SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: CORE

SUBJECT CODE: MTMW 11

SUBJECT NAME: ADVANCED DIGITAL SIGNAL PROCESSING

[60Hrs]

Course Objectives:

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

UNIT 1[10Hrs]

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 2[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 3[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 4[10 Hrs]

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

UNIT 5[10Hrs]

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 6[10Hrs]

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 – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.
3. Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997.
4. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.
5. S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.
6. 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: MTMW 12

SUBJECT NAME: ANTENNA AND RADIATING SYSTEMS

[60Hrs]

Course Objectives:

The student will learn and understand

1. Fundamental antenna parameters and numerical methods to analyze and differentiate the antennas.
2. Concept of radiation mechanism of various antennas.
3. Mechanism and models for radio-wave propagation.

Unit 1: [10 Hrs]

Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna. Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.

Unit 2: [10 Hrs]

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects. Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non uniform current.

Unit 3: [10 Hrs]

LinearArrays: Two element array, N Element array: Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.

Unit 4: [10 Hrs]

Aperture Antennas: Huygens's Field Equivalence principle, radiation equations, Rectangular Aperture, Circular Aperture. Horn Antennas: E-Plane, H-plane Sectoral horns, Pyramidal and Conical horns.

Unit 5: [10 Hrs]

Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis, Rectangular Patch, Circular Patch.

Unit 6: [10 Hrs]

Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO.

Course Outcomes:

On completion of this course, the students will be able to

1. Identify basic antenna parameters.
2. Design and analyze antenna arrays.
3. Design and analyze wire and aperture antennas.
4. Identify the characteristics of radio-wave propagation**.**

References:

1. Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.
2. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", Tata
3. McGraw-Hill, 2002.
4. R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984.
5. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: CORE

SUBJECT CODE: MTMW 13

SUBJECT NAME: RESEARCH METHODOLOGY AND IPR

COURSE OBJECTIVES: **[60Hrs]**

The course should enable the students to:

1. Identify an appropriate research problem in their interesting domain.
2. Understand ethical issues Understand the Preparation of a research project thesis report.
3. Understand the Preparation of a research project thesis report
4. Understand the law of patent and copyrights.
5. Understand the Adequate knowledge on IPR

Unit 1[10 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 2[10 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 3[10 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.

Unit 4[10 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 5[10 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.

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SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTMW 14(A)

SUBJECT NAME: MIMO SYSTEM

COURSE OBJECTIVES: [60Hrs]

The course should enable the students to MIMO systems use a combination of multiple antennas and multiple signal paths to gain knowledge of the communications channel. By using the spatial dimension of a communications link, MIMO systems can achieve significantly higher data rates than traditional single-input, single-output (SISO) channels

Unit 1: [10 Hrs]

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

Unit 2: [10 Hrs]

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 3: [10 Hrs]

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 4: [10 Hrs]

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

Unit 5: [10 Hrs]

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 6: [10 Hrs]

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:

1: Introduce Multiple Input Multiple Output (MIMO) Communication Systems
2: Compare MIMO Systems with Single Input Single Output (SISO) Systems
3: Analyse the Information Theoretic advantages of MIMO Systems
4: Analyse the spatial multiplexing properties of MIMO
5: Introduce and analyse space time codes
6: Prove the existence of some space time codes.

References:

1. Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design",Academic Press, 1st edition, 2010.

2. Mohinder Janakiraman, “Space - Time Codes and MIMO Systems”, Artech House Publishers, 2004.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTMW 14(B)

SUBJECT NAME: REMOTE SENSING

COURSE OBJECTIVES: **[60Hrs]**

The course is designed to fulfill the following objectives

1. To provide exposure to students in gaining knowledge on concepts and applications leading to modeling of earth resources management using Remote Sensing
2. To acquire skills in storing, managing digital data for planning and development.
3. To acquire skills in advance techniques such as hyper spectral, thermal and LiDAR scanning for mapping, modeling and monitoring.

Unit 1: [10 Hrs]

Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing- Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.

Unit 2: [10 Hrs]

Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmanned spacecrafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD etc.

Unit 3: [10 Hrs]

Photographic products, B/W, color, color IR film and their characteristics –resolving power of lens and film -Opto mechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery - calibration of thermal scanners.

Unit 4: [10 Hrs]

Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution – range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit 5: [10 Hrs]

Thermal And Hyper Spectral Remote Sensing: Sensors characteristics-principle of spectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.

Unit 6: [10 Hrs]

Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification– Principles of LiDAR, Aerial Laser Terrain Mapping.

COURSE OUTCOMES:

1. Fully equipped with concepts, methodologies and applications of Remote Sensing Technology.
2. Prepare the candidates for National and Global Employability
3. Acquire skills in handling instruments, tools, techniques and modeling while using Remote Sensing Technology
4. It empowers the candidate with confidence and leadership qualities.

References:

1. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, John Wiley & Sons-2000, 6thEdition
2. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective,

2nd Edition, 1995.

3. John A.Richards, Springer –Verlag, Remote Sensing Digital Image Analysis,1999.
4. Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.
5. Charles Elachi and Jakob J. van Zyl , Introduction To The Physics and Techniques of Remote Sensing , Wiley Series in Remote Sensing and Image Processing, 2006.
6. Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman& Co, 1978.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTMW 14(C)

SUBJECT NAME: MICROWAVE SEMICONDUCTOR DEVICES

Course Objectives: **[60Hrs]**

The purpose of this program was to carry out fundamental studies in semiconductor materials and devices which are suitable for improving the state of the art*: in microwave and millimeter-wave power generation, amplification and detection. Students are able to understand the designing and working of diodes, FET family and other microwave device.

Unit 1: [12 Hrs]

Transient and ac behavior of p-n junctions, effect of doping profile on the capacitance of p-n junctions, noise in p-n junctions, high-frequency equivalent circuit, varactor diode and its applications; Schottky effect, Schottky barrier diode and its applications; Heterojunctions.

Unit 2: [12 Hrs]

Tunneling process in p-n junction and MIS tunnel diodes, V-I characteristics and device performance, backward diode.

Unit 3: [12 Hrs]

Impact ionization, IMPATT and other related diodes, small-signal analysis of IMPATT diodes.

Two-valley model of compound semiconductors, vd-E characteristics, Gunn effect, modes of operation, small-signal analysis of Gunn diode, power frequency limit.

Unit 4: [12 Hrs]

Construction and operation of microwave PIN diodes, equivalent circuit, PIN diode switches, limiters and modulators.

Unit 5: [12 Hrs]

High frequency limitations of BJT, microwave bipolar transistors, hetero-junction bipolar transistors; Operating characteristics of MOFETs and MOSFETs, short-channel effects, high electron mobility transistor.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain different types of diodes devices and their respective modes of operation.

2Explain the operation of BJT, FET and MOSFET devices and recite their applications.

References:

1. Liao, S.Y., "MicrowaVe Devices and Circuits", 4th Ed., Pearson Education (2 2).
2. Rebeiz, M.G., "R.F. MEMS: Theory, design and Technology", 2nd Ed., wiley-Interscience (2003).
3. Sze, S.M., and Ng, K.K., "Physics of Semiconductor devices", 3rd Ed., wiley-Interscience (2006).
4. Gloer, I.A., Pennoe , S.R. and Shepherd P.R., "Microwave devices, Circuits and Sub- Systems", 4th Ed., John iley & Sons (2 5).
5. Golio, M., "RF and Microwave Semiconductor devices Handboo ", CRC Press (2 2).

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTMW 15(A)

SUBJECT NAME: MICROCONTROLLER SYSTEM DESIGN

Course Objectives: **[60Hrs]**

To understand the concepts of microcontroller based system, to enable design and programming of microcontroller based system.

Unit 1[12 Hrs]

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.

Unit2[12 Hrs]

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.

Unit3[12 Hrs]

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

Unit 4[12 Hrs]

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

Unit 5[12 Hrs]

DSP Processor architecture and sample design using TI – DSP

Course Outcomes:

1..Review 8-bit microcontrollers

2. Implement assembly and c-program of ARM microcontrollers.

3. Design of basic circuits for ARM microcontroller.

4. Design interfacing circuits for ARM microcontroller.

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: MTMW 15(B)

SUBJECT NAME: COGNITIVE RADIO

Course objectives: [60Hrs]

1. To understand the spectrum scarcity problem and how cognitive radio deals with this problem.

2. The contribution of cognitive radio systems in wireless networks and its architectures that enable the development of the cognitive radio network (both centralized and distributed).

3. Technologies to allow an efficient use of TVWS for radio communications.

4. Discussion about various cognitive radio standards.

5. Understanding the various research challenges for deployment of cognitive radio network.

6. Update about current research scenario in this field.

Unit 1: [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 2: [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 3: [10 Hrs]

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

programming.

Unit 4: [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 5: [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 6:[10 Hrs]

Research Challenges in Cognitive Radio: Network layer and transport layer issues, crosslayer 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.
3. Different spectrum sharing models.
4. Efficient sharing of the unutilized spectrum among cognitive and licensed users.
5. Interference avoidance at licensed user due to cognitive user's transmission.

References:

1. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
2. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
3. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.

4. Huseyin Arslan, “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems”, Springer, 2007.
5. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, “Optimizing Wireless Communication Systems” Springer, 2009.
6. Linda Doyle, “Essentials of Cognitive Radio”, Cambridge University Press, 2009.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: PE

SUBJECT CODE: MTMW 15(C)

SUBJECT NAME: DSP ARCHITECTURE

Course objectives: [60Hrs]

1. To understand the key theoretical principles underpinning DSP in a design procedure through design examples and case studies.
2. To learn how to use a powerful general-purpose mathematical package such as MATLAB to design and simulate a DSP systems.
3. To understand the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.
4. To learn to design a real-time signal processing algorithms using the latest fixed-point processor**.**

Unit 1 : [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 2: [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 3: [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 4: [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 5: [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 6: [10 Hrs]

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

Course Outcomes:

At the end of this course, students would be able to Comprehend the knowledge and concepts of digital signal processing techniques. Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor. Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor. •Develop basic DSP algorithms using DSP processors. Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device. Demonstrate the programming of CODEC interfacing.

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 MATLAB", 1st Edition, Springer Netherlands,2007.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: I

CATEGORY: AUDIT

AUDIT COURSE-I

SUBJECT NAME: ENGLISH FOR RESEARCH PAPER WRITING

[60 HRS]

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.

REFERENCES

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

SUBJECT NAME: DISASTER MANAGEMENT

[60 HRS]

UNIT I[12 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 ConflictsNIT II

UNIT II**[12 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**[12 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**[12 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**[12 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.

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

SUBJECT NAME: SANSKRIT FOR TECHNICAL KNOWLEDGE

[60 Hrs]

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

SUBJECT NAME: VALUE EDUCATION

[60 Hrs]

UNIT I [20 Hrs]

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

UNIT II[20 Hrs]

- 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[10 Hrs]

- 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[10 Hrs]

- 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

Suggested reading

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

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: MTMW 21

SUBJECT NAME: ADVANCED MICROWAVE DEVICES

Course Objectives: **[60Hrs]**

This course will enable student to:

1. Understand the basics of RF passive components and circuits
2. Analyze the RF circuits using S-parameters, Signal flow graphs and smith charts.
3. Design RF circuits using EDA tools.
4. Evaluate the performance of designed RF circuits

Unit 1: [15 Hrs]

Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

Unit 2: [15 Hrs]

Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.

Unit 3: [15 Hrs]

Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.

Unit 4: [15 Hrs]

Nonlinearity And Time Variance Inter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

Suggested Reading

1. Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", AuthorHouse, 2009.
2. D.M.Pozar, " Microwave engineering" ,Wiley, 4th edition, 2011.
3. R.Ludwig and P.Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.
4. G.D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear And Non Linear Techniques", John Wiley 1990.
5. S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.
6. Radmanesh, "RF and Microwave Electronics Illustrated , Pearson Education, 2004.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: CORE

SUBJECT CODE: MTMW 22

SUBJECT NAME: EMT THEORY

Course Objectives: **[60Hrs]**

1. To provide the basic skills required to understand, develop, and design various engineering applications involving electromagnetic fields.
2. To lay the foundations of electromagnetism and its practice in modern communications such as wireless, guided wave principles such as fiber optics and electronic electromagnetic structures.

Unit 1[15 Hrs]

Introduction & review of Electromagnetic Field theory, boundary value problems.

Unit 2[15 Hrs]

Time varying fields, Maxwell's equation, source concepts, Duality equivalence principle, induction theorem, reciprocity theorem, Green's function & applications.

Unit 3[15 Hrs]

Plane wave function, Plane waves, Rectangular waveguides Models, Cylindrical wave function, circular guide modes, Coaxial Line modes.

Unit 4 [15 Hrs]

Spherical wave function; Wave transformation.

Course Outcomes

After study through lectures and assignments, students will be able to:

1. Apply vector calculus to static electric-magnetic fields in different engineering situations.
2. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.

3. Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.

4. Analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications.

Reference Books:

1. Plonsey & Collin; Principle & Application of EM Fields
2. R. F. Harrington; Time Harmonic EM Fields
3. Collins; Fields Theory of Guided Waves 4. Ramo & Whinnery; Fields & Waves in Modren Radio.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG.SPECIFIC

SUBJECT CODE: MTMW 23(A)

SUBJECT NAME: SATELLITE COMMUNICATION

Course Objectives: **[60Hrs]**

The goal of the course is to introduce students to the fundamentals of satellite communication. To provide them with a sound understanding of how a satellite communication system successfully transfers information from one earth station to another. To expose them to examples of applications and tradeoffs that typically occur in engineering system design, and to ask them to apply the knowledge in design problems. This course contributes to the educational objectives 1(Fundamental knowledge), 2 (Specialization),3 (design skills) and 4 (self-learning)

Unit 1: [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 2: [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 3: [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 4: [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 5: [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 6: [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

After completing this course students will be able to:

1. Explain the basics of satellite communication
2. Explain and analyzes link budget of satellite signal for proper communication
3. Use the system for the benefit of society 4. Use the different application of satellite communication

References:

1. Timothy Pratt and Others, “Satellite Communications”, Wiley India, 2nd edition,2010.
2. S. K. Raman, “Fundamentals of Satellite Communication”, PearsonEducation 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

SUBJECT CODE: MTMW 23(B)

SUBJECT NAME: MICROWAVE MEASUREMENT

Course Objectives: **[60Hrs]**

The Students learn the characteristics of Microwave components. To gain the practical hands on experience by exposing the students to various microwave components**.**

Unit 1 [12 Hrs]

Microwave detectors, detector characteristics, law of detection, detector mounts, tuning arrangements of probes. Slotted line, effect of penetration of probe, measurement of VSWR and transmission line impedance, measurement of detection law, effect of detection law on VSWR measurement, techniques of high VSWR measurement+, VSWR meter.

Unit 2 [12 Hrs]

Measurement of impedance, S – parameter of networks, Smith chart, reflecto meter and network analysis. Measurement of high, medium and low microwave power, Bolometer, Power bridges and calorie meters.

Unit 3 [12 Hrs]

Measurement of microwave frequency, standard resonating cavities, electronic method of measurement, Microwave counters, comparison of various methods.

Unit 4 [12 Hrs]

Microwave components – attenuator, Phase shifters wave-guide joints, directional couplers, matching screw wave-guide excitation connectors and cables.

Unit 5 [12 Hrs]

Antenna measurement – antenna pattern, antenna impedance, near field and far field errors, Anechoic chambers, Antenna Range.

Course Outcomes:

On completion of this lab course the students will be able to: a. Able to handle microwave equipment b. Able to understand microwave measurements. c. Able to understand Wave guide and antenna measurements

Reference Books:

1. A.K. Maini – Microwave & Radar, Khanna Publisher

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG.SPECIFIC

SUBJECT CODE: MTMW 23(C)

SUBJECT NAME: MICROWAVE CIRCUITS AND SYSTEMS

Course Objectives: **[60Hrs]**

1. To understand Analysis of Waveguides and gain complete knowledge about Microwave Components.
2. Design of Impedance Matching and Tuning using lumped and distributed elements for network. 3. To Analysis and study characteristics of microwave tube Generators and Amplifiers.
4. To Analysis and study characteristics of microwave Semiconductor of detector, switch and generator.

Unit 1: [10 Hrs]

Introduction to Wireless Systems: Classification of wireless systems; Design and performance issues: Choice of operating frequency, multiple access and duplexing, circuit switching versus packet switching, propagation, radiated power and safety; Cellular telephone systems and standards.

Unit 2: [10 Hrs]

Noise and Distortion in Microwave Systems: Basic threshold detection, noise temperature and noise figure, noise figure of a lossy transmission line; Noise figure of cascade systems: Noise figure of passive networks, two-port networks, mismatched transmission lines and Wilkinson power dividers; Dynamic range and inter-modulation distortion.

Unit 3: [10 Hrs]

Resonators: Principles of microwave resonators, loaded, unloaded and external Q, open and shorted TEM lines as resonators, microstrip resonators, dielectric resonators. Power Dividers and Couplers: Scattering matrix of 3- and 4-port junctions; Design of T junction and ilinson power di

iders design of 9 and 8 hybrids. Filters: Analysis of periodic structures, Floquet's theorem, filter design by insertion loss method, maximally flat and Chebyshev designs.

Unit 4: [10 Hrs]

Microwave Amplifier Design: Comparison of active devices such as BJT, MOSFET, MESFET, HEMT, and HBT; Circuit models for FETs and BJTs; Two-port power gains; Stability of transistor amplifier circuits; Amplifier design using S-parameters: Design for maximum gain, maximum stable gain, design for specified gain, low-noise amplifier design, design of class-A power amplifiers.

Unit 5: [10 Hrs]

Mixers: Mixer characteristics: Image frequency, conversion loss, noise figure; Devices for mixers: p-n junctions, Schottky barrier diode, FETs; Diode mixers: Small-signal characteristics of diode, single-ended mixer, large-signal model, switching model; FET Mixers: Single-ended mixer, other FET mixers; Balanced mixers; Image reject mixers.

Switches: Devices for microwave switches: PIN diode, BJT, FET; Device models; Types of switches; Switch configurations; Basic theory of switches; Multi-port, broad-band and isolation switches.

Unit: [10 hrs}

Oscillators and Frequency Synthesizers: General analysis of RF oscillators, transistor oscillators, voltage-controlled oscillators, dielectric resonator oscillators, frequency synthesis methods, analysis of first and second order phase-locked loop, oscillator noise and its effect on receiver performance.

Course Outcomes:

1. Understand various parameters of waveguide and use of component as per applications.

2. Able to design impedance matching network for any transmission line or system.

3. Able to analyze and find applications and limitations of microwave tube Generators and Amplifiers.

4. Able to analyze and find applications and limitations of microwave Semiconductor devices.

5. Able to discriminate different Radars, find applications and use of its supporting systems.

6. Able to find various applications of microwave engineering in specific area

References:

1. Pozar, .M. "Microwave and RF design of wireless Systems", Johnwiley & Sons. 2001
2. Gonzalez, G., "Microwave Transistor Amplifiers: Analysis and design", 2nd Ed., Prentice- Hall. 1997
3. Bahl, I. and Bhartia, P., "Microwave Solid State Circuit design", 2nd Ed., John Wiley & Sons. 2003
4. Chang, K., Bahl, I. and Nair, V., "RF and Microwave Circuit and Component Design for w ireless Systems", wiley Interscience. 2 2
5. Rohde, U.L. and New ir, .P., "RF/Microwave Circuit design for wireless Applications", John Wiley & Sons. 2000
6. Larson, L.E., "RF and Microwa e Circuit design for wireless Applications", Artech House. 1996

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG.SPECIFIC

SUBJECT CODE: MTMW 24(A)

SUBJECT NAME: MILLIMETER WAVE INTEGRATED CIRCUITS

Course Objectives: **[60Hrs]**

1. To understand the integration of microwave devices in the form of IC.
2. To understand the basic principles and advanced applications of Microwave Engineering,
3. To design different amplifier, oscillator and mixers for various applications

Unit 1: [10 Hrs]

Fundamental Concepts: Elements of microwave/millimeter wave integrated circuits; Classification of transmission lines: Planar, quasiplanar and 3-D structures, their basic properties, field distribution and range of applications; Substrate materials and technology used for fabrication.

Unit 2: [10 Hrs]

Analysis of Planar Transmission Lines: Variational approach for the determination of capacitance of planar structures; Transverse transmission line techniques for multi-dielectric planar structures; Rigorous analysis of dielectric integrated guides; Use of effective dielectric constant in the approximate analysis of dielectric guide.

Unit 3: [10 Hrs]

Metamaterials: Theory of Composite Right/Left Handed (CRLH) transmission line metamaterials; Representation of CRLH metamaterial by an equivalent homogeneous CRLH TL; L-C network implementation and its physical realization.

Unit 4: [10 Hrs]

Discontinuities: Analysis of discontinuities in planar and non-planar transmission lines and their equivalent circuit representation.

Unit 5: [10 Hrs]

Passive Circuits: Design and circuit realization of filters, couplers, phase shifters, and switches using planar and non-planar transmission lines.

Unit 6: [10 Hrs]

Active Circuits: Design and circuit realization of amplifiers and oscillators using planar and non-planar transmission lines.

Course outcomes:

1. Design and implement the microwave layouts.
2. Design and implement the microwave amplifier, oscillator, and mixer circuits

References:

1. Leo Young and H. Sobol, Ed. Advances in Microwaves, Vol.2, Academic Press Inc., 1974.
2. B.Bhat and S. Koul, Stripline-like transmission lines for MICs, John Wiley, 1989.
3. T.K. Ishii, Handbook of Microwave Technology, vol. I, Academic Press, 1995.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG.SPECIFIC

SUBJECT CODE: MTMW 24(B)

SUBJECT NAME: ADAPTIVE AND SMART ANTENNAS

Course Objectives: **[60Hrs]**

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Unit 1: [10 Hrs]

Adaptive Array Concept: Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Nulling Limitations due to miscellaneous array effects, Narrow band and broad band signal processing considerations

Unit 2: [10 Hrs]

Optimum Array Processing: Steady state performance limits and the Wiener solution, Mathematical Preliminaries, Signal Description for conventional and signal aligned arrays, Optimum Array Processing for narrowband applications, Optimum Array Processing for broadband applications, Optimum Array Processing for perturbed propagation conditions

Unit 3: [10 Hrs]

Adaptive Algorithms: The least mean square error (LMS) algorithm, the Differential Steepest descent algorithm, the accelerated gradient approach, Gradient algorithm with constraints, Simulation studies.

Unit 4: [10 Hrs]

Recursive Methods for Adaptive Error Processing: The weighted Least Square Error Processor, Updated Covariance Matrix Inverse, Kalman Filter methods for Adaptive Array Processing, the minimum variance processor, Simulation studies.

Unit 5: [10 Hrs]

Effect of Mutual Coupling on Adaptive Antennas: Accounting for mutual effects for dipole array- compensation using open-circuit voltages, compensation using the minimum norm formulation, Effect of mutual coupling- Constant Jammers, Constant Signal, Compensation of mutual coupling- Constant Jammers, Constant Signal, Result of different elevation angle.

Course Outcomes:

References:

1. T. S. Rappaport, Smart antennas: Adaptive arrays, algorithms and wireless position location, IEEE Press, 1998.
2. Frank Gross, Smart antennas for wireless communications, McGra-Hill, 2006.
3. S. Chandran, Adaptive antenna arrays, trends and applications, Springer, 2009.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: PROG.SPECIFIC

SUBJECT CODE: MTMW 24(C)

SUBJECT NAME: PHASED ARRAY ANTENNAS

Course Objectives: **[60Hrs]**

The main objective of the course is to Provide student with theoretical background and applied knowledge so that they can design an phased array antenna for communication system under given power, spectral and error performance constraints.

UNIT -1: **[15 Hrs]**

Phased Arrays in Radar and Communication Systems: System requirements for radar and communication antennas, Array characterization for radar and communication systems, Fundamental results from array theory, Array size determination, Time-delay compression

UNIT -2: [15 Hrs]

Pattern characteristics of Linear and Planar Arrays : Array analysis, characteristics of linear and planer arrays, Scanning to endfire, Thinned arrays.

UNIT-3: [15 Hrs]

Pattern Synthesis for Linear and Planar Arrays: Linear arrays and planar arrays with separable distributions, circular planar arrays and adaptive arrays.

UNIT -4: [15 Hrs]

Electronic Scanning Radar Systems: Frequency and phase scanning, Phase design techniques.

Course Outcomes:

After studying this course the students would gain enough knowledge

1. Analyze the design parameters of PHASED ARRAY ANTENNA FOR communication system.

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

Reference Books:

1. R. J. Mailloux, Phased array antenna handbook, Artech house, 2005.
2. R. C. Hansen, Phased array antennas, John Wiley and Sons, 1998
3. H. J. Visser, Array and phased array antennas basics, John Wiley and Sons, 2005.
4. Alan J. Fenn, Adaptive antennas and phased array for radar and communications, Artech house, 2007.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: AUDIT

AUDIT COURSE-II

SUBJECT NAME: CONSTITUTION OF INDIA

UNIT I[12 Hrs] **[60 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 directions

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

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

SUBJECT NAME: PEDAGOGY STUDIES

[60 Hrs]

UNIT I [10 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 [10 Hrs]

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

UNIT III [10 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 [10 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 [10 Hrs]

- Research gaps and future direction
- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

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

SUBJECT NAME: STRESS MANAGEMENT BY YOGA

[60 Hrs]

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

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: II

CATEGORY: AUDIT

AUDIT COURSE-II

SUBJECT NAME: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

[60 Hrs]

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

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: MTMW 31(A)

SUBJECT NAME: RF IC AND MICROWAVE MEMS

Course Objective: **[60Hrs]**

1. Design of different types of passive filters used for radio frequency application.

2. Radiation phenomena and pattern of various antennas.

3. The various characteristics of different types of antennas

Unit 1[12 Hrs]

Intro to MMIC, Processing & Layers, Passive MMIC Elements & Models, Active MMIC Elements & Models Biasing, Amplifiers.

Unit 2[12 Hrs]

Introduction to MMICs. Technologies: GaAs/Si/InP: MESFET HEMT BJT HBT. Applications, Circuit basics. Fabrication Technology. MMIC components, Active devices, Passive lumped elements, Microstrip elements.

Unit 3 [12 Hrs]

Introduction: RF MEMS for microwave applications, MEMS technology and fabrication, mechanical modeling of MEMS devices, MEMS materials and fabrication techniques.

Unit 4 [12 Hrs]

MEMS Switches: Introduction to MEMS switches; Capacitive shunt and series switches: Physical description, circuit model and electromagnetic modelling; Techniques of MEMS switch fabrication and packaging; Design of MEMS switches.

Unit 5 [12 Hrs]

RF Filters and Phase Shifters: Modeling of mechanical filters, micro-machined filters, surface acoustic wave filters, micro-machined filters for millimeter wave frequencies; Various types of MEMS phase shifters; Ferroelectric phase shifters.Transmission Lines and Antennas: Micro-machined transmission lines, losses in transmission lines, coplanar transmission lines, micro-machined waveguide components; Micro-machined antennas: Micromachining techniques to improve antenna performance, reconfigurable antennas.

Integration and Packaging: Role of MEMS packages, types of MEMS packages, module packaging, packaging materials and reliability issues.

Course Outcomes:

1. Analyze and design RF Filters

2. Analyze the radiation mechanisms of antennas

3. Demonstrate knowledge of antennas in communication systems. Ability to discriminate between antennas on the basis of their electrical performance.

4. Discriminate various antennas on the basis of their electrical performance.

Reference Books:

1. Varadan, V.K., Vinoy, K.J. and Jose, K.J., “RF MEMS and their Applications”, John iley & Sons. 2002.
2. Rebeiz, G.M., “MEMS: Theory esign and Technology”, John iley & Sons. 999.
3. e Los Santos, H.J, “RF MEMS Circuit esign for ireless Communications”, Artech House. 1999
4. Trimmer, ., “Micromechanics & MEMS”, IEEE Press. 996
5. Madou, M., “Fundamentals of Microfabrication”, CRC Press. 997
6. Sze, S.M., “Semiconductor Sensors”, John iley & Sons. 994.

SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

SEMESTER: III

CATEGORY: PE

SUBJECT CODE: MTMW 31(B)

SUBJECT NAME: SELECTED TOPICS IN MATHEMATICAL

Course Objective: **[60Hrs]**

The primary goal of this course is to give students the knowledge of methods of complex analysis, with emphasis on complex differentiation, integration in the complex plane and conformal mappings. Functional analysis part covers the understanding of Hilbert spaces and the properties of especially self-adjoint operators on those spaces.

Unit 1: [12 Hrs]

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 2: [12 Hrs]

Special Distributions: Discrete uniform, Binomial, Geometric, Poisson, Exponential, Gamma, Normal distributions.

- Pseudo random sequence generation with given distribution, Functions of a Random Variable

Unit 3: [12 Hrs]

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 4: [12 Hrs]

Multivariate Data Analysis

- Linear and non-linear models, Regression, Prediction and Estimation
- Design of Experiments – factorial method
- Response surface method

Unit 5: [6 Hrs]

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 6: [6 Hrs]

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 algorithms for minimal spanning tree

Course Outcome:

Inculcate critical thinking to carry out scientific investigation objectively without being biased with preconceived notions. • Equip the student with skills to analyze problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. • Prepare students for pursuing research or careers in industry in mathematical sciences and allied fields • Imbibe effective scientific and/or technical communication in both oral and writing. • Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematical sciences. • Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges

References:

1. Henry Stark, John W. Woods, "Probability and Random Process with Applications to Signal Processing", Pearson Education, 3rd Edition

2. C. L. Liu, “Elements of Discrete Mathematics”, Tata McGraw-Hill, 2nd Edition
3. Douglas C. Montgomery, E.A. Peck and G. G. Vining, “Introduction to Linear Regression Analysis”, John Wiley and Sons, 2001.
4. Douglas C. Montgomery, “Design and Analysis of Experiments”, John Wiley and Sons, 2001.
5. 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: MTMW 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 (20HRS)

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 (10HRS)

Synthesis process of metal nano particles: 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: MTMW 32(A)

SUBJECT NAME: BUSINESS ANALYTICS

Course Objective: **[60Hrs]**

This course is intended for business students with these goals:

1. To provide the key methods of predictive analytics and advanced BI concepts;

2. To provide business decision-making context for these methods;

3. Using real business cases, to illustrate the application and interpretation of these methods.

4. The course will cover R Programming, trends in predictive analytics, and understanding available application programs that can be deployed within the business enterprise.

Unit1: [12 Hrs]

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 modelling, sampling and estimation methods overview.

Unit 2: [12 Hrs]

Trendiness and Regression Analysis: Modelling 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 3: [12 Hrs]

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. 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 4: [12 Hrs]

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

Unit 5: [12 Hrs]

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

Course Outcomes:

After completing this course, you should be able to:

1. Assess Advanced BI concepts and core IT concepts
2. Explain predictive analytics fundamentals
3. Facilitate advanced problem solving using data mining.
4. Critique problems, issues, and trends using predictive analysis
5. Perform predictive analytics and data science
6. Evaluate advanced data science concepts

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: MTMW 32(B)

SUBJECT NAME: OPERATIONS RESEARCH

Course Objectives: **[60Hrs]**

1 .To impart knowledge in concepts and tools of Operations Research

2. To understand mathematical models used in Operations Research

3. To apply these techniques constructively to make effective business decisions

Unit 1: **[12 Hrs]**

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

Unit 2[12 Hrs]

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

Unit 3: **[12 Hrs]**

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

Unit 4[12 Hrs]

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

Unit 5[12 Hrs]

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

Course Outcomes

Solve the mathematical model manually as well as using soft resources/software such as solver, TORA etc. Understand variety of problems such as assignment, transportation, travelling salesman etc. Solve the problems mentioned in point 4 using linear programming approach using software.

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: MTMW 33(C)

SUBJECT NAME: COST MANAGEMENT OF ENGINEERING PROJECTS

Course Objective: **[60Hrs]**

The objective of Cost Management for the client should be to control costs and maximise value for the business and must therefore not be confined to controlling the main project (capital) budget, but should address all budgets related to the project and also the projected impacts upon overall business performance.

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. Isostra in 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, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Course Outcome:

1. Manage the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders.
2. Align the project to the organization's strategic plans and business justification throughout its lifecycle.
3. Identify project goals, constraints, deliverables, performance criteria, control needs, and resource requirements in consultation with stakeholders.
4. Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.
5. Adapt projects in response to issues that arise internally and externally.
6. Interact with team and stakeholders in a professional manner, respecting differences, to ensure a collaborative project environment.
7. Utilize technology tools for communication, collaboration,

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: DISSERTATION

SUBJECT CODE: MTMW DP (I)

MTMW DP (I) Dissertation (PHASE I)

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: MTMW DP(II)

MTMW DP(II) Dissertation (PHASE II)

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, 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