MEWAR UNIVERSITY CHITTORGARH (RAJASTHAN)
Faculty of Engineering and Technology

Three – Year (Part-time) M Tech: Digital Communication

Eligibility for Admission: A candidate for being eligible for admission to the Master of Technology in *Digital Communication* in the faculty of engineering and technology should have passed B.Sc. (Engg.)/ B.Tech/ B.E. or any other equivalent degree in the relevant discipline / branch from any recognized Indian or foreign University.

A candidate should have at least 55% marks or equivalent CGPA in the qualifying examination (50% marks or equivalent CGPA for Scheduled Caste/Scheduled Tribes Candidates) on the basis of which the admission is being sought.

Overview of the Programme: The normal duration of programme shall be Six Semesters for part-time students. A part time candidate shall mean a person employed in any government/ semi-government/ private organisation. The duration of the programme is extendable upto five years. However, in exceptional circumstances one-year extension may be granted with approval of the Vice-Chancellor of the University.

The complete programme comprises of 13 theory courses (09 Core and 04 elective) and 02 Lab courses followed by the dissertation in two phases. Student has to obtain at least 40 % marks to pass the examination (both internal and external examination separately) for all the courses specified in the scheme of the programme. The degree will be awarded on the basis of cumulative marks obtained in all the six semesters and the division obtained will be as under:

Marks Obtained	Division / Result
70% and above	1st Division with Honours
60% and above	1st Division
50% to 59%	2nd Division
40% to 49%	Pass Class

MEWAR UNIVERSITY CHITTORGARH (RAJASTHAN)
Scheme of Three – Year (Part-time) M Tech: Digital Communication

First Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Evaluation		External Examination /Viva-voce	Total Marks
		L	P		Assignments /Lab Record	Teacher's Evaluation		
DC – 611	Advanced Digital Communications	4	-	4	30	10	60	100
DC – 613	Satellite Communication	4	-	4	30	10	60	100
DC – 711/713/715	Elective-I	3	-	3	20	10	45	75
DC – 617	Communication Systems Lab	-	2	2	15	10	25	50
Total Semester Credits = 13					**Total Semester Marks = 325**			

Second Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Evaluation		External Examination /Viva-voce	Total Marks
		L	P		Assignments /Lab Record	Teacher's Evaluation		
DC – 612	Information Theory and Coding	4	-	4	30	10	60	100
DC – 614	Optical Communication	4	-	4	30	10	60	100
DC – 712/714/716	Elective-II	3	-	3	20	10	45	75
DC – 618	Optical Communication Lab	-	2	2	15	10	25	50
Total Semester Credits = 13					**Total Semester Marks = 325**			

Third Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Evaluation		External Examination /Viva-voce	Total Marks
		L	P		Assignments /Lab Record	Teacher's Evaluation		
DC – 615	Mobile Communication	4	-	4	30	10	60	100
DC – 621	Digital Signal Processing and its Applications	4	-	4	30	10	60	100
DC – 721/723/725	Elective – III	3	-	3	20	10	45	75
Total Semester Credits = 11					**Total Semester Marks = 275**			

Fourth Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Evaluation		External Examination /Viva-voce	Total Marks
		L	P		Assignments	Teacher's Evaluation		
DC – 616	Data Communication and Computer Networks	4	-	4	30	10	60	100
DC – 624	Antenna Theory and Design	4	-	4	30	10	60	100
DC – 722/724/726	Elective – IV	3	-	3	20	10	45	75
Total Semester Credits = 11					**Total Semester Marks = 275**			

Fifth Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Evaluation		External Examination /Viva-voce	Total Marks
		L	P		Assignments / Report	Teacher/ Committee Evaluation		
DC – 627	Research Methodology	2	-	2	30	20	-	50
DC – 629	Dissertation (Phase-I)	-	4	4	50	50	-	100
Total Semester Credits = 06					**Total Semester Marks = 150**			

Sixth Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Evaluation		External Examination /Viva-voce	Total Marks
		L	P		Report	Teacher(s) Evaluation		
DC – 630	Dissertation (Phase-II)	-	12	12	50	-	250	300
Total Semester Credits = 12					**Total Semester Marks =300**			

LIST OF ELECTIVES

ELECTIVE – I

1.	DC – 711	Network Protocol Design
2.	DC – 713	Low-Power VLSI Design
3.	DC – 715	Modern Telephone Switching Systems

ELECTIVE – III

1.	DC – 721	Digital Image Processing
2.	DC – 723	Photonic Network and Switching
3.	DC – 725	Micro-Electro-Mechanical-Systems (MEMS)

ELECTIVE – II

1.	DC – 712	RF and Microwave Circuit Design
2.	DC – 714	Design of Communication Networks
3.	DC – 716	Modeling and Simulation of Data Networks

ELECTIVE – IV

1.	DC – 722	Microwave Communication
2.	DC – 724	VLSI Design
3.	DC – 726	Internet and Intranet

Internal Assessment/Examination: The internal evaluation for all theory courses (40% of the total marks) will be based on the evaluation of **three assignments** provided during the semester and assessment of the teacher concerned. Similarly, the internal evaluation for all Lab courses (50% of the total marks) will be based on the evaluation of lab record and assessment of the teacher concerned.

External Examination/Viva -voce: For all the theory courses, there will be **08 (Eight)** questions to be set by the external paper setter (nominated /approved by the competent authority) out of which the candidate will have to attempt **05 (Five)** questions all carrying equal marks. Duration of each external examination will be three hours. Similarly, the external evaluation for all Lab courses (50% of the total marks) will be based on the evaluation/viva-voce conducted by an external examiner (from the relevant field) nominated/approved by the competent authority.

Submission and Evaluation of Dissertation:

a) A dissertation supervisor (s) having at least post- graduate qualification, from industry/research organization shall be assigned to the student approved by the competent authority. *In no case, the candidate can have more than two dissertation supervisors.*

b) Dissertation work (Phase-I) in 5^{th} semester shall comprise of literature survey, problem formulation, finalization of goals to be achieved, outlines of the methodology to be used for achieving the targeted goals and final decision about S/W, H/W tools to be used for dissertation work in 6^{th} semester. The entire work will be documented in the form of report.

c) Internal assessment of dissertation (Phase-I) in 5^{th} semester will be made by the committee evaluating the report (50% weightage), oral presentation and response of the student in the discussion / presentation (50% weightage). The dissertation supervisor (s) shall be the member (s) of the committee.

d) The submission of dissertation (Phase-II) in 6^{th} semester shall be allowed only after ensuring that the research work carried out by the candidate has attained the level of satisfaction of the 'Dissertation Supervisor (s)' and proof of communication/acceptance of the research paper (if any, and certified in the report) in the relevant refereed journal/ conference.

e) The final dissertation external examination in 6^{th} semester shall be taken by a panel of examiners comprising of concerned Supervisor (s), one external examiner (from the relevant field) nominated/approved by the competent authority. Hard copies of dissertation, one for each supervisor (s), examiner and the university/ department, are required to be submitted by the student before the final dissertation external examination. The candidate shall appear before the examining committee for oral examination and presentation on the scheduled date.

M TECH: DIGITAL COMMUNICATION

DC – 611 ADVANCED DIGITAL COMMUNICATIONS

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Digital PAM, binary PAM formats, line coding, band limited digital PAM systems, Nyquist pulse shaping, equalization, synchronization techniques, bit and frame synchronization.

Coded pulse modulation, Quantizer, voice digitization rate (VDR) of PCM, DPCM, DM, ADM, CVSD, log PCM, their performance comparison, VDR reduction by speech coding, VOCODERS, noise performance of PCM and DM, Digital multiplexes, FDM, TDM

Digital CW modulation, BPSK, DPSK, DEPSK, QPSK, M'ary PSK, QASK, BFSK, QPR coherent and non-coherent systems, error probabilities in PSK, DPSK, FSK, QPSK, MSK.

Spread Spectrum techniques: DS, CDMA, FH, PN sequence, Power requirement, PN- sequence code, and Walsh's code.

ISDN & Value added communication system simulation & Analysis using MATLAB & Simulink Application using communication toolboxes.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Digital Communication. By Haykins Mc Graw Hill Int Edition.
- Modern Digital & Analog Communication. By B P Lathi,. Willey Eatern Ltd. 2000.
- Communication. Systems by A B Carlson, Tata Mc Graw Hill, 2000.

M TECH: DIGITAL COMMUNICATION

DC – 612 INFORMATION THEORY AND CODING

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Information theory: Base band and band pass sampling theorems reconstruction from samples, Marginal, joint and conditional entropy, information rate, mutual information, channel capacity of various channels, Cascaded channels, repetition of signals.
Shannon's theorem, Shannon – Hartley theorem, BW-S/N ratio trade off, continuous channel, negative entropy, effect of medium on the information, Selection of channels, effect of noise and its minimization.
Coding: Coding efficiency, source encoding, Shannon- Fano code, Huffman code, Data compression, Types of errors and error control strategies, Galois fields, Linear block codes, Error detecting and correcting capabilities of a block code, Hamming code, cyclic code.
Channel encoding – minimum distance, error detection and correction, FEC and ARQ, block code, convolution codes, cyclic codes, signal error correction, multiple error correction, Burst error correction, Cryptography, Encryption, Decryption, general description of basic ARQ strategies.
Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Information theory: F.M Reza, McGraw Hill
- Digital and Analog Communication Systems: K.Sam Shanmugam, John Wiley
- Communication Systems: Analog and Digital: Singh & Sapre, TMH, 1995.
- Digital Communication: B. Sklar, Pearson Education Asia.

M TECH: DIGITAL COMMUNICATION

DC – 613 SATELLITE COMMUNICATION

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Evolution of Satellite Technology, Active & Passive satellite, Modem & Codec, Satellite frequency Bands, Satellite frequency allocation & Band spectrum, Atmospheric & Ionospheric effects on link design, Earth station parameters

Satellite Channel analysis, Digital baseband signals, Digital modulation techniques, Satellite digital link design, cross-links, Carrier to Noise ratios, Frequency reuse with spot beams, Multiple beams.

Orbital parameters, Satellite location with respect to earth, Look angles, Earth coverage & slant range, Eclipse effect, Satellite placement in geostationary orbit, station keeping, Front-end noise. Noise temperature, Front end filters.

Satellite multiple access methods. FDMA, TDMA, CDMA Systems, DS-CDMA and frequency hopped CDMA, Satellite jamming, Code acquisition and tracking.

Satellite applications, Data Communication and VSAT network, Satellite placement in geostationary orbit, station keeping, Satellite stabilization, Mobile satellite services (GEO and NONGEO), BDS, INMARSAT, INTELSAT, VSAT (data broadband satellite), MSAT (Mobile Satellite Communication technique), Sarsat (Search & Rescue satellite) & LEOs (Lower earth orbit satellite), Satellite communication with respect to Fiber Optic Communication.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- The Satellite Communication applications handbook By Brauce. R. Elbert Artech House, Inc.
- Electronic Communication Systems by Wayne Tomasi, Regents Prentice Hall, 1988.
- Satellite Communication by Robert M. Gagliardi, CBS Publisher & 1st ed. 1987
- Digital Satellite Comm By Tri T. Ha, Mc Graw Hill.

M TECH: DIGITAL COMMUNICATION

DC – 614 DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Discrete Time signals - sequences, Representation, Discrete Time Systems – Linear, Time invariant, LTI System, Properties, Constant – coefficient difference equation.

Frequency Domain Representation of discrete time signals & systems, Discrete – Time Random Signals, Z Transform – properties, R.O.C, stability, Causality criterion.

Inverse Z- Transform, Recursive and Non recursive systems, Realization of discrete time system, D.F.T – properties, linear and circular convolution, Discrete Cosine transform, relationship between DFT & DCT.

F.I.R and I.I.R Systems: Basic structure of FIR & IIR, Bilinear transformation, Design of discrete time I.I.R filters – Butterworth, Chebychev, Inv. Chebychev, elliptic etc.

Design of F.I.R filters by windowing – rectangular, Bartlett, Hann, Hamming, Kaiser Window filter, Design method, Relationship of Kaiser to other windows.

Advanced signal processing techniques and transforms: Multirate Signal processing – Down sampling/up sampling, Introduction to discrete Hilbert transform, wavelet transform, Application of DSP to Speech Signal Processing.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- A.V Opprenheim and R.W Schaffer, Discrete – Time signal processing (2nd edition), Prentice Hall
- S. Mittra Digital Signal Processing using MATLAB, 2nd Edition.
- Proakis, Digital Signal Processing, Maxwell Mcmillan.

M TECH: DIGITAL COMMUNICATION

DC – 615 MOBILE COMMUNICATION

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

An overview of wireless communication systems, First generation analog cellular systems, second generation digital cellular systems, third generation systems standards for wireless communications systems, GSM, IMT-2000, UMTS. Mobile Satellite Communication – GEO, LEO, MEO, Terrestrial mobile system.
Cellular communication fundamentals, Cellular systems, Geometry of a Hexagonal Cell, Cochannel interference ratio, Cellular system design, co channel interference reduction. Cell splitting, Frequency Reuse, channel assignment strategies, Frequency and spectrum management and handoffs Access Techniques.
GSM architecture and interfaces, GSM frequency bands, GSM PLMN, GSM PLMN Services, GSM interfaces, Radio interface MS to BTS, interface BTS to MSC, Interface BSC to MSC.
Radio Propagation and cellular engineering concept, Propagation characteristics. Multipath faded radio signals, Radio link design, Receiver sensitivity and link budget.
Data services in GSM, Packet ratio GSM GPRS, Privacy and security in GSM.
Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Wireless Digital Communication- Feher 1991, PHI.
- Principles & applications of GSM – Vijay K Garg, and J E Wilkes 1999 – Prentice hall PTR.
- Telecom Transmission handbook 4th edition Roger L. Freeman 1998 John Wiley & Sons. Inc. New York.
- Mobile Cellular Telecomm, Lee 1995 Mc Graw Hill Inc

M TECH: DIGITAL COMMUNICATION

DC – 616 DATA COMMUNICATION AND COMPUTER NETWORKS

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Overview of Data Communications & Networking: Data Communication, Computer Network, Types, Network Standards, Networking Models, Data Transmission Modes, Multiplexing & Switching, Network Architecture, Layered Architecture, OSI Reference Model, TCP/IP Model.

Network Hardware Components: Connectors, Transceivers, Media Converters, repeaters, Network Interface Card (NIC), Bridges, Switches, Routers, Gateways, Virtual Private Network (VPNs).

High Speed Network: X.25, Frame Relay, Asynchronous Transfer Mode (ATM) High Speed LAN – Ethernet, Fast Ethernet, Gigabit Ethernet, Fiber Channel, Wireless LANs, Wimax, SONET, FDDI, ISDN.

Internet Routing: Routing Protocols, Interior Routing Protocols, Exterior Routing Protocols.

Congestion & Traffic Management: Congestion control in Data Networks & Internets, Flow & Error Control, TCP Traffic Control, Traffic and Congestion Control in ATM Networks.

Network Security: Issues, Threat Assessment, Network Attacks, Firewalls, Encryption Methods, Authentication & Access Control Measures, Digital Certificates, Public Key Infrastructure (PKI).

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Michael A. Gallo & William M. Hancock; Computer Communications & Network Technologies: Thomson Publications 2007.
- William Stallings; High Speed Networks & Internets, Pearson Publications 2007.
- William Stallings; Computer Networking with Internet Protocols & Technology, Pearson Publications 2007.
- Atul Kahate; Cryptography & Network Security: Tata Mcgrawhill 2008.

M TECH: DIGITAL COMMUNICATION

DC – 617 COMMUNICATION SYSTEMS LAB

Internal Assessment/Evaluation: 25 Marks
External Examination: 25 Marks
Duration of Examination: 03 Hours

LIST OF EXPERIMENTS

- Implementation of digital modulation schemes – BASK, BFSK, BPSK.
- Study and Performance comparison of QPSK, DPSK, MSK & GMSK.
- Communication over fading channels – Rayleigh fading & Rician fading channels.
- Simulation of GSM systems.
- Simulation of CDMA systems.
- Implementation of Matched filter, Correlation receiver & Equalizer.
- Carrier recovery and bit synchronization.
- Implementation of multicarrier communication.
- Plotting Eye pattern.
- Constellation diagram of various digital modulation schemes.
- Miniproject in the area of advanced communication/signal processing.

M TECH: DIGITAL COMMUNICATION

DC – 618 DIGITAL SIGNAL PROCESSING LAB

Internal Assessment/Evaluation: 25 Marks
External Examination: 25 Marks
Duration of Examination: 03 Hours

LIST OF EXPERIMENTS

- FIR Digital Filter Design.
- IIR Digital Filter Design.
- FFT of a given signal.
- Plot PSD/Power Spectrum of a signal.
- Discrete Cosine Transform.
- MATLAB Programme for cross correlation and auto correlation.
- Adaptive Filter Design using Standard LMS Algorithm.
- Speech analysis using L.P.C.
- Write MATLAB statement for algebraic equations.
- Working with DSP Processor &Hardware.

M TECH: DIGITAL COMMUNICATION

DC – 621 OPTICAL COMMUNICATION

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Introduction to optical communication, principles of light transmission , optical fiber modes and configuration, Mode theory for circular waveguides, single mode fibers, Multi – mode fibers, Numerical Aperture, Mode Field Diameter, V-Number, Fibre Fabrication Technique.
Optical sources, L.E.D's, LASER Diodes, Modal Reflection Noise, Power Launching & Coupling, Population Inversion, Fiber splicing, optical connector , photo detector PIN, Avalanche, Detector Response Time, Avalanche Multiplication Noise.
Signal Degradation in optical fibers, Attenuation losses, signal distortion in optical waveguides, material dispersion, waveguide dispersion, chromatic dispersion, Intermodal distortion, pulse broadening in graded-index fibers, mode coupling, Advance fiber design: Dispersion shifted, Dispersion flattened, Dispersion compensating fiber, Design optimization of single mode fibres.
Coherent optical fiber communication, Modulation Techniques, Misalignment, Fiber to Fiber joints.
Optical Fiber Link Design: Rise Time Budget and Link power Budget, Long-Haul systems, Bit error Rate.
Line Coding: NRZ, RZ, Block codes, Error correction.
WDM concepts and components, operation, Hologram, Tunable Filters, Directional coupler, Dispersion Management.
Optical Amplifiers – EDFA, Photonic Switching, Optical Networks – SONET/SDH, Optical Interfaces, Ring Topology, Star Architecture

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- G. Keiser, Optical Fiber Communication (3rd Edition), Mc Graw Hill International, 2000.
- D.F Mynbacv and L. Scheiner, Fiber optic communication technology, Pearson Education.
- Ghatak and K. Thyangarajan, Introduction to fiber optics, Cambridge University press.

M TECH: DIGITAL COMMUNICATION

DC – 624 ANTENNA THEORY AND DESIGN

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Antenna Fundamentals and Definitions: Radiation mechanism - over view, Electromagnetic Fundamentals, Solution of Maxwell's Equations for Radiation Problems, Ideal Dipole, Radiation Patterns, Directivity and Gain, Antenna Impedance, Radiation Efficiency. Antenna Polarization.
Resonant Antennas: Wires and Patches, Dipole antennas, Yagi - Uda Antennas, Micro strip Antenna.
Arrays: Array factor for linear arrays, uniformly excited, equally spaced Linear arrays, pattern multiplication, directivity of linear arrays, non- uniformly excited -equally spaced linear arrays, Mutual coupling, multidimensional arrays, phased arrays, feeding techniques, perspective on arrays.
Broad band Antennas: Traveling - wave antennas, Helical antennas, Biconical antennas, Principles of frequency - independent Antennas, spiral antennas, and Log - Periodic Antennas.
Aperture Antennas: Techniques for evaluating Gain, reflector antennas - Parabolic reflector antenna principles, symmetric parabolic reflector antenna, offset parabolic reflectors, dual reflector antennas, Gain calculations for reflector antennas, feed antennas for reflectors, field representations, matching the feed to the reflector, general feed model, feed antennas used in practice.
Antenna Synthesis: Formulation of the synthesis problem, synthesis principles, line sources shaped beam synthesis, linear array shaped beam synthesis
Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Robert E.Collin, Antenna & Wave Propagation, McGraw Hill
- John D. Kraus, Antennas, McGraw Hill.
- E.C.Jordan and K.G.Balmain, Electromagnetic Waves and Radiating Systems, PHI

M TECH: DIGITAL COMMUNICATION

DC – 627 RESEARCH METHODOLOGY

Internal Assessment/Evaluation: 50 Marks

Introduction to Educational Research: Concept; types – basic; applied and action; Need for educational research; Reviewing Literature; Need; Sources – Primary and Secondary; Purposes of Review; Scope of Review; steps in conducting review.

Identifying and defining research problem: Locating; analyzing stating and evaluating problem. Generating different types of hypotheses and evaluating them.

Methods of Research: Descriptive research design - survey; case study; content analysis; Ex-post Facto Research; Co relational and Experimental Research; Design and development of measuring instruments; Tests; questionnaires; checklists; observation schedules; evaluating research instruments; selecting a standardized test.

Data Collection: Procedure of data collection; Aspects of data collection; coding data for analysis; Statistical Methods of Analysis.

Descriptive statistics: Meaning; Graphical representations; mean; Range and standard deviation; characteristics and uses of normal curve; Inferential statistics: t-test; Chi-square tests; correlation (rank difference and product moment); ANOVA (one way); Selecting appropriate methods.

Procedure for writing a research proposal: Purpose; types and components of research proposal; Procedure for writing a research report; Audiences and types of research reports; Format of research report and journal articles.

Strategies for evaluating; Research disseminating and utilizing research – An Overview

Practice Tasks:

- Define a research problem in engineering education/industry after studying problem situation and literature
- Given the purpose, objectives of research, write hypotheses
- Select research designs for the given research objectives
- Identify the measuring instruments for the given research objectives/hypotheses
- Identify the appropriate statistical methods of analysis for the given research proposal.
- Critically analyse the given research reports on various aspects such as hypothesis, design, measuring tools, statistical analysis, interpretation etc. to identify the gaps or weaknesses in the study.

Recommended Books:

- Borg; W and Gall; M. Educational Research: An Introduction; New York; Longman.2003
- Cohen; L. Educational Research in Classrooms and Schools! A Manual of Materials and Methods NY: Harper and Row

Publishers.2000
- CPSC: Developing Skills in Technician Education Research Modules 1 to 11 Singapore; Colombo Plan Staff College for Technician Education
- Garrett; HE and Woodworth; RS. Statistics in Psychology and Education; Educational Research; Bombay: Vakils Fetter and Simons Ltd. 2003
- Gay; LR; Educational Research; Ohio: Charles E. Merril Publishing Company2000
- Wiersma William Research Methods in Education – An Introduction London; Allyn and Bacon; Inc.2000

M TECH: DIGITAL COMMUNICATION

DC – 629 DISSERTATION (PHASE-I)

Internal Assessment/Evaluation: 100 Marks

The primary objective of this course is to enhance the student ability to analyze and carry out independent investigations etc. Each student will carry out independent work which should involve creativity; innovation and ingenuity. A dissertation supervisor (s) having at least post- graduate qualification; from industry/research organization shall be assigned to the student approved by the competent authority. *In no case; the candidate can have more than two dissertation supervisors.* Industry oriented projects may be encouraged for the purpose.

The whole Dissertation work will be carried out and reported in two phases in 5^{th} semester and 6^{th} semester. Dissertation work (Phase-I) in 5^{th} semester shall comprise of literature survey; problem formulation; finalization of goals to be achieved; outlines of the methodology to be used for achieving the targeted goals and final decision about S/W; H/W tools to be used for dissertation work in 6^{th} semester. The entire work will be documented in the form of report.

Internal assessment of dissertation (Phase-I) in 5^{th} semester will be made by the committee evaluating the report (50% weightage); oral presentation and response of the student in the discussion / presentation (50% weightage). The dissertation supervisor (s) shall be the member (s) of the committee.

M TECH: DIGITAL COMMUNICATION

DC – 630 DISSERTATION (PHASE-II)

Internal Assessment/Evaluation: 50 Marks
External Examination: 250 Marks

The complete dissertation work shall comprise of literature survey; problem formulation; methodology used; S/W; H/W tools used; Results and discussion followed by the conclusions & further scope of work in that area. The submission of dissertation in 6th semester shall be allowed only after ensuring that the research work carried out by the candidate has attained the level of satisfaction of the 'Dissertation Supervisor (s)' and proof of communication/acceptance of the research paper (if any; and certified in the report) in the relevant refereed journal/ conference.

The final dissertation external examination in 6th semester shall be taken by a panel of examiners comprising of concerned Supervisor (s); one external examiner (from the relevant field) nominated/approved by the competent authority. Hard copies of dissertation; one for each supervisor (s); examiner and the university/ department; are required to be submitted by the student before the final dissertation external examination. The candidate shall appear before the examining committee for oral examination and presentation on the scheduled date.

M TECH: DIGITAL COMMUNICATION

DC – 711 NETWORK PROTOCOL DESIGN

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Introduction: Network Protocols Syntax and semantics of Traditional protocol specifications, new protocol specifications, First protocol Examples: Vending machine, Request/Reply, Manchester Encoding
Telephone Network Protocols: Protocols stacks, Digital Transmission hierarchy, SONET/SDH Signaling system. Multi Media Communication over global telephone N/W Introduction to Datagram switches, ATM Switches.
Network Processes: Constants, inputs and variables, actions, protocol execution, Messages with fields, Nondeterministic assignment, Process arrays, parameters, Resource allocation protocol
Transmission errors, random and brust errors, maintaining local, global, hierarchical topology information, the abstraction of perfect channel, Application structures
Security: Encryption, classical encryption techniques, advance encryption techniques
Data Compression: Huffman coding, static Huffman compression, dynamic Huffman compression, context sensitive compression, lossy compression
Applications, Protocol layers and hierarchies
Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Mohamed G. Gouda: Elements of Network Protocol Design, John Wiley & Sons 2004
- Douglas E Comer: Computer Networks and Internet with Internet Applications, Fourth Edition, Pearson 2004

M TECH: DIGITAL COMMUNICATION

DC – 712 DIGITAL IMAGE PROCESSING

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Introduction to Image Processing System: Digital Image Fundamentals, Image model, Relationship between pixels, Imaging Geometry, Camera model. Manipulation on Images
Images Transformation: Introduction to FT, DFT & FFT, 2D-DFT, DLT, KLT, DWT, Slant, Harr, Walsh transformation, Hadamard transformation, Hotelling transformation, Histogram, Sub-band coding.
Image Smoothing: Neighborhood averaging, Median filtering lowpass filters, average of multiple images, Image sharpening by differentiation technique, High pass filtering.
Image Restoration: Degradation models for continuous function, effect of diagonalization, On degradation, Algebraic approach to restoration, Interactive restoration, gray level interpolation.
Image Encoding & Segmentation: Encoding, Mapping, Quantizer, Coder, Segmentation, Detection of discontinuation by point detection, line detection, edge detection.
Edge linking & boundary detection: Local analysis, Global by graph theoretic techniques.
Thresholding: Definition, Global thresholding Filtering, Median, Gradient, Simple Method of representation signatures, Boundary Segments, Skeleton of region
Image compression: Lossy and lossless techniques, standards of image compression, video compression, standards of video compression, motion compensation.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Digital Image Processing: Gonzalez & Wood, Addison-Wisley Publisher, 1993.
- Digital Image Processing: A.K Jain, PHI, Edition 1995.

M TECH: DIGITAL COMMUNICATION

DC – 713 LOW POWER VLSI DESIGN

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches. Physics of power dissipation in CMOS devices. Device & Technology Impact on Low Power, Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

Power estimation: Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation, Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Low Power Design: Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network

Algorithm & architectural level methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Gary K. Yeap, Practical Low Power Digital VLSI Design, KAP, 2002
- Rabaey, Pedram, Low power design methodologies Kluwer Academic, 1997
- Kaushik Roy, Sharat Prasad, Low-Power CMOS VLSI Circuit Design Wiley, 2000

M TECH: DIGITAL COMMUNICATION

DC – 714 PHOTONIC NETWORKS AND SWITCHING

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Introduction: Introduction to basic optical communication & devices, WDM optical Network evolution.
Optical Multiplexing Techniques: Wavelength Division multiplexing, Time division multiplexing & code division multiplexing.
Optical Networks: Why optical networks? Conventional optical networks, SONET/SDH, FDDI, IEEE 802.3, DQDB, Multiple access optical networks, WDM optical networks architectures and issues in wavelength routed networks.
All Optical Networks: Amplification in all optical networks, All optical subscriber access networks, Design issues.
Optical Switching & Routing: Optical switching, example of an optical switch using 2 x 2 coupler, evolution of switching technologies, switching architectures, Micro Electro Mechanical Systems (MEMS), free space optical switching, thermoptic & bubble switches, optical routers, Protection of optical switched path. Wavelength converters, Add drop multiplexers with & without wavelength conversions.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Uyless Black, 'Optical Networks', Pearson Education, 2008
- D.K. Mynbaeu & L. Scheiner, 'Fiber Optic Communication Technology', Pearson Edu. Asia, 2008
- C. Siva Ram Murthy & M. Gurusamy, 'WDM Optical Networks' Pearson Education, 2009
- RG Gallager & D Bertsekas, 'Data Networks', PHI, 2006

M TECH: DIGITAL COMMUNICATION

DC – 715 MODERN TELEPHONE SWITCHING SYSTEMS

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Electronic space Division switching: Stored program control (SPC), switching matrices, multistage switching, enhance services photonic switching, cellular mobile telephony: Analog Switch System for Cellular Mobile, Cellular digital switching, centralized & remote controlled small switching system

Time Division switching: Time division space, and time switching, multiplexed switching, combination switching, T-S, T-S-T, switching n-stage combination switching, PBX switching, PBX networking, digital PBX.

Traffic Engg: Traffic load, Grade of service, blocking Probability models of switching systems, Markov processes, Birth-Death processes, delay systems, Models for packetized sources (voice and video), models for traffic flow in packet networks, Erlang's formulas, blocking modeling switching systems, Blocking model.

Subscriber Loop, Dialing Systems: Switching hierarchy & routing, Transmission plan, numbering plan, charging plan, signaling technique.

Local Access Techniques, Digital subscriber lines, DSL, ADSL etc, WLL, FIL, wireless for local telephone services.

Integrated services digital network, Concept of ISDN, ISDN interfaces and End-user applications, ISDN architecture.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Telecomm. Switching systems & networks- Thaigrajan PHI
- Comm. System – Taub & Schilling, Mc Graw Hill
- Telecomm. & the Computers - James Martin – PHI
- The Issential Guide to Telecomm – Pearson Educah- Annabelz Dodd.

M TECH: DIGITAL COMMUNICATION

DC – 716 MICRO-ELECTRO-MECHANICAL-SYSTEMS (MEMS)

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Micro electro mechanical system (MEMS) origins, MEMS impetus/ motivation, Material for MEMS, Processes for micro machining, MEMS fabrication technologies.

Deposition processes, Physical deposition, Physical vapor deposition (PVD), Chemical deposition, Etching processes, Wet etching, Isotropic etching, Anisotropic etching, HF etching, Electrochemical etching, Dry etching, Plasma etching.

Bulk micromachining, Surface micromachining, Patterning of device, Fundamentals MEMS device physics: Actuation. Fundamental MEMS devices: The cantilever beam. Microwave MEMS applications, MEMS switch design considerations,

Micro-machined transmission line, MEMS-based microwave circuit and system, Pressure sensors with embedded electronics (Analog/Mixed signal): Accelerometer with transducer, Sensor, Actuator, Gyroscope, RF MEMS switch with electronics, RF MEMS, and Optical MEMS, Future of MEMS.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Gregory T.A. Kovacs, Micromachined Transducers Sourecbook, The McGraw-Hill, Inc. 1998
- Stephen D. Senturia, Microsystem Design, Kluar Publishers, 2001
- Nadim Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House, 2000.
- M.H. Bao, Micro Mechanical Transducers, Volume 8, Handbook of Sensors and Actuators, Elsevier, 2000.
- Masood Tabib-Azar, Microactuators, Kluwer, 1998.
- Ljubisa Ristic, Editor, Sensor Technology and Devices, Artech House, 1994
- D. S. Ballantine, et. al., Acoustic Wave Sensors, Academic Press, 1997
- H. J. De Los Santos, Introduction to Microelectromechanical (MEM) Microwave Systems, Artech, 1999.
- James M.Gere and Stephen P. Timoshenko, Mechanics of Materials, 2nd Edition, Brooks/Cole Engineering Division, 1984

M TECH: DIGITAL COMMUNICATION

DC – 721 RF AND MICROWAVE CIRCUIT DESIGN

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Wave Propagation in Networks: Introduction to RF/Microwave Concepts and applications; RF Electronics Concepts; Fundamental Concepts in Wave Propagation; Circuit Representations of two port RF/MW networks, Different modes of propagation, Ground waves, Space waves, Surface waves and Tropospheric waves, Ionosphere, Wave propagation in the ionosphere, critical frequency, Maximum Usable Frequency (MUF), Skip distance, Virtual height, Radio noise of terrestrial and extra terrestrial origin, Multipath fading of radio waves.

Passive Circuit Design: The Smith Chart, Application of the Smith Chart in Distributed and lumped element circuit applications, Design of Matching networks.

Basic Considerations in Active Networks: Stability Consideration in Active networks, Gain Considerations in Amplifiers, Noise Considerations in Active Networks.

Active Networks: Linear and Nonlinear Design: RF/MW Amplifiers Small Signal Design, Large Signal Design, RF/MW Oscillator Design, RF/MW Frequency Conversion Rectifier and Detector Design, Mixer Design, RF/MW Control Circuit Design, RF/MW Integrated circuit design.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Matthew M. Radmanesh, Radio Frequency and Microwave Electronics Illustrated, Pearson Education, 2004.
- Reinhold Ludwig and Pavel Bretchko, RF Circuit Design: Theory and Applications, Pearson Education, 2004.

M TECH: DIGITAL COMMUNICATION

DC – 722 MICROWAVE COMMUNICATION

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Microwave radio system: Transmitter & receivers block diagram, FM microwave repeater, diversity protection switching microwave terminal station, repeater station.
Microwave links: Block diagram, path characteristics, system gain, free space path loss, S/N ratio. Measurement of frequency, attenuation, power, dielectric constant, measurement of V.S. W. R., insertion loss and permeability.
Microwave sources: Vacuum tube & solid state devices, microwave modulators microwave amplifiers, transmitting & receiving antennas, microwave detectors, Solid State Microwave Devices: Transferred electron devices- GUNN EFFECT; negative differential resistance phenomenon, field domain formation, GUNN diode structure. Avalanche transit time devices: IMPATT, TRAPATT, BARITT diodes, Parametric amplifiers.
Microwave components: waveguide, joints, Tees, frequency meters, attenuators, ferrite devices, direction couplers etc. isolators and circulators-their constructional features and applications. Microwave filters, Phase shifters, Wavemeters.
Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Advanced Electronic Communication System, W Tomasi, PHI, 1988
- Electronic Communication Systems II Edition Roy Blake Thomsar
- Electronic Communication Kemealy & Dakis TMH

M TECH: DIGITAL COMMUNICATION

DC – 723 DESIGNS OF COMMUNICATION NETWORKS

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Design considerations: Analog design trade offs – Bandwidth, performance, systems complexity.
Digital design trade offs, Performance, bandwidth, bps/Hz comparisons, Digital communication design requirements.
Design features of a computer communication networks: response time, throughput, link design, cost complexity, flow control, security aspects.
Design of cellular mobile system: design parameters at the base station, design parameters at the mobile unit, criteria of signaling design, channel assignment.
Case studies: Paging systems, Cellular telephone, Global positioning satellite.
Network planning for digital microwave network, optical communication, satellite networks, design aspects of LAN, MAN and WAN.
Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Analog & Digital Communication Systems – Martin S. Rodess, Prentice Hall of India Pvt. Ltd. New Delhi, 3rd Edition.
- Data Communications and Distributed networks – U.D Black, Prentice Hall of India Pvt. Ltd. New Delhi 3rd Edition 1997.
- Mobile communications design fundamentals – Williams C.Y Lee, 2nd edition TMH, 1995.

M TECH: DIGITAL COMMUNICATION

DC – 724 VLSI DESIGN

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Introduction to MOSFETs: MOS Transistor Theory - Introduction MOS Device, Fabrication and Modeling, Body Effect, Noise Margin, Latch-up in CMOS

MOS Inverter : MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Transistor Sizing, Static and Switching Characteristics, MOS Capacitor; Resistivity of Various Layers.

Symbolic and Physical Layout Systems, MOS Layers Stick/Layout Diagrams, Layout Design Rules, Issues of Scaling, Scaling factor for device parameters.

Combinational MOS Logic Circuits: Pass Transistors/Transmission Gates, Designing with transmission gates, Primitive Logic Gates, Complex Logic Circuits.

Sequential MOS Logic Circuits: SR Latch, clocked Latch and flip flop circuits, CMOS D latch and edge triggered flip flop. Dynamic Logic Circuits, Basic principle, nonideal effects, domino CMOS Logic, high performance dynamic CMOS Circuits, Clocking Issues, Two phase clocking.

CMOS Subsystem Design: Semiconductor memories, memory chip organization, RAM Cells, dynamic memory cell.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- W. Wolf, Modern VLSI Design: System on Chip, Third Edition, PH/Pearson, 2002.
- N. Weste, K. Eshraghian and M. J. S. Smith, Principles of CMOS VLSI Design: A Systems Perspective, Second Edition (Expanded), AW/Pearson, 2001.
- J. M. Rabaey, A. P. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, Second Edition, PH/Pearson, 2003.
- D. A. Pucknell and K. Eshraghian, Basic VLSI Design: Systems and Circuits, Third Edition, PHI, 1994.
- J. P. Uyemura, CMOS Logic Circuit Design, Kluwer, 1999.
- J. P. Uyemura, Introduction to VLSI Circuits and System, Wiley, 2002

M TECH: DIGITAL COMMUNICATION

DC – 725 MODELING AND SIMULATION OF DATA NETWORKS

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Delay Models in Data Networks: Queuing Models and other Markov System, Networks of Transmission Lines, Time Reversibility, Networks of Queues.

Multi-access Communication: Slotted Multi-access and the Aloha System, Splitting Algorithms, Carrier Sensing, Multi-access Reservations, Packet Radio Networks.

Routing in Data Networks: Introduction, Network Algorithms and Shortest Path Routing, Broadcasting Routing Information: Coping with Link Failures, Flow models, Optimal Routing, and Topological Design, Characterization of Optimal Routing, Feasible Direction Methods for Optimal Routing, Projection Methods for Optimum Routing, Routing in the Codex Network.

Flow Control: Introduction, Window Flow Control, Rate Control Schemes, Overview of Flow Control in Practice, Rate Adjustment Algorithms.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Dimitri Bertsekas and Robert Gallager, Data Networks, 2nd edition, Prentice Hall of India, 2003.
- William Stallings, High-Speed Networks and Internets, Pearson Education (Asia) Pvt. Ltd, 2004.

M TECH: DIGITAL COMMUNICATION

DC 726 INTERNET AND INTRANET

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Development of Internet, Designing principles of Internet, Internetworking architecture Internetworking issues, Connection oriented and connectionless services.

Network layer structure, Internet protocol standards, internetworking, bridges, gateways, Internet IP, Ipv6 The ISO Internet protocol, ISO routing protocols, Transmission and switching

The World Wide Web: Web fundamentals, URL, Web protocols- HTTP, SSL, Services HTTP other web tools, FTP, HTML, Java, VRML, Jargon IRC, WAIS.

Net components: Internet terminology, provider, client & browser, services, viewers, Gateway and Routers. File transfer and management.

Net applications: e mail, Netnews, Telnet, e commerce, Network security firewalls, Digital Signature, Intranet and extranet, virtual terminals, directory services.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Data Communication, Computer Network and Open system: F Halshal, Addison Wesley.
- Internetworking with TCP/IP: Volume I: Comer, PHI.
- Launching Business on the Web: David Cook, PHI