



**SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL**

**Scheme of examination as per AICTE model Curriculum w.e.f July 2020**

**Grading System**

**Course Name –Master of Technology (Digital Communication)**

**Semester I / Year : I**

**Scheme for 2020 Admitted Students onward**

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Hours/ Week			Credit	Total Marks
				Theory			Practical		L	T	P		
				End Sem.	Mid Sem	Quiz, Assignment	End Sem	Term Work					
1	MTDC 11	CORE	ADVANCED DIGITAL SIGNAL PROCESSING	100	30	30	50	50	3	1	4	6	150
2	MTDC 12	CORE	DIGITAL IMAGE AND VIDEO PROCESSING	100	30	30	50	50	3	1	4	6	150
3	MTDC 13	CORE	RESEARCH METHODOLOGY AND IPR	100	30	30	-	-	3	1	-	4	150
4	MTDC 14	PE	ELECTIVE-I	100	30	30	-	-	3	1	-	4	150
5	MTDC 15	PE	ELECTIVE-II	100	30	30	-	-	3	1	-	4	150
6	MTDC 16	AUDIT	AUDIT - I	-	-	-	-	-	2	0	0	0	-
<b>TOTAL</b>				<b>500</b>	<b>150</b>	<b>150</b>	<b>100</b>	<b>100</b>	<b>17</b>	<b>5</b>	<b>8</b>	<b>24</b>	<b>1000</b>

**L: Lecture**

**T:Tutorial**

**P:Practical**

ELECTIVE -I	ELECTIVE -II
MTDC14(A).OPTICAL NETWORK	MTDC15(A) . MICROCONTROLLER SYSTEM DESIGN
MTDC14(B) WIRELESS SENSOR NETWORK	MTDC15(B) .COGNITIVE RADIO
MTDC14(C) .STATISTICAL INFORMATION PROCESSING	MTDC15(C).DSP ARCHITECTURE



**SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL**

**Scheme of examination as per AICTE model Curriculum w.e.f July 2020**

**Grading System**

**Course Name –Master of Technology (Digital Communication)**

**Semester II / Year : I**

**Scheme for 2020 Admitted Students onw**

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Hours/ Week			Credit	Total Marks
				Theory			Practical		L	T	P		
				End Sem.	Mid Sem	Quiz, Assignment	End Sem	Term Work					
1	MTDC 21	CORE	ADVANCED COMMUNICATION NETWORKS	100	30	30	50	50	4	1	2	6	260
2	MTDC 22	CORE	ANTENNA AND RADIATING SYSTEMS	100	30	30	50	50	4	1	2	6	260
4	MTDC 23	PROG SPECIFIC ELECTIVE	ELECTIVE III	100	30	30	-	-	4	1	-	5	160
5	MTDC 24	SPECIFIC ELECTIVE	ELECTIVE IV	100	30	30	-	-	4	1	-	5	160
		CORE	MINI PROJECT	-	-	-	100	60	-	-	4	2	160
6	MTDC 26	AUDIT	AUDIT - II	-	-	-	-	-	2	-	-	-	-
<b>TOTAL</b>				<b>400</b>	<b>120</b>	<b>120</b>	<b>200</b>	<b>160</b>	<b>18</b>	<b>4</b>	<b>8</b>	<b>24</b>	<b>1000</b>

**L: Lecture**

**T:Tutorial**

**P:Practical**

<b>ELECTIVE -III</b>	<b>ELECTIVE -IV</b>	<b>AUDIT COURSE - I</b>
MTDC231.SATELLITE COMMUNICATION	<b>MTDC241. COGNITIVE RADIO</b>	1. Constitution of India
MTDC232. INTERNET OF THING	MTDC252.MIMO SYSTEM	2. Pedagogy Studies
<b>MTDC233.VOICE ABD DATA NETWORKS</b>	MTDC243.MARKOV CHAIN AND QUE	3. Stress Management by Yoga
	MTDC244. WIRELESSAND MOBILE C	4. Personality Development



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Scheme of examination as per AICTE model Curriculum w.e.f July 2020

## Grading System

Course Name –Master of Technology (Digital Communication)

Semester III / Year : II

Scheme for 2020 Admitted Students o

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Hours/ Week			Credit	Total Marks
				Theory			Practical		L	T	P		
				End Sem.	Mid Sem	Quiz, Assignment	End Sem	Term Work					
1	MTDC31	PE	ELECTIVE V	100	30	30	-	-	4	1	-	5	160
2	MTDC32	OE	OE	100	30	30	-	-	4	1	-	5	160
3	MTDC DP(1)	DESSERTATION	DESSERTATION (PHASE-I)	-	-	-	400	280	-	-	20	10	680
<b>TOTAL</b>				200	60	60	400	280	8	2	20	<b>20</b>	<b>1000</b>

**L:** Lecture

**T:**Tutor

**P:**Practical

ELECTIVE -V	OPEN ELECTIVE
MTDC311.COMMUNICATION NETWORK	<b>MTDC321.Business Analytics</b>
MTDC312.SELECTED TOPICS IN	MTDC322.OPERATIONS RESEARCH
<b>MTDC313.NANO MATERIAL AND</b>	MTDC23 COST MANAGEMENT OF



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

Scheme of examination as per AICTE model Curriculum w.e.f July 2020

## Grading System

Course Name –Master of Technology (Digital Communication)

Semester IV / Year : II

Scheme for 2020 Admitted Students o

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Hours/ Week			Credit	Total Marks
				Theory			Practical		L	T	P		
				End Sem.	Mid Sem	Quiz, Assignment	End Sem	Term Work					
1	MTDC DP (II)	DESSERTATION	DESSERTATION (PHASE-II)	-	-	-	500	500	-	-	30	15	1000
<b>TOTAL</b>				-	-	-	500	500	-	-	30	<b>15</b>	<b>1000</b>

**L:** Lecture

**T:**Tutoria

**P:**Practical



## MTDC 11 ADVANCED DIGITAL SIGNAL PROCESSING

### Unit 1

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

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

### Unit 3

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

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

### Unit 5

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, Eigenanalysis Algorithms for Spectrum Estimation.

### Unit 6

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

### References:

- J.G.Proakis and D.G.Manolakis "Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.
- N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.



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- Bruce W. Suter, “Multirate and Wavelet Signal Processing”, 1<sup>st</sup> Edition, Academic Press, 1997.
- M. H. Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley & Sons Inc., 2002.
- S.Haykin, “Adaptive Filter Theory”, 4<sup>th</sup> Edition, Prentice Hall, 2001.
- D.G.Manolakis, V.K. Ingle and S.M.Kogon, “Statistical and Adaptive Signal Processing”, McGraw Hill, 2000.



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 12 DIGITAL IMAGES AND VIDEO PROCESSING

### Unit 1

#### 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 2

#### 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 3

#### 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 4

#### Colour image Processing

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

### Unit 5

#### 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 6

#### 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

### References:

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



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 13 RESEARCH METHODOLOGY AND IPR

### Unit 1

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

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

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.

**Assignment 3: Propose a method for Data Analysis on Research problem identified**

### Unit 4

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

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**

#### 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.





## MTDC 14(A) OPTICAL NETWORK

### Unit 1

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 2

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 3

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 4

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

### Unit 5

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 6

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

### 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



## MTDC14 (B) WIRELESS SENSOR NETWORK

**Unit 1:** 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 2:** Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

**Unit 3:** Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

**Unit 4:** 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 5:** Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

**Unit 6:** Specialized features: Energy preservation and efficiency; security challenges; faulttolerance,

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.

### References:

- H. Karl and A. Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, India, 2012.
  
- C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, “Wireless Sensor Networks”, Springer Verlag, 1<sup>st</sup> Indian reprint, 2010.
- F. Zhao and L. Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Morgan Kaufmann, 1<sup>st</sup> Indian reprint, 2013.
- YingshuLi, MyT. Thai, Weili Wu, “Wireless sensor Network and Applications”, Springer series on signals and communication technology, 2008.



## **MTDC14(C) .STATISTICAL INFORMATION PROCESSING**

**Unit 1:** 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 2:** 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 3:** 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 4:** 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 5:** Information Theory and Source Coding: Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shannon 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 6:** 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.

### **References:**

- Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw-Hill, 2002.
- D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.
- Mourad Barkat, "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.
- R G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968.



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- F. J. MacWilliams and N. J. A. Sloane, “The Theory of Error-Correcting Codes”, New York, North-Holland, 1977.
- Rosen K.H, “Elementary Number Theory”, Addison-Wesley, 6th edition, 2010.



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## EC15 (A) MICROCONTROLLER SYSTEM DESIGN

### Unit 1

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

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

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

### Unit 4

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

DSP Processor architecture and sample design using TI – DSP.

### 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

## MTDC 15(B) COGNITIVE RADIO

### Unit 1:

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:

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:

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

### Unit 4:

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

### Unit 5:

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:

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

### References:

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



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 15(C) DSP Architecture

### Unit 1 :

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:

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:

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 C and Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.

### Unit 4:

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:

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:

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

### References:

- M. Sasikumar, D. Shikhare, Ravi Prakash, “Introduction to Parallel Processing”, 1st Edition, PHI, 2006.
- Fayez Gebali, “Algorithms and Parallel Computing”, 1st Edition, John Wiley & Sons, 2011
- Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald, “Parallel Programming in OpenMP”, 1st Edition, Morgan Kaufman, 2000.



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- Ann Melnichuk, Long Talk, “Multicore Embedded systems”, 1st Edition, CRC Press, 2010.
- Wayne Wolf, “High Performance Embedded Computing: Architectures, Applications and Methodologies”, 1st Edition, Morgan Kaufman, 2006.
- E.S.Gopi, “Algorithmic Collections for Digital Signal Processing Applications Using MATLAB”, 1st Edition, Springer Netherlands, 2007.





# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## AUDIT COURSE-I

### 1. ENGLISH FOR RESEARCH PAPER WRITING

#### UNIT I

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

#### UNIT II

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

#### UNIT III

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

#### UNIT IV

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

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.

#### **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

## 2. DISASTER MANAGEMENT

### UNIT I

#### **Introduction**

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. **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 III

#### **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 IV

#### **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 V

#### **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.

#### **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

## 3. SANSKRIT FOR TECHNICAL KNOWLEDGE

### UNIT I

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

### UNIT II

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

### UNIT III

- 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

## MTDC– 21 ADVANCED COMMUNICATION SYSTEM

### U NIT -1

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.

### U NIT -2

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-3

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.

### U NIT -4

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.

### Reference Books:

1. Mobile Communication By Jochen Schiller
2. Digital Communication By Taub & Schiller
3. Modulation, Coding By Swartz & Noise.



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC –22 ANTENNA AND RADIATING SYSTEMS

### U nit 1

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 impedance calculation between wire antennas and aperture antenna in infinite conductor plane.

### U nit 2

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

### U nit 3

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.

### U nit 4

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

### U nit 5

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

### Reference Books:

1. Antenna Engineering – Krans
2. Electromagnetic Fields & Radiating Systems – Jordan & Balmaini



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 23(A) Satellite Communication

### Unit 1:

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:

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:

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:

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:

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:

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.

### References:

- Timothy Pratt and Others, "Satellite Communications", Wiley India, 2nd edition, 2010.
- S. K. Raman, "Fundamentals of Satellite Communication", Pearson Education India, 2011.
- Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.
- Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008.



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 23(B) INTERNETS OF THINGS

### **Unit 1:**

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

### **Unit 2:**

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 3:**

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

### **Unit 4:**

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 5:**

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

### **Unit 6:**

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

### **References:**

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



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 23(C) Voice and Data Networks

**Unit 1:** Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

**Unit 2:** 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 3:** 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 4:** 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 5:** 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 6:** Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

### References:

- D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, Prentice Hall, 1992.
- L. Peterson and B. S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufman, 2011.
- Kumar, D. Manjunath and J. Kuri, “Communication Networking: An analytical approach”, 1st Edition, Morgan Kaufman, 2004.
- Walrand, “Communications Network: A First Course”, 2nd Edition, McGraw Hill, 2002.
- Leonard Kleinrock, “Queueing Systems, Volume I: Theory”, 1st Edition, John Wiley and Sons, 1975.
- Aaron Kershenbaum, “Telecommunication Network Design Algorithms”, McGraw Hill, 1993.
- Vijay Ahuja, “Design and Analysis of Computer Communication Networks”, McGraw Hill, 1987





# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 24(A) Cognitive Radio

**Unit 1:** 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:** 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:** Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

**Unit 4:** Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

**Unit 5:** 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:** Research Challenges in Cognitive Radio: Network layer and transport layer issues, crosslayer design for cognitive radio networks.

### References:

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



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 23(B) MIMO Systems

**Unit 1:** Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems.

**Unit 2:** 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:**

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

**Unit 5:** 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:** 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.

### **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

## MTDC 24(C) Markov Chains and Queueing Systems

**Unit 1:** Introduction: Review of basic probability, properties of nonnegative random variables, laws of large numbers and the Central Limit Theorem.

**Unit 2:** Renewal Processes: Basic definitions, recurrence times, rewards and renewal reward theorem, point processes, Poisson process, Walds equation, Blackwell's theorem.

**Unit 3:** Discrete time Markov chains: definitions and properties, matrix representation, Perron-Frobenius theory.

**Unit 4:** 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 5:** 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 6:** Advanced queuing models: priority, vacation and retrials in queues.

### References:

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



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## AUDIT COURSE-II

### 1. CONSTITUTION OF INDIA

#### UNIT I

##### **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

. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.

- Curriculum, Teacher education

#### UNIT III

. 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

. 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

##### **Research gaps and future directions**

- Research design
- Contexts
- Pedagogy



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

- 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](http://www.pratham.org/images/resource%20working%20paper%202.pdf).



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## 2. STRESS MANAGEMENT BY YOGA

### UNIT I

Definitions of Eight parts of yog. ( Ashtanga )

### UNIT II

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

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 Training-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

## MTDC 31(A) COMMUNICATION NETWORKS

### **Unit 1:**Introduction:

- Network Architecture, Performance

### **Unit 2:**Connecting nodes:

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

### **Unit 3:**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 4:**End-to-End Protocols:

- Services, Multiplexing, De-multiplexing, UDP, TCP, RPC, RTP

### **Unit 5:**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 6:**Network monitoring – Packet sniffing tools such as Wireshark

Simulations using NS2/OPNET

### **References:**

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



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 31(B) Selected Topics in Mathematics

### **Unit 1:** 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:** 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:** 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:** Multivariate Data Analysis

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

### **Unit 5:** 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:** 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

### **References:**

- Henry Stark, John W. Woods, "Probability and Random Process with Applications to Signal Processing", Pearson Education, 3rd Edition
- C. L. Liu, "Elements of Discrete Mathematics", Tata McGraw-Hill, 2nd Edition
- Douglas C. Montgomery, E.A. Peck and G. G. Vining, "Introduction to Linear Regression Analysis", John Wiley and Sons, 2001.
- Douglas C. Montgomery, "Design and Analysis of Experiments", John Wiley and Sons, 2001.
- B. A. Ogunnaike, "Random Phenomena: Fundamentals of Probability and Statistics for Engineers", CRC Press, 2010.





# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 31(C) Nanomaterials and Nanotechnology

**Unit 1:** Nanomaterials in one and higher dimensions,

**Unit 2:** Applications of one and higher dimension nano-materials.

**Unit 3:** Nano-lithography, micro electro-mechanical system (MEMS) and nano-phonics.

**Unit 4:** carbon nanotubes – synthesis and applications

**Unit 5 and 6:** Interdisciplinary arena of nanotechnology.

### References:

- Nanoscale Materials in Chemistry edited by Kenneth J. Klabunde and Ryan M. Richards, 2nd edn, John Wiley and Sons, 2009.
- Nanocrystalline Materials by A I Gusev and A A Rempel, Cambridge International Science Publishing, 1st Indian edition by Viva Books Pvt. Ltd. 2008.
- Springer Handbook of Nanotechnology by Bharat Bhushan, Springer, 3rd edn, 2010.
- Carbon Nanotubes: Synthesis, Characterization and Applications by Kamal K. Kar, Research Publishing Services; 1st edn, 2011, ISBN-13: 978-9810863975..



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## MTDC 32(A) Business Analytics

### Unit 1:

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, 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:

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:

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 4:

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 5:

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

### Unit 6:

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

### Reference:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

2. Business Analytics by James Evans, persons Education.

## MTDC 32(B) Operations Research

### Unit 1:

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

### Unit 2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex

method - sensitivity analysis - parametric programming

### Unit 3:

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

### Unit 4

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

### Unit 5

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

### 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

## MTDC 32(C) Cost Management of Engineering Projects

### UNIT-I:

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:

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:

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:

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:

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



# SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL

## **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.

## **MTVD 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.

## **MTVD 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 presubmission 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.



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## **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, white 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.



## **SARVEPALLI RADHAKRISHNAN UNIVERSITY, BHOPAL**

- 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



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