SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: CORE

SUBJECT CODE: MTDC 11

SUBJECT NAME: ADVANCED DIGITAL SIGNAL PROCESSING

60 HRS

COURSE OBJECTIVES:

At the completion of this course, the student should have in depth knowledge of processing digital signals.

UNIT I (10 HRS)

Overview of DSP, Characterization in time and frequency, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR.

UNIT II (10 HRS)

Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in sub-band coding.

UNIT III (10 HRS)

Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

UNIT IV (10 HRS)

Adaptive Filters, Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm

UNIT V (10 HRS)

Estimation of Spectra from Finite-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum-Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation.

UNIT VI (10 HRS)

Application of DSP & Multi rate DSP, Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications

COURSE OUTCOMES:-

After the successful completion of the course, student should be able to:

1. Know the analysis of discrete time signals.

2. To study the modern digital signal processing algorithms and applications.

3. Have an in-depth knowledge of use of digital systems in real time applications

4. Apply the algorithms for wide area of recent applications.

REFERENCES:

1. J.G.Proakis and D.G.Manolakis"Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.
2. N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks –
3. Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.
4. Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997.
5. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.
6. S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.

7. D.G.Manolakis, V.K. Ingle and S.M.Kogon, “Statistical and Adaptive Signal Processing”, McGraw Hill, 2000.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: CORE

SUBJECT CODE: MTDC 12

SUBJECT NAME: DIGITAL IMAGES AND VIDEO PROCESSING

60 HRS

COURSE OBJECTIVES:

Beyond the obvious applications in entertainment and scientific visualization, digital images and video have become a central component of net-centered computing, human/computer interfaces, and databases, as well as data analysis for domains such as biometrics, surveillance and remote sensing. This course offers fundamentals of digital image and video processing and algorithms for most of the work currently underway in this field. Through this course, students will get a clear impression of the breadth and practical scope of digital image and video processing and develop conceptual understanding which will enable them to undertake further study, research and/or implementation work in this area.

UNIT I (10 HRS)

Digital Image and Video Fundamentals

Digital image and video fundamentals and formats, 2-D and 3-D sampling and aliasing, 2-D/3-D filtering, image decimation/interpolation, video sampling and interpolation, Basic image processing operations, Image Transforms Need for image transforms, DFT, DCT, Walsh, Hadamard transform, Haar transform, Wavelet transform.

UNIT II (10 HRS)

Image and Video Enhancement and Restoration

Histogram, Point processing, filtering, image restoration, algorithms for 2-D motion estimation, change detection, motion-compensated filtering, frame rate conversion, deinterlacing, video resolution enhancement, Image and Video restoration (recovery).

UNIT III (10 HRS)

Image and Video Segmentation

Discontinuity based segmentation- Line detection, edge detection, thresholding, Region based segmentation, Scene Change Detection, Spatiotemporal Change Detection, Motion Segmentation, Simultaneous Motion Estimation and Segmentation Semantic Video Object Segmentation, Morphological image processing.

UNIT IV (10 HRS)

Colour image Processing

Colour fundamentals, Colour models, Conversion of colour models, Pseudo colour image processing, Full colour processing

UNIT V (10 HRS)

Image and Video Compression

Lossless image compression including entropy coding, lossy image compression, video compression techniques, and international standards for image and video compression (JPEG, JPEG 2000, MPEG-2/4, H.264, SVC), Video Quality Assessment

UNIT VI (10 HRS)

Object recognition

Image Feature representation and description-boundary representation, boundary descriptors, regional descriptors, feature selection techniques, introduction to classification, supervised and unsupervised learning, Template matching, Bayes classifier.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Describe the fundamentals of image and video processing and their applications

2. Develop familiarity and implement basic image and video processing algorithms.
3. Select and apply appropriate technique to real problems in image and video analysis.

REFERENCES:

1. Ed. Al Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic Press, 2000.
2. J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding",2nd Edition, Academic Press, 2011.
3. Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.
4. A. M. Tekalp, "Digital Video Processing", 2nd Edition, Prentice Hall, 2015.
5. S. Shridhar, "Digital Image Processing", 2nd Edition, Oxford University Press, 2016.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: CORE

SUBJECT CODE: MTDC 13

SUBJECT NAME: REASEARCH METHODOLOGY AND IPR

60HRS

COURSE OBJECTIVES:

To explain various research designs and their characteristics. Methods of data collections. To explain several parametric tests of hypotheses and Chi-square test. To explain the art of interpretation and the art of writing research reports.

UNIT I (12 HRS)

Foundations of Research: Meaning, Objectives, Motivation, Utility. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable, Research process, Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance

Assignment 1: Identify Research Problem based on Trends

UNIT II (12 HRS)

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

Assignment 2: Identify Research methodology for Research Problem identified

UNIT III (12 HRS)

Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

Assignment3: Propose a method for Data Analysis on Research problem identified

UNIT IV(12 HRS)

Importance of Literature Review. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.

Assignment 4: Write paper on Literature Review of your research Problem

UNIT V (12 HRS)

Use of tools / techniques for Research: methods to search required information effectively, REFERENCE Management Software like Zotero/Mendeley, Software for paper formatting like Latex/MS Office, Software for detection of Plagiarism. Documentation of Research work, Synopsis, Presentations, Writing Research papers on experimentation results, proposed methods, thesis formats

Assignment 5: Write Synopsis for proposed Research Problem

COURSE OUTCOMES:-

1: Understand the research problem and research process.

2: Understand research ethics.

3: Prepare a well-structured research paper and scientific presentations

4: Explore on various IPR components and process of filing.

5. Understand the adequate knowledge on patent and rights.

REFERENCE Books:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari
4. Select REFERENCES from the Internet.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTDC 14(A)

SUBJECT NAME: OPTICAL NETWORK

60 HRS

COURSE OBJECTIVES:

The main objectives of the course are to: Familiarize students with the optical network evolution, from the point-to-point link to the intelligent transport Introduce the main elements and components of the all-optical networking solution explore the capabilities and limitations of the optical network Expose students to recent research articles on various optical networking issues.

UNIT I (10 HRS)

Introduction to optical network: Telecommunication, first generation optical network, multiplexing technique, second generation optical network, virtual circuit services and data gram, transparencies of regenerator

UNIT II (10 HRS)

Network components: couplers, Isolators, Circulators, Multiplexer , filter, fiber bragg gratings as ADD/Drop multiplexers, frabry perot filters, acoustics optical tunable filters, characterization of switches, mechanical, electro-optic, thermo-optic, and SOA switches, switching architecture.

UNIT III (10 HRS)

First generation of optical network: SONET, SDH, goals of SONET design , Multiplexing in SONET, elements of SONET/SDH infrastructure, SONET physical layer, comuter interconnections, ESCON, fiber channel, FDDI,ATM,IP layered architecture , physical layer, data link layer, network layer, transport layer

UNIT IV (10 HRS)

Broad cast and select network: topologies for broadcast networks, bus topology, star topology, and media access control (MAC) protocols, throughput calculation, synchronization, aloha and slotted ALOHA, test beds, LAMBDANET, rainbow, starnet

UNIT V (10 HRS)

Wavelength routing network: optical layer, wavelength cross connect, wavelength reuse reliability, virtual topology and circuit switching and node design, degree of wavelength conversion, network design and operation traffic models, and performance criteria, static and reconfigurable network, classification of light paths

UNIT VI (10 HRS)

Photonic packet switching ,optical time domain multiplexing(OTDM),Method of multiplexing and de-multiplexing, Broadcast ,OTDM network ,bit interleaving and packet interleaving, optical and gates non linear optical loop mirror, tera-hertz optical asymmetric de-multiplexer, switch based network, deflection routing.

COURSE OUTCOMES:-

After completion of the course students are expected to be able to: Identify the three generations of optical networking evolution Name the all-important technological issues that affect how optical networks are implemented Comprehend the potentialities and limitations of optical networks Underline how these networks fit in the more classical communication networks based on electronic time division.

REFERENCE BOOKS:

1. Optical Networks: Apractical Prospective By R. Ramaswamy and K.N.Shivrajan
2. Optical Networks By C.S.R.Murthy and M.Guruswamy, PHI
3. Computer Networks By Tanenbaum

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTDC 14(B)

SUBJECT NAME: WIRELESS SENSOR NETWORK

60HRS

COURSE OBJECTIVES:

The objective of this course is to make the students

1. To Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology
2. Understand the medium access control protocols and address physical layer issues
3. Learn key routing protocols for sensor networks and main design issues
4. Learn transport layer protocols for sensor networks, and design requirements
5. Understand the Sensor management, sensor network middleware, operating systems.

UNIT I (10 HRS)

Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

UNIT II (10 HRS)

Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

UNIT III (10 HRS)

Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

UNIT IV (10 HRS)

Overview of sensor network protocols (details of atleast 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

UNIT V (10 HRS)

Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

UNIT VI (10 HRS)

Specialized features: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

COURSE OUTCOMES:-

To get a basic understanding of physical properties of optical networks. To get a profound understanding of optical switching methods and networking techniques, circuit, packet, hybrid, burst and flow. To get a basic understanding of optical components and optical node design.

REFERENCES:

1. H. Karl and A. Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, India, 2012.
2. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, “Wireless Sensor Networks”, Springer Verlag, 1st Indian reprint, 2010.
3. F. Zhao and L. Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Morgan Kaufmann, 1st Indian reprint, 2013.

4. YingshuLi, MyT. Thai, Weili Wu, “Wireless sensor Network and Applications”, Springer series on signals and communication technology, 2008.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTDC 14(C)

SUBJECT NAME: STATISTICAL INFORMATION PROCESSING

60HRS

COURSE OBJECTIVES:-

The objective of this course is to student understood about Vector quantization, Tchebay chef inequality theorem, Central and Maximum Likelihood Estimation, Generalized Likelihood Ratio Test.

UNIT I (10 HRS)

Review of random variables: Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebaychef inequality theorem, Central Limit theorem, Discrete &Continuous Random Variables. Random process: Expectations, Moments, Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

UNIT II (10 HRS)

Random signal modelling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications ,Linear System with random input , Forward and Backward Predictions, Levinson Durbin Algorithm.

UNIT III (10 HRS)

Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing. Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio

Test ,Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate, Multiple Parameter Estimation Best Linear Unbiased Estimator, Least-Square Estimation Recursive Least-Square Estimator.

UNIT IV (10 HRS)

Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.

UNIT V (10 HRS)

Information Theory and Source Coding: Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shanon Fano , Arithmetic , Adaptive coding , RLE , LZW Data compaction, , LZ-77, LZ-78. Discrete Memory less channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.

UNIT VI (10 HRS)

Application of Information Theory: Group, Ring & Field, Vector, GF addition, multiplication rules. Introduction to BCH codes, Primitive elements ,Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes,& Decoder, Reed-Solomon codes & Decoder, Implementation of Reed Solomon encoders and decoders.

COURSE OUTCOMES:-

Student able to understand Information Theory and Source Coding , BCH codes , Least-Square Estimation Recursive Least-Square Estimator.

REFERENCES:

1. Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw-Hill, 2002.

2. D.G. Manolakis, V.K. Ingle and S.M. Kogon, “Statistical and Adaptive Signal Processing”, McGraw Hill, 2000.

3. Mourad Barkat , “Signal Detection and Estimation”, Artech House, 2nd Edition, 2005.

4. R G. Gallager, “Information theory and reliable communication”, Wiley, 1st edition, 1968.

5. F. J. MacWilliams and N. J. A. Sloane, “The Theory of Error-Correcting Codes”, New York, North-Holland, 1977.

6. Rosen K.H, “Elementary Number Theory”, Addison-Wesley, 6th edition, 2010.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTDC 15(A)

SUBJECT NAME: MICROCONTROLLER SYSTEM DESIGN

60HRS

COURSE OBJECTIVES

1. To have knowledge about the basic working of a microcontroller system and its programming in assembly language.
2. To provide experience to integrate hardware and software for microcontroller applications systems.

UNIT I (12HRS)

Review of 8-Bit and 16-bit microprocessor, support chips and interfacing techniques, single chip micro-computers, architecture, program and data memory, ports, input Output interfacing and programming.

UNIT II (12HRS)

Single chip micro controllers- INTEL 8051/ 8751, MOTOROLA 68HC0/68HC11 architecture, instruction set and programming, Memory mapping, addressing modes, Registers, expanded modes. Interrupt handling timing and serial I / O.

UNIT III (12HRS)

Software development Modular approach, integrated software development environment, Object oriented interfacing and programming, Recursion and debugging.

UNIT IV (12HRS)

ATMEL 89C51/52 and PIC micro-Controllers- Case studies. Design and application of Micro Controller in Data acquisition, embedded controllers, Process control etc.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

UNIT V (12HRS)

DSP Processor architecture and sample design using TI – DSP.

COURSE OUTCOMES:-

Students are able to

1. Recall and apply a basic concept of digital fundamentals to Microprocessor based
2. Personal computer system.
3. Identify a detailed s/w & h/w structure of the Microprocessor.
4. Illustrate how the different peripherals are interfaced with Microprocessor.
5. Distinguish and analyze the properties of Microprocessors & Microcontrollers.
6. Analyze the data transfer information through serial & parallel ports.
7. Train their practical knowledge through laboratory experiments.

REFERENCE BOOKS:

1. Embedded Systems 8051 by Majidi & Majidi

2. Design with Micro-Controllers by John P. Peatman TMH

3. Embedded Micro-Computers System by Jonathan W. Valvano

4. Data Manuals – Intel Motorola.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTDC 15(B)

SUBJECT NAME: COGNITIVE RADIO

60HRS

COURSE OBJECTIVES

Learn the design of the wireless networks based on the cognitive radios. Understand the concepts of wireless networks and next generation networks.

UNIT I (10 HRS)

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, Functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, Spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

UNIT II(10 HRS)

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

UNIT III (10 HRS)

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

UNIT IV (10 HRS)

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

UNIT V (10 HRS)

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).

UNIT VI (10 HRS)

Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

COURSE OUTCOMES

Upon successful completion of this course the students will have developed following skills/abilities

1. Fundamental issues regarding dynamic spectrum access and radio-resource management.

2. Emerging issues in cognitive radio network.

REFERENCES:

1. Ekram Hossain, Dusit Niyato, Zhu Han, “Dynamic Spectrum Access and Management in
2. Cognitive Radio Networks”, Cambridge University Press, 2009.
3. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive radio networks”, John Wiley & Sons Ltd., 2009.
4. Bruce Fette, “Cognitive radio technology”, Elsevier, 2nd edition, 2009.
5. Huseyin Arslan, “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems”, Springer, 2007.
6. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, “Optimizing Wireless Communication Systems” Springer, 2009.
7. Linda Doyle, “Essentials of Cognitive Radio”, Cambridge University Press, 2009.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTDC 15(C)

SUBJECT NAME: DSP ARCHITECTURE

60HRS

COURSE OBJECTIVE:

To make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors. To make students aware about the meaning and implications of the properties of systems and signals.

UNIT I (10 HRS)

Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point Computations, Special Architectures Modules used in Digital Signal Processors (like MAC UNIT, Barrel shifters), On-Chip peripherals, DSP benchmarking.

UNIT II (10 HRS)

Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family,TMS320C25 –Internal Architecture, Arithmetic and Logic UNIT, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

UNIT III (10 HRS)

VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Replacement of MAC UNIT by ILP, Detailed study of

ISA, Assembly Language Programming, Code Composer Studio, Mixed Cand Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.

UNIT IV (10 HRS)

Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware, Concept of threads, introduction to P-thread, mutex and similar concepts, heterogeneous and homogenous multi-core systems, Shared Memory parallel programming –OpenMP approach of parallel programming, PRAGMA directives, OpenMP Constructs for work sharing like for loop, sections, TI TMS320C6678 (Eight Core subsystem).

UNIT V (10 HRS)

FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor.

UNIT VI (10 HRS)

High Performance Computing using P-DSP: Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

COURSE OUTCOMES:

At the end of the course, a student will be able to:

1. Use concepts of trigonometry, complex algebra, Fourier transform, z-transform to analyze the operations on signals and acquire knowledge about Systems

2. Select proper tools for analog-to-digital and digital-to-analog conversion. Also select proper tools for time domain and frequency domain implementation.

3. Design, implementation, analysis and comparison of digital filters for processing of discrete time signals

4. Integrate computer-based tools for engineering applications.

REFERENCES:

1. M. Sasikumar, D. Shikhare, Ravi Prakash, "Introduction to Parallel Processing", 1st Edition, PHI, 2006.
2. Fayez Gebali, "Algorithms and Parallel Computing",1st Edition, John Wiley & Sons, 2011
3. Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff
4. McDonald,"Parallel Programming in OpenMP", 1st Edition, Morgan Kaufman,2000.
5. Ann Melnichuk,Long Talk, "Multicore Embedded systems", 1st Edition, CRC Press,2010.
6. Wayne Wolf, "High Performance Embedded Computing: Architectures, Applications and Methodologies", 1st Edition, Morgan Kaufman, 2006.
7. E.S.Gopi, "Algorithmic Collections for Digital Signal Processing Applications Using
8. MATLAB", 1st Edition, Springer Netherlands, 2007.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: AUDIT

AUDIT I

1. ENGLISH FOR RESEARCH PAPER WRITING

60HRS

COURSE OBJECTIVE:

The course provides instruction, exercises, structure, and deadlines needed to create a publishable paper. The aim of the course is to improve competence in scholarly communications by deepening knowledge of the core features of the scientific writing style.

UNIT I (12 HRS)

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II (12 HRS)

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT III (12 HRS)

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

UNIT IV (12 HRS)

Key skills are needed when writing a Title; key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT V (12 HRS)

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

COURSE OUTCOMES:

Understand professional writing by studying management communication contexts and genres, researching contemporary business topics, analyzing quantifiable data discovered by researching, and constructing finished professional workplace documents.

Recognize, explain, and use the formal elements of specific genres of organizational communication: white papers, recommendation and analytical reports, proposals, memorandums, web pages, wikis, blogs, business letters, and promotional documents.

Understand the ethical, international, social, and professional constraints of audience, style, and content for writing situations a.) Among managers or co-workers and colleagues of an organization, and b.) Between organizations, or between an organization and the public.

SUGGESTED STUDIES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .

4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: AUDIT

AUDIT I

2. DISASTER MANAGEMENT

60HRS

COURSE OBJECTIVES

The aim of the master programme is to, through knowledge, experience and research build capacities that will reduce disaster risks and contribute to better and more targeted public health based relief following disasters. The Master has the following four objectives:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
2. To increase the knowledge and understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
3. To ensure skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
4. To ensure skills and ability to design, implement and evaluate research on disasters.

UNIT I (10 HRS)

Introduction

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. U Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods,

Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT II (10 HRS)

Disaster Prone Areas In India

Study of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special REFERENCE To Tsunami; Post-Disaster Diseases And Epidemics

UNIT III (10 HRS)

Disaster Preparedness and Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And CommUNITy Preparedness.

UNIT IV (10 HRS)

Risk Assessment

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

UNIT V(10 HRS)

Disaster Mitigation

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India. Capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.

Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

COURSE OUTCOMES:-

Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters. Capacity to manage the Public Health aspects of the disasters. Capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L, Disaster Administration And Management Text And Case Studies" ,Deep &Deep

Publication Pvt. Ltd., New Delhi.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: AUDIT

AUDIT I

3. SANSKRIT FOR TECHNICAL KNOWLEDGE

60HRS

UNIT I (20 HRS)

- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

UNIT II (20 HRS)

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

UNIT III(20 HRS)

- Technical concepts of Engineering-Electrical, Mechanical,
- Architecture, Mathematics

SUGGESTED READING

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: AUDIT

AUDIT I

4. VALUE EDUCATION

60HRS

COURSE OBJECTIVES Students will be able to 1. Understand value of education and self-development 2. Imbibe good values in students 3. Let the should know about the importance of character.

UNIT I(15HRS)

- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles,
- Value judgments

UNIT II (15HRS)

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence,
- Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National UNITy.
- Patriotism.Love for nature, Discipline

UNIT III (15HRS)

- Personality and Behavior Development - Soul and Scientific
- Attitude. Positive Thinking. Integrity and discipline.

- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature.

UNIT IV (15HRS)

- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, studying effectively.

COURSE OUTCOMES

Students will be able to

1. Knowledge of self-development

2. Learn the importance of Human values

3. Developing the overall personality

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: CORE

SUBJECT CODE: MTDC 21

SUBJECT NAME: ADVANCED COMMUNICATION SYSTEM

60HRS

COURSE OBJECTIVES

The main objective of the course is to

1. Provide student with theoretical background and applied knowledge so that they can design an optimum Single and multi-carrier communication system under given power, spectral and error performance constraints.

2. Analyze the error performance of digital modulation techniques.

3. Explore M-ary signaling

UNIT –I (15 HRS)

Review of basic communication theoretical concept, Digital Modulation Techniques, On-Off Keying: Frequency shift keying, Phase shift keying, Quadrature Phase shift keying,. Frequency Multiple access; Demand assigned multiple access, Code Division Multiple access.

UNIT –II (15 HRS)

Noise & Communication System, Error Rate in Binary Transmission, Optimum decision levels information capacity of PCM systems; Noise, Power & Spectral representation of noise Random signals & noise through linear systems, Matched Filter Detection, Narrow band noise representation, Signal-to-noise ratio in FM & AM, AM detector spectral analysis, Thermal noise consideration & other types of the noise encountered in communication.

UNIT-III (15 HRS)

Statistical communication theory in digital communication, Statistical decision theory signal vectors, multiple sample detector optimum, Binary transmission, M-array transmission additive white Gaussian noise channel, Matched filter detection signal constellation and probability of error calculation, Binary signals M-array orthogonal signals.

UNIT –IV (15 HRS)

Mobile communication, Introduction, Spread spectrum, Direct sequence spread spectrum, Cellular systems, Access contracts SDMA, FDMA, TDMA, CDMA systems architecture, Radio interface, Protocols, Wireless LAN, Wireless ATM, Mobile Network Layer, Mobile transport layer.

COURSE OUTCOMES

After studying this course the students would gain enough knowledge

1. Analyze the design parameters of a single and multi-carrier communication system.

2. Use mathematical tools to analyze the performance of communication systems.

3. Use probability theory and stochastic processes in communication system applications

4. Learn synchronization and adaptive equalization techniques.

REFERENCE Books:

1. Mobile Communication By Jochen Schiller

2. Digital Communication By Taub & Schiller

3. Modulation, Coding By Swartz & Noise.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: CORE

SUBJECT CODE: MTDC 22

SUBJECT NAME: ANTENNA AND RADIATING SYSTEMS

60HRS

COURSE OBJECTIVES

Students will be introduced to antennas, their principle of operation Antenna analysis and their applications. Introduce the student to wave propagation over ground, through troposphere and ionosphere; diversity principles. Propagation effects in microwave systems, satellite, space, and radar links.

UNIT I (12 HRS)

Review of e.m. waves, fields solution in free space, generalized plane wave representation of spherical and other waves, radiation conditions at infinity, elementary current and aperture element sources, Equivalence theorems, antenna impedance, mutual impendence calculation between wire antennas and aperture antenna in infinite conductor plane.

U nit II (12 HRS)

Relationship between radiation pattern and source current distributions, Radiation pattern and aperture field distribution, Diploes, helical and rhombus antennas.

U nit III (12 HRS)

Antenna arrays, mathematical theory of uniform and non-uniform arrays. Beam width, SLL, gain of long arrays. Planar arrays, change in element radiation pattern in array environment. Trade off between SLL and beam width, design by Tsebycheff and other methods, optimum Taylor’s distribution.

UNIT IV (12 HRS)

Aperture antenna analysis, box and horn antenna, reflector antennas, parabolic and cassagrain antenna design. Corrugated horns, Lens antennas – dielectric and metallic.

UNIT V (12 HRS)

Antenna bandwidth considerations, broadband antennas. Electronically scanned arrays, design considerations feed systems. Strip line antennas, design and applications.

COURSE OUTCOMES

Students are able to understand the various applications of antennas and radio wave propagation. Define various antenna parameters, Analyze radiation patterns of antenna, Evaluate antennas for given specifications. Illustrate techniques for antenna parameter measurements.

REFERENCE BOOKS:

1. Antenna Engineering – Krans

2. Electromagnetic Fields & Radiating Systems – Jordan & Balmaini

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG SPECIFIC ELECTIVE

SUBJECT CODE: MTDC 23(A)

SUBJECT NAME: SATELLITE COMMUNICATION

60HRS

COURSE OBJECTIVES

- To enable the student to become familiar with satellites and satellite services.
- Study of satellite orbits and launching.
- Study of earth segment and space segment components
- Study of satellite access by various users.

UNIT I (10 HRS)

Architecture of Satellite Communication System: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks.

UNIT II (10 HRS)

Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.

UNIT III (10 HRS)

Satellite sub-systems: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems, antenna sub-system.

UNIT IV (10 HRS)

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

UNIT V (10 HRS)

Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.

UNIT VI (10 HRS)

Modulation and Multiple Access Schemes used in satellite communication. Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO, GPS.

COURSE OUTCOMES

1. Define orbital mechanics and launch methodologies
2. Describe satellite subsystems
3. Design link power budget for satellites
4. Compare competitive satellite services
5. Explain satellite access techniques
6. DTH and compression standards

REFERENCES:

1. Timothy Pratt and Others, “Satellite Communications”, Wiley India, 2nd edition,2010.

2. S. K. Raman, “Fundamentals of Satellite Communication”, Pearson Education India, 2011.

3. Tri T. Ha, “Digital Satellite Communications”, Tata McGraw Hill, 2009.

4. Dennis Roddy, “Satellite Communication”, McGraw Hill, 4th Edition, 2008.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG SPECIFIC ELECTIVE

SUBJECT CODE: MTDC 23(B)

SUBJECT NAME: INTERNETS OF THINGS

60HRS

COURSE OBJECTIVES:

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices

UNIT I (10HRS)

Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networking concepts, Ipv4 and IPV6.

UNIT II (10HRS)

Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, Protocols to support IoT communications,

modular design and abstraction, security and privacy in fog.

UNIT III (10HRS)

Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edge resource pooling and caching, client side control and configuration.

UNIT IV (10HRS)

Smart objects as building blocks for IoT, Open source hardware and Embedded systems platforms for IoT, Edge/gateway, IO drivers, C Programming, multithreading concepts.

UNIT V (10HRS)

Operating systems requirement of IoT environment, study of mbed, RIoT, andContiki operating systems, Introductory concepts of big data for IoT applications.

UNIT VI (10HRS)

Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT

COURSE OUTCOMES:

• Able to understand the application areas of IOT

• Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

• Able to understand building blocks of Internet of Things and characteristics.

REFERENCES:

1. A Bahaga, V. Madisetti, “Internet of Things- Hands on approach”, VPT publisher, 2014.
2. A. McEwen, H. Cassimally, “Designing the Internet of Things”, Wiley, 2013.
3. CunoPfister, “Getting started with Internet of Things”, Maker Media, 1st edition, 2011.
4. Samuel Greenguard, “Internet of things”, MIT Press, 2015.legislation.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG SPECIFIC ELECTIVE

SUBJECT CODE: MTDC 23(C)

SUBJECT NAME: VOICE AND DATA NETWORKS

60 HRS

COURSE OBJECTIVE:-

Understanding Voice and Data Networks is intended as an introduction to the communications technologies used in transporting voice and data. The goal of the course is to provide a comprehensive understanding of communications technologies.

UNIT I (10HRS)

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

UNIT II (10HRS)

Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

UNIT III (10HRS)

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

UNIT IV (10HRS)

Queuing Models of Networks , Traffic Models , Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks,

UNIT V (10HRS)

Inter-networking, Bridging, Global Internet , IP protocol and addressing , Sub netting , Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control , Additive Increase/Multiplicative Decrease , Slow Start, Fast Retransmit/ Fast Recovery,

UNIT VI (10HRS)

Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

COURSE OUTCOMES:

At the end of this course, students will be able to:

1. Protocol, algorithms, trade-offs rationale.

2. Routing, transport, DNS resolutions

3. Network extensions and next generation architectures.

REFERENCES:

1. D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, Prentice Hall, 1992.
2. L. Peterson and B. S. Davie, “Computer Networks: A Systems Approach”,5th Edition, Morgan Kaufman, 2011.
3. Kumar, D. Manjunath and J. Kuri, “Communication Networking: An analytical approach”,1st Edition, Morgan Kaufman, 2004.
4. Walrand, “Communications Network: A First Course”, 2nd Edition, McGraw Hill, 2002.
5. Leonard Kleinrock, “Queueing Systems, Volume I: Theory”, 1st Edition, John Wiley and Sons, 1975.

6. Aaron Kershenbaum, “Telecommunication Network Design Algorithms”, McGraw Hill,1993.

7. Vijay Ahuja, “Design and Analysis of Computer Communication Networks”, McGraw Hill, 1987

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG SPECIFIC ELECTIVE

SUBJECT CODE: MTDC 23(A)

SUBJECT NAME: MIMO SYSTEMS

60HRS

COURSE OBJECTIVES

The main objective of the course is to

1. To make students familiar with fundamentals of wireless communication systems.

2. To understand the diversity and spatial multiplexing phenomenon in MIMO system.

3. To understand the receiver system design for MIMO.

4. To become familiar with OFDM and MIMO-OFDM systems.

UNIT I (10HRS)

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems.

UNIT II(10HRS)

Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation

UNIT III(10HRS)

The generic MIMO problem, Singular Value Decomposition, Eigenvalues and eigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Predistortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in

MIMO systems, Advantages of pre-coding and combining, Disadvantages of precoding and combining, Channel state information.

UNIT IV (10HRS)

Codebooks for MIMO, Beamforming, Beamforming principles, Increased spectrum efficiency, Interference cancellation, Switched beamformer, Adaptive beamformer, Narrowband beamformer, Wideband beamformer

UNIT V (10HRS)

Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models

UNIT VI (10HRS)

Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

COURSE OUTCOMES

After studying this course the students would gain enough knowledge of

1. Emerging issues for implementing MIMO wireless channels.

2. Different fading channel distributions in multipath wireless channel.

3. OSTBC design for multiple antenna system.

4. Computation of performance parameters of MIMO wireless system.

REFERENCES:

- Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design",Academic Press, 1st edition, 2010.
- Mohinder Janakiraman, “Space - Time Codes and MIMO Systems”, Artech House
- Publishers, 2004.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG SPECIFIC ELECTIVE

SUBJECT CODE: MTDC 24(B)

SUBJECT NAME: MARKOV CHAINS AND QUEUEING SYSTEMS

60HRS

COURSE OBJECTIVES

The main objective of the course is to student to understand Basic definitions, recurrence times, rewards and renewal reward theorem **,**Fundamental queuing results.

UNIT I (10HRS)

Introduction: Review of basic probability, properties of nonnegative random variables, laws of large numbers and the Central Limit Theorem.

UNIT II(10HRS)

Renewal Processes: Basic definitions, recurrence times, rewards and renewal rewardtheorem, point processes, Poisson process, Walds equation, Blackwell's theorem.

UNIT III(10HRS)

Discrete time Markov chains: definitions and properties, matrix representation, Perron-Frobenius theory.

UNIT IV (10HRS)

Continuous time Markov chains: basic definitions, Q-matrix, birth-death processes, quasi birth death processes.;Embedded Markov processes, semi Markov processes, reversible Markov chains, Random walks.

UNIT V(10HRS)

Fundamental queuing results: Little's theorem, invariance of the mean delay, Conservation law. Markovian queues: Jackson and BCMP networks, numerical Algorithms. M/G/1 & G/M/1 queues and G/G/1 queues.

UNIT VI (10HRS)

Advanced queuing models: priority, vacation and retrials in queues.

REFERENCES:

1. Cliffs, “Stochastic Modelling and the Theory Queues”, Prentice Hall, 1989.
2. P.Bremaud, “Markov Chains”, Springer-Verlag, 1999.
3. E.Seneta, “Non Negative Matrices and Markov Chains”, Springer Series in Statistics, Springer,1981.
4. R.Gallager, “Discrete Stochastic Processes”, Kluwer Academic Press, 1996.
5. L.Kleinrock, “Queuing Systems”, vols I and II, John Wiley and Sons 1976.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG SPECIFIC ELECTIVE

SUBJECT CODE: MTDC 24(C)

SUBJECT NAME: WIRELESS AND MOBILE COMMUNICATION

60HRS

COURSE OBJECTIVES

To explain the various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks. To enable students to compare and contrast multiple division techniques, mobile communication systems, and existing wireless networks.

UNIT-I (10HRS)

Introduction, Applications and requirements of wireless services: history, types of services, requirements for the services, economic and social aspects. Technical challenges in wireless communications: multipath propagation, spectrum limitations, limited energy, user mobility, noise and interference-limited systems. Propagation mechanism: free space loss, reflection transmission, diffraction, scattering by rough surfaces, wave guiding.

UNIT-II(10HRS)

Wireless Propagation channels, Statistical description of the wireless channel: time invariant and variant two path models, small-scale fading with and without a dominant spectra, temporal dependence of fading, large scale fading. Wideband and directional channel characteristics: causes of delay dispersion, system theoretic description of wireless channels,WSSUS model, condensed parameters, ultra wideban channels, directional description.

UNIT-III(10HRS)

Channel models: Narrowband, wideband and directional models, deterministic channel methods. Channel sounding: Introduction, time domain measurements, frequency domain analysis, modified measurement met Introduction, antennas for mobile stations, antennas for base stations.

UNIT-IV(10HRS)

Introduction to cellular mobile system

A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning of cellular system. description of problem, concept of frequency reuse channels, factor, desired C/I in an Omni-directional antenna system, hand off mechanism, cell splitting, components of cellular systems.

UNIT-V(10HRS)

Cell coverage for signal and traffic General introduction, mobile point foliage loss, propagation in nearpoint prediction model, cell site antenna heights and signal coverage cells, mobile to mobil propagation. Cell site antennas and mobile antennas pattern relationship, sum and difference patterns site antennas, mobile antennas. Cochannel interference reduction Cochannel interference, real time cochannel interference measurement at mobile radio transceivers, design of antenna systems.

UNIT-VI (10HRS)

Frequency management and Channel Assignment

Frequency management, frequency spectrum utilization, setup channels, channel assignment, fixed channel assignment, non-fixed channel assignment algorithms, additional spectrum, traffic and channel assignment, perception of call blocking from the subscribers.

COURSE OUTCOMES

Understand fundamentals of wireless communications. Analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks. Demonstrate basic skills for cellular networks design. Apply knowledge of TCP/IP extensions for mobile and wireless networking.

REFERENCES:

1. Lee: Cellular and Mobile Telecommunication

2. Rappaport: Wireless Communications

3. Lee: Mobile communications design fundamentals, Wiley India.

4. Faher Kamilo: Wireless Digital Communication, PHI Learning.

5. Raj Kamal: Mobile Computing, Oxford University Press.

Grading System w.e.f. 2012-13

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: AUDIT

AUDIT COURSE-II

1. CONSTITUTION OF INDIA

60HRS

COURSE OBJECTIVE

This course is to

1. Understand the premises informing the twin themes of liberty and freedom from a civilrights perspective.

2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

UNIT I (12HRS)

Introduction and Methodology:

- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions**.**
- Overview of methodology and Searching.

UNIT II (12HRS)

Thematic overview: Pedagogical practices are being used by teachers in formal and

informal classrooms in developing countries.

 Curriculum, Teacher education

UNIT III (12HRS)

Evidence on the effectiveness of pedagogical practices

- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum
- and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV (12HRS)

Professional development: alignment with classroom practices and follow-up

support

- Peer support
- Support from the head teacher and the commUNITy.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

UNIT V (12HRS)

Research gaps and future directions

- Research design

- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

COURSE OUTCOMES

- Students will be able to:
- 1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- 2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India

SUGGESTED READING

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.

Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: AUDIT

AUDIT COURSE-II

2. PEDAGOGY STUDIES

60HRS

COURSE OBJECTIVES:

Students will be able to:

Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.

Identify critical evidence gaps to guide the development.

UNIT I [12 HRS]

Introduction and Methodology:

- Aims and rationale, Policy background, Conceptual framework and terminology.
- Theories of learning, Curriculum, Teacher education
- Conceptual framework, Research questions.
- Overview of methodology and Searching.

UNIT II [12 HRS]

- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

UNIT III [12 HRS]

- Evidence on the effectiveness of pedagogical practices
- Methodology for the in depth stage: quality assessment of included studies
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV [12 HRS]

- Professional development: alignment with classroom practices and follow-up support
- Peer support .
- Support from the head teacher and the commUNITy
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

UNIT V [12 HRS]

- Research gaps and future direction
- Research design
- Contexts
- Pedagogy
- Teacher education

- Curriculum and assessment
- Dissemination and research impact.

COURSE OUTCOMES

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: AUDIT

AUDIT COURSE-II

3. STRESS MANAGEMENT BY YOGA

60HRS

COURSE OBJECTIVE

This course helps to achieve overall health of body and mind and overcome stress

UNIT I (20 HRS)

Definitions of Eight parts of yog. (Ashtanga)

UNIT II(20 HRS)

Yam and Niyam.

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III(20 HRS)

Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii)Regularization of breathing techniques and its effects-Types of pranayam

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

COURSE OUTCOMES

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also

2. Improve efficiency

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: AUDIT

AUDIT COURSE-II

4. Personality Development through Life Enlightenment Skills

[60 HRS]

COURSE OBJECTIVES

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

UNIT I [20 HRS]

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT II [20 HRS]

- Approach to day to day work and duties.
- Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35
- Chapter 18-Verses 45, 46, 48.

UNIT III [20 HRS]

- Statements of basic knowledge.
- Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model

Shrimad BhagwadGeeta:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

COURSE OUTCOMES

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity

3. Study of Neetishatakam will help in developing versatile personality of students.

SUGGESTED READING

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication

2. Department), Kolkata

3. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath

4. Rashtriya Sanskrit Sansthanam, New Delhi.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: III

CATEGORY: PE

SUBJECT CODE: MTDC 31(A)

SUBJECT NAME: COMMUNICATION NETWORKS

60HRS

COURSE OBJECTIVES

The COURSE OBJECTIVES include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems.

UNIT I (10HRS)

Introduction:- Network Architecture, Performance

UNIT II(10HRS)

Connecting nodes:- Connecting links, Encoding, framing, Reliable transmission, Ethernet and Multiple access networks, Wireless networks

UNIT III(10HRS)

Queuing models- For a) one or more servers b) with infinite and finite queue size c) Infinite population

Internetworking:- Switching and bridging, IPv4, Addressing, Routing Protocols, Scale issues, Routers - Architecture, IPv6

UNIT IV (10HRS)

End-to-End Protocols:- Services, Multiplexing, De-multiplexing, UDP, TCP, RPC, RTP

UNIT V(10HRS)

Congestion control and Resource Allocation- Issues, Queuing disciplines, TCP congestion control, Congestion Avoidance, QoS

Applications:- Domain Name Resolution, File Transfer, Electronic Mail, WWW, Multimedia Applications

UNIT VI (10HRS)

Network monitoring – Packet sniffing tools such as Wireshark Simulations using NS2/OPNET

COURSE OUTCOMES:-

After completion of the course student will be able to:

Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction. Apply various network layer techniques for designing subnets and supernets and analyse packet flow on basis of routing protocols.

REFERENCES:

1. Larry L. Peterson, Bruce S, Devie, “Computer Networks” , MK, 5th Edition
2. . Aaron Kershenbaum, “Telecommunication Network Design Algorithms”, MGH,
3. International Edition 1993.
4. Vijay Ahuja, “Communications Network Design and Analysis of Computer
5. Communication Networks”, MGH, International Editions.
6. Douglas E. Comer, “Internetworking with TCP/IP”, Pearson Education, 6th Edition

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: III

CATEGORY: PE

SUBJECT CODE: MTDC 31(B)

SUBJECT NAME: SELECTED TOPICS IN MATHEMATICS

60HRS

COURSE OBJECTIVE:

The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modeling, climate prediction and computer networks etc

UNIT I (10HRS)

Probability and Statistics:- Definitions, conditional probability, Bayes Theorem and independence.

Random Variables: Discrete, continuous and mixed random variables, probability mass,

Probability density and cumulative distribution functions, mathematical expectation, moments, moment generating function, Chebyshev inequality.

UNIT II(10HRS)

Special Distributions: Discrete uniform, Binomial, Geometric, Poisson, Exponential,Gamma, Normal distributions. Pseudo random sequence generation with given distribution, Functions of a Random Variable

UNIT III(10HRS)

Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation,

independence of random variables, bi-variate normal distribution.

- Stochastic Processes: Definition and classification of stochastic processes, Poisson process

- Norms, Statistical methods for ranking data

UNIT IV (10HRS)

Multivariate Data Analysis

- Linear and non-linear models, Regression, Prediction and Estimation

- Design of Experiments – factorial method

- Response surface method

UNIT V(10HRS)

Graphs and Trees: - Graphs: Basic terminology, multi graphs and weighted graphs, paths and circuits, shortest path Problems, Euler and Hamiltonian paths and circuits, factors of a graph, planar graph and Kuratowski's graph and theorem, independent sets, graph colouring

UNIT VI(10HRS)

Trees: Rooted trees, path length in rooted trees, binary search trees, spanning trees and cut set, theorems on spanning trees, cut sets , circuits, minimal spanning trees, Kruskal's and Prim's

Course Outcomes :-

how to derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions. how to calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.

REFERENCES:

1. Henry Stark, John W. Woods, "Probability and Random Process with Applications to
2. Signal Processing", Pearson Education, 3rd Edition
3. C. L. Liu, "Elements of Discrete Mathematics", Tata McGraw-Hill, 2nd Edition

4. Douglas C. Montgomery, E.A. Peck and G. G. Vining, “Introduction to Linear Regression Analysis”, John Wiley and Sons, 2001.

5. Douglas C. Montgomery, “Design and Analysis of Experiments”, John Wiley and Sons,2001.

6. B. A. Ogunnaike, “Random Phenomena: Fundamentals of Probability and Statistics for Engineers”, CRC Press, 2010.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: III

CATEGORY: PE

SUBJECT CODE: MTDC 31(C)

SUBJECT NAME: NANOMATERIALS AND NANOTECHNOLOGY

60HRS

COURSE OBJECTIVE

This is course deals with fundamental behavior of Nano Materials and competing nano technologies for various applications

UNIT I (10HRS)

Introduction of nanomaterials and nanotechnologies, Features of nanostructures, Background of nanostructures, Techniques of synthesis of nanomaterials, Tools of the nanoscience, Applications of nanomaterials and technologies. Bonding and structure of the nanomaterials, Predicting the Type of Bonding in a Substance crystal structure, Metallic nanoparticles, Surfaces of Materials, Nanoparticle Size and Properties, Mechanical, ELECTRICAL, properties of materials, theories relevant to mechanical properties, techniques to study mechanical properties of nanomaterials

UNIT II (10HRS)

Applications of one and higher dimension nano-materials. Application of Nanomaterial: Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application.

UNIT III (10HRS)

Overview of Nano-lithography technologies and overview of pattern transfer, Nanoimprint lithography and soft lithography, micro electro-mechanical system (MEMS) Definition - MEMS materials. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries and nano-phonics.

UNIT IV (10HRS)

Basic Concept of Carbon Nanotube, the structure of Carbon Nanotubes, properties of carbon nanotubes, Mechanical Properties, Thermal Stability, Electronic Properties, Optical Properties, Elastic Properties, Vibrational Properties, Intrinsic Properties of individual Carbon Nano Tube, APPLICATION OF CARBON NANOTUBES, Carbon Nanotubes in Electronics, Carbon Nanotubes in Energy Applications, Carbon Nanotubes For Mechanical Applications, Carbon Nanotube Sensors, Carbon Nanotubes in Field Emission and Lighting Applications, Carbon Nanotubes for Biological Applications.

UNIT V and VI (20HRS)

Synthesis process of metal nanoparticles: Wet Chemical Synthesis Routes, Phase Transfer Method, Stabilization Mechanisms, Electrochemical Method, Interdisciplinary arena of nanotechnology.

COURSE OUTCOMES

At the end of this course student will demonstrate the ability to:

1. To understand the basic science behind the design and fabrication of nano scale systems.

2. To understand and formulate new engineering solutions for current problems and competing technologies for future applications.

3. To be able make inter disciplinary projects applicable to wide areas by clearing and fixing the boundaries in system development.

4. To gather detailed knowledge of the operation of fabrication and characterization devices to achieve precisely designed systems.

REFERENCES:

1. Nanoscale Materials in Chemistry edited by Kenneth J. Klabunde and Ryan M. Richards,

2. 2ndedn, John Wiley and Sons, 2009.

3. Nanocrystalline Materials by A I Gusev and A ARempel, Cambridge International

4. Science Publishing, 1st Indian edition by Viva Books Pvt. Ltd. 2008.

5. Springer Handbook of Nanotechnology by Bharat Bhushan, Springer, 3rdedn, 2010.

6. Carbon Nanotubes: Synthesis, Characterization and Applications by Kamal K. Kar,

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: III

CATEGORY: OE

SUBJECT CODE: MTDC 32(A)

SUBJECT NAME: BUSINESS ANALYTICS

60HRS

COURSE OBJECTIVES:

To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making. To become familiar with the processes needed to develop, report, and analyze business data.

UNITI (10HRS)

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

UNIT II (10HRS)

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT III(10HRS)

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive

analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT IV (10HRS)

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT V (10HRS)

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making.

UNIT VI (10HRS)

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

COURSE OUTCOMES:-

Student able to recognize, understand and apply the language, theory and models of the field of business analytics. Foster an ability to critically analyze, synthesize and solve complex unstructured *business* problems. Encourage an aptitude for business improvement, innovation and entrepreneurial action.

REFERENCE:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G.

Schniederjans, Christopher M. Starkey, Pearson FT Press.

2. Business Analytics by James Evans, persons Education.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: III

CATEGORY: OE

SUBJECT CODE: MTDC 32(B)

SUBJECT NAME: OPERATIONS RESEARCH

60HRS

COURSE OBJECTIVES:

This module aims to introduce students to use quantitive methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

UNIT I (12HRS)

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II (12HRS)

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III (12HRS)

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV (12HRS)

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V (12HRS)

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

COURSE OUTCOMES

1. Formulate and solve problems as networks and graphs.
2. Develop linear programming (LP) models for shortest path, maximum flow, minimal spanning tree, critical path, minimum cost flow, and transshipment problems.
3. Solve the problems using special solution algorithms.

REFERENCES:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008

2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008

4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009

5. Pannerselvam, Operations Research: Prentice Hall of India 2010

6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: III

CATEGORY: OE

SUBJECT CODE: MTDC 32(C)

SUBJECT NAME: COST MANAGEMENT OF ENGINEERING PROJECTS

60HRS

COURSE OBJECTIVE:-

The objective of Project Cost Management is to ensure that the cost aspects of the project are delivered. However this must be achieved within the overall project objectives, in particular the (usual) need to maximise value for the client's business.

UNIT–I (12 HRS)

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: (12 HRS)

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: (12 HRS)

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: (12 HRS)

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: (12 HRS)

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygro-thermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

COURSE OUTCOMES

Student able to understand Manufacturing of Metal Matrix Composites, Manufacturing of Polymer Matrix Composites, Rule of mixtures, Inverse rule of mixtures

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

REFERENCES:

1. Hand Book of Composite Materials-ed-Lubin.

2. Composite Materials – K.K.Chawla.

3. Composite Materials Science and Applications – Deborah D.L. Chung.

4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: III

CATEGORY: DESSERTATION

SUBJECT CODE: MTDC DP (I)

SUBJECT NAME: DISSERTATION (PHASE I)

60 HRS

Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available. End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals contribution. Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: IV

CATEGORY: DISSERTATION

SUBJECT CODE: MTDC DP (II)

SUBJECT NAME: DISSERTATION (PHASE II)

60HRS

Dissertation – II will be extension of the to work on the topic identified in Dissertation – I.

Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre-submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with guide.

Guidelines for Dissertation Phase – I and II at M. Tech.

- As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
- The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

- Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results and a record of continuous progress.
- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.
- During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.
- Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work