eric, Fundamentals of Network Security, Dreamtech.
2. Char lie Kaufman, Radia Perlman & Mike Speciner, Network Security - Private Communication in a Public World, Pearson/PHI.
3. Whitman, Principles of Information Security, Thomson

## **Major Project      DISSERTATION AND VIVA VOCE**

Objective of this course is to facilitate transfer of knowledge acquired by a student to a field of his chosen specialization for application to solving a problem. The Co-ordinator of Students' Project works from the department shall coordinate this course. Student is expected to collect and study relevant material under mentorship of a Project Supervisor, identify a suitable problem and propose methodology towards its solution. Alternately a student can explore hardware / software implementation of existing solution(s).

The student will be tested for his understanding of basic principles of the core Specializations. The internal assessment will be made by Project Supervisor. The Project Supervisor will conduct three reviews in each level of progress. On completion of the work, a thesis report should be prepared in the prescribed format and submitted to the department. The end-semester university examination, will have a thesis presentation and Viva-Voce examination conducted by a committee of one external examiner and one internal examiner appointed by the HOD/Professor/ Co-ordinator of Students' Project works.