RAJASTHAN TECHNICAL UNIVERSITY

M.Tech. (Digital Communication)
Teaching & Examination Scheme (Full Time) w.e.f. 2008-09

Semester : I

Course Code	Course	Hrs. / Week			Marks		
		L	T	P	IA*	Exam	Total
	Compulsory Courses						
1MDC1	Signal Theory	3	1		25	100	125
1MDC2	Digital Communication System	3	1		25	100	125
1MDC3	Satellite Communication	3	1		25	100	125
	Elective I						
1MDC4.1	High Frequency Electronics	3	1		25	100	125
1MDC4.2	Optimization Techniques	3	1		25	100	125
1MDC4.3	Biomedical Electronics	3	1		25	100	125
1MDC5	Communication System Lab			3	60	40	100
	TOTAL						**600**

Semester : II

Cours`e Code	Course	Hrs. / Week			Marks		
		L	T	P	IA*	Exam	Total
	Compulsory Courses						
2MDC1	Digital Signal Processing	3	1		25	100	125
2MDC2	Information Theory & Coding	3	1		25	100	125
2MDC3	Advanced Optical Communication	3	1		25	100	125
	Elective II						
2MDC4.1	Detection & Estimation Theory	3	1		25	100	125
2MDC4.2	Adaptive Signal Processing	3	1		25	100	125
2MDC4.3	Antenna Theory & Techniques	3	1		25	100	125
2MDC5	Modeling & Simulation Lab			3	60	40	100
	TOTAL						**600**

* I.A. – Internal Assessment

M.Tech. (**Digital Communication)**
Teaching & Examination Scheme (Full Time) w.e.f. 2008-09

Semester : III

Course Code	Course	Hrs. / Week			Marks		
		L	**T**	**P**	**IA***	**Exam**	**Total**
	Compulsory Course						
3MDC1	Mobile Communication	3	1		25	100	125
	Elective III						
3MDC2.1	Telecommunication Switching & Networks	3	1		25	100	125
3MDC2.2	Digital Image Processing	3	1		25	100	125
3MDC2.3	Micro-Electro-Mechanical-Systems	3	1		25	100	125
3MDC4	Dissertation (Stage-I)				100	-	100
3MDC5	Seminar			3	90	60	150
	TOTAL						**500**

Semester : IV

Course Code	Courses	Hrs. / Week			Marks		
		L	**T**	**P**	**IA***	**Exam**	**Total**
4MDC1	Dissertation (Stage-II)				-	500	500
	TOTAL						**500**
	GRAND TOTAL						**2200**

* I.A. – Internal Assessment

RAJASTHAN TECHNICAL UNIVERSITY

SYLLABUS: M.TECH. (DIGITAL COMMUNICATION)

1MDC1 SIGNAL THEORY

Representation of deterministic signals: Orthogonal representation of signals. Dimensionality of signal spaces. Construction of orthogonal basis functions.

Random Processes: Definition and classification, stochastic integrals, Fourier transforms of random processes, stationary and non-stationary processes, correlation functions. Ergodicity, power spectral density, transformations of random processes by linear systems.

Representation of random processes (via sampling, K-L expansion and narrow band representations), special random processes :white Gaussian noise, Wiener-Levy process, Poisson process, shot-noise process, Markov process.

Optimum Filtering: Matched filters for deterministic signals in white and colored Gaussian noise. Wiener filters for random signals in white and colored Gaussian noise.

BOOKS

- Principles Of Linear Systems And Signals,2e (Intl. Version),Lathi ,2nd,Oxford
- Signal & Systems 3e,Chen 3rd,Oxford
- Fundamentals Of Signals And Systems,M.J. Roberts ,Wiley
- Signals And Systems,P Rao,Tmh
- Signals And Systems: A Simplified Approach,Ganesh Rao ,Pearson
- Signals And Systems: Continuous And Discrete,Roger E Ziemer, Phi
- Signals And Systems,Ravi Kumar, ,Phi

1MDC2 DIGITAL COMMUNICATION SYSTEM

Characterization of communication signals, signal space representation, equalisation, matched filtering, binary PSK, QPSK, FSK, QAM & M-Ary modulation techniques and their representation. Coherent & non coherent detection, carrier & symbol synchronization, bits vs symbol error probability, bandwidth efficiency, Spread spectrum modulation: Pseudo noise sequences, DS & FH spread spectrum.

BOOKS

- Analog And Digital Communication,Hwei Hsu, Debjani Mitra , ,Tmh
- Digital Commnunication,Amitabha Bhattacharya, ,Tmh
- Schaums Outline And Digital Communication,Hwei Hsu, ,Tmh
- Taub's Principles Of Communication Systems,Taub & Schilling, ,Tmh
- Electronic Communication Systems,Kennedy, ,Tmh
- Analog And Digital Communication,Sudakshina Kundu, ,Pearson
- Digital Communication,Sklar & Ray, ,Pearson
- Digital Communication,Ian Glover, ,Pearson
- Modern Digital And Analog Communication Systems,Lathi, ,Oxford
- Digital Communications , Simon Haykin, ,Wiley
- Digital And Analog Communication Systems ,K.Sam Shanmugam, ,Wiley
- An Introduction To Analog And Digital Communication System, Simon Haykin, ,Wiley
- Information Theory And Network Coding,Raymond W, ,Springer
- Principle Of Digital Communication,J.Das, ,New Age
- Digital Commnunication,Barry John,Le ,Edward,David.G, ,Springer

1MDC3 SATELLITE COMMUNICAITON

Introduction: Orbital mechanics and launching, earth station and satellite sub systems, satellite link: design and analysis, multiplexing techniques, multiple accesses for satellite links: FDMA, TDMA CDMA & DAMA, propagation effects, DBS-TV, GPS. VSAT: Network architecture, access control protocol & link Analysis

BOOKS

- Fundamentals Of Satellite   Communications ,K.N. Raja Rao, ,Phi
- Wireless Broadband Networks,David T. Wong, Peng-Yong Kong,John Wiley & Sons
- Satellite Communications ,Timothy Pratt, Charles Bostian And, John Wiley & Sons

2MDC1 DIGITAL SIGNAL PROCESSING

DFT & its properties. Decimation in time and decimation in frequency FFT algorithms, discrete cosine transform.
IIR Filter design: Butterworth design, bilinear transformation. Low Pass, High Pass, Band Pass and Band Stop digital filters. Spectral transformation of IIR filters.
FIR filter design: Symmetric and antisymmetric linear phase. FIR filter by rectangular, triangular and Blackman window functions.
Finite word length effects in FIR and IIR digital filters: Quantization, round off errors and overflow errors. Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Polyphase decompositions.

BOOKS

- Digital Signal Processing,Sanjit K Mitra, Tmh
- Digital Signal Processing ,S.Salivahanan A Vallavaraj,C.Gnanapriya,Tmh
- Digital Signal Processing : Principals,Algorithms And Applications,John G.Proakis,Dimitris G Manolakis,Phi
- Digital Signal Processing ,A.V. Oppenheim And R.W. Schaffer,Phi
- Digital Signal Processing ,Thomas J. Cavicchi,John Wiley & Sons
- Digital Signal Processing,Emmanuel Ifeachor,Barry Jervis,Pearson
- Digital Signal Processing,Chi-Tsong Chen,Oxford
- Digital Signal Processing,Engelberg, Shlomo,Springer
- Digital Signal Processing For Measurement ,D Antona, Gabriele ,New Age International

2MDC2 INFORMATION THEORY & CODING

Shannon's fundamental coding theorems, Differential entropy & mutual information for discrete & continuous ensembles, source coding, Rate distortion theory.
Introduction to Algebra:Groups,fields,Binary field arithmatic,Basic properties of Galois field GF(2m)and vector spaces.
Channel coding & decoding: Run length limited codes, LBC, cyclic code, BCH code, convolutional code, Trellis coded modulation, Reed-Solomon code.

BOOKS

- Basic Concepts In Information Theory And Coding , Golomb, PLETINUM PRESS
- Information Theory And Network Coding, Raymond W, Springer
- Taub's Principles Of Communication Systems, Taub & Schilling, TMH
- Digital Communication, Ian Glover, Pearson
- Modern Digital And Analog Communication Systems, Lathi, Oxford
- Digital Communications, Simon Haykin, Wiley
- Digital And Analog Communication Systems, K.Sam Shanmugam, Wiley
- An Introduction To Analog And Digital Communication System, Simon Haykin, Wiley
- Principle Of Digital Communication, J.Das, New Age
- Digital Commnunication, Barry John, Le, Edward, David.G, Springer

2MDC3 ADVANCED OPTICAL COMMUNICATION

Optical fibers: review of fundamentals, Signal distortion and attenuation, Intermodal and intramodal dispersion, dispersion flattened and dispersion compensated fibers, Profile dispersion, study of PMD.
Laser diode and photodiode, Photodetector noise analysis, Analog and Digital communication link design.
WDM, DWDM, optical couplers, Mach-Zehnder interferometer multiplexer, optical add/drop multiplexers, isolators, circulators, optical filters, tunable sources and tunable filters, arrayed waveguide grating, diffraction grating, optical amplifiers, optical integrated circuits .Characterization of optical fibers, OTDR
SONET: frame format, overhead channels, payload pointer, Virtual tributaries, multiplexing hierarchy.
SDH: Standards ,frame structure and features.
Optical switching, WDM networks,
Classification of optical sensors.Intensity modulated, phase modulated and spectrally modulated sensors.

BOOKS

- Optical Fibre And Laser : Principles And Applications,De, Anuradha, New Age
- Opto Electronics And Fibre Optics Communication,Sarkar, D.C,
- Optical Fiber Communications: Principles And Practice,G P Agrawal, Govind P Agrawal, Wiley
- Optical Communication System,Johan Gowar, Phi
- Fiber Optics And Optoelectronics,Khare, Oxford
- Optical Wdm Networks - Principles And Practice ,Biswanath Mukherjee,Oxford
- Optical Fiber Communication: Principles And Practice,: John M Senior, Pearson
- Optical Communication ,Palais, Pearson
- Optical Fiber Communications,Keiser, Gerd, Tmh
- Optical Fiber Communication: Principles And Systems,Selvarajan, A, Tmh

3MDC1 MOBILE COMMUNICATION

Cellular concept. Mobile radio propagation. Co-channel interference. Diversity. Multiple access. Cellular coverage planning. Wireless networking. Wireless systems and standards. Fading channels, spreading codes, power control. WAP and other protocols for internet access. Data transmission in GSM and UMTS, TCP in wireless environment, multi-user detection and its performance analysis. Blue-tooth and other wireless networks, system comparison.
Spread spectrum concept. Basics of CDMA. Properties and generation of PN sequences. Applications of CDMA to cellular communication systems. Second and third generation CDMA systems/ standards. Multicarrier
CDMA. Synchronization and demodulation .Diversity techniques and rake receiver.

BOOKS

- Mobile Cellular Telecommunications ,W.C.Y. Lee,Tmh
- Wireless Communication And Networking,Misra,Tmh
- Wireless Communications ,Theodore S. Rappaport ,Pearson
- Wireless Communication And Networking ,William Stallings,Pearson
- Wireless Communication,Upena Dalal,Oxford
- Broadband Wireless Communications,Jiangzhou Wang,Springer
- Wireless And Mobile Communication,Kumar, Sanjeev ,New Age International

1MDC4.1 HIGH FREQUENCY ELECTRONICS

Analysis of planar transmission lines: Variational method. losses in microstrip lines, analysis & design of devices; passive circuits, impedance transformers, couplers, power dividers, filters, oscillators, mixers, switches, amplifiers (narrow band /broad band) oscillators, active & passive phase shifters.
Microstrip lines on ferrite and garnet substrate; Isolators and circulators; lumped elements in MICs Analysis of basic transmission lines for millimeter wave frequencies. Integrated finline, image guide and its variants, non-radiative guide, H-guide and groove guide. Millimetre wave devices for generation and detection. Transitions, bends and discontinuities.
Monolithic circuit components planar transmission lines, lumped and distributed passive elements.

BOOKS

High Frequency and Microwave Engineering - Ed Da Silva
High Frequency Techniques - Joseph F White.

1MDC4.2 OPTIMIZATION TECHNIQUES

Introduction: Historical development, application to engineering problems, statement of optimization, classification of optimization, examples of optimization problems.
Linear Programming: Graphical method, simplex method, revised simplex method, Big-M method, 2-phase method, alternate optimal solutions, unbounded LPs, degeneracy and convergence, duality in linear programming, sensitivity analysis, dual simplex method, Transportation, assignment and other applications.
Non-Linear Programming: Unconstrained optimization techniques, direct search methods (Fibannoci method, golden section, quadrature and cubic interpolation) descent methods, constrained optimization, direct and indirect methods, optimization with calculm, kuhn-tucker conditions.
Dynamic Programming: Multistage decision process, principles of optimality, computational procedures in dynamic programming.

BOOKS

- Hiller and Lieberman, Introduction to Operation Research (Seventh Edition) Tata McGrawHill Publishing Company Ltd

- Ravindren Philips and Solberg, Operation Research Principles and Practice (Second Edition) John Wiley & Sons.

1MDC4.3 BIOMEDICAL ELECTRONICS

Brief introduction to human physiology. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases.
Bioelectrodes and biopotential amplifiers for ECG, EMG, EEG, etc. Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrsonic and nuclear imaging.
Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.
Telemetry – Transmission of the original through wire & wireless.
Imaging techniques – Ultrasound, CAT, X-Rays, PET, NMR, Nuclear.
Physiological effect of electric current, safety.
Cardiological Signal Processing: Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG parameters & their estimation, the use of multi scale analysis for parameters estimation of ECG waveforms, Arrhythmia analysis, monitoring, long form continuous ECG recording.
ECG data reduction technique, Direct data compression techniques, Direct ECG data compression techniques. Transformation compression techniques. Other data compression techniques. Data compression techniques, comparison.

BOOKS

- Medical Instrumentation: Application And Design, 3ed-,Webster ,Wiley
- Biomedical Signal Processing, D Reddy ,TMH
- Electronics In Medicine And Biomedical Instrumentation, ,Phi
- Biomedical Signal Processing, D.Reddy ,TMH
- Medical Instrumentation Application And Design,John G. Webster,Oxford
- Advanced Methods Of Biomedical Signal Processing,Sergio Cerutti, Oxford

2MDC4.1 DETECTION AND ESTIMATION THEORY

Hypothesis testing:bayes, minimax and Neyman-Pearson criteria. Types of estimates and error bounds. Parameter Estimation: Least square, generalized and recursive least square, estimator properties including error bounds and convergence, MES, ML and MAP estimators. general Gaussian problem. Detection and estimation in coloured noise. Elements of sequential and non-parametric detection. Applications to communication, radar and sonar systems.

BOOKS

- S.M. Kay, Fundamentals of Statistical Signal Processing: Estimation Theory. Englewood Cliffs, NJ:
- H.V. Poor, An Introduction to Signal Detection and Estimation, 2nd ed. New York: Springer-Verlag.
- Gelman, J.B. Carlin, H.S. Stern, and D.B. Rubin, Bayesian Data Analysis, 2nd ed. New York: Chapman & Hall.
- L. Wasserman, All of Statistics. New York: Wiley.

2MDC4.2 ADAPTIVE SIGNAL PROCESSING

Adaptive filtering: Wiener filters, linear prediction, methods of steepest descent and least-squares, least mean square adaptive filters, recursive least-squares adaptive filters, frequency domain & sub-band adaptive filters, kalman filters, square root adaptive filters, order recursive adaptive filters, finite precision effects, IIR adaptive filters. Adaptive algorithms: adaptive equalization and echo cancellation. Applications of adaptive filters.

BOOKS

- Adaptive Signal Processing, Bernard Widrow, Prentice Hall
- Adaptive Signal Processing: Jacob Benesty, Yiteng Huang
- Adaptive Radar Signal Processing: Simon S Haykin
- Optimal and Adaptive Signal Processing: Peter M Clarkson

2MDC4.3 ANTENNA THEORY AND TECHNIQUES

Review of the theory of electromagnetic radiation. Introduction to various antenna types wire, loop and helical antennas, analysis using assumed current distribution.

Aperture antennas: slot, wave guide, horn, and reflector antennas. Analysis using field equivalence principle and Fourier transform methods. Linear arrays. Traveling wave & broadband antennas. Antenna measurements.

Printed antennas: Feeding methods, transmission line & cavity models, analysis and design of rectangular & circular microstrip antenna. Arrays: pattern synthesis, planar arrays, phased arrays. Active antennas and arrays.

Paraboloidal reflector antenna, different feed configurations, shaped beam antennas, lens antenna. Antennas for biomedical applications. Smart antennas for mobile communications. Antenna for infrared detectors.

BOOKS

- Antennas,John Kraus, Ronald Marhefka,Tmh
- Electromagnetic Waves And Radiating Systems,E.C. Jordan And K.G. Balmain, ,Phi
- Antenna Theory: Analysis And Design,Constantine A. Balanis , John Wiley & Sons
- Antenna Theory & Design,Robert S. Elliott, John Wiley & Sons
- Antennas And Wave Propagation,G. S. N. Raju , Pearson
- Antennas And Wave Propagation,A.R. Harish, M. Sachidananda, Oxford
- Antenna Handbook: Antenna Theory,Y. T. Lo, S. W. Lee, Springer
- Antenna Theory And Practice,Chatterjee, R., New Age International

3MDC2.1 TELECOMMUNICATION SWITCHING & NETWORKS

Principles of circuit switching & signaling schemes, space time & space time division switching, single stage & multi stage switching network. Traffic engineering and teletraffic theory.

Markov processes representing traffic, calculation of blocking probability.

Modeling and analysis of important media access control protocols: ALOHA, slotted ALOHA,CSMA,CSMA/CD.

LAN: Ethernet, token ring, FDDI.

B-ISDN architecture, B-ISDN protocols, ATM traffic & congestion control, signaling, routing and addressing, Internetworking: switches, bridges, routers, gateways. ATM switching.

BOOKS

- Digital Telephony,Bellamy ,Wiley
- Fields And Waves In Communication Electronics 3ed By Ramo,Ramo ,Wiley

3MDC2.2 DIGITAL IMAGE PROCESSING

Human visual system and image perception, monochrome & color vision models, color representation; image sampling & quantization; 2-D systems; image transforms; image coding, stochastic models for image representation, image enhancement, restoration & reconstruction, image analysis using multiresolution techniques.
Wavelet Transform for Image Processing: Continuous wavelet transform, discrete wavelet transform, multi-resolution analysis, image compression.

BOOKS

- Digital Image Processing Using MATLAB, Gonzalez, Woods and Eddins, Gatesmark Publishing
- Digital Image Restoration, Andrews, H.C. Hunt, B.R., Prentice Hall, Englewood Cliffs.
- Applications of Digital Signal Processing, Oppenheim, A.V.,Prentice Hall Englewood Cliffs.
- Digital Image Processing, Gonzalez, R.C. and Wintz, P.A., Reading, Addison-Wesley.
- Digital Image Processing, Pratt, W.K., New York: Wiley
- Digital Image Processing of Remotely Sensed Data, Hord, R.M., Academic Press.
- Fundamentals of Digital Image Processing, Jain, A.K., Prentice Hall
- Algorithms for Graphics and Image Processing, Pavlidis, T., Computer Science Press
- Selected Papers on Digital Image Processing, Trivedi, M.M., Optical Engineering Press.
- The Image Processing Handbook, Ross, J.C., CRC Press, Boca Raton

3MDC2.3 MICRO-ELECTRO-MECHANICAL-SYSTEMS (MEMS)

Micro electro mechanical system (MEMS) origins. MEMS impetus/ motivation. Material for MEMS. The toolbox: processes for micro machining. MEMS fabrication technologies. Fundamentals MEMS device physics: Actuation. Fundamental MEMS devices: The cantilever beam. Microwave MEMS applications: MEM switch design considerations. The micro-machined transmission line. MEMS-based microwave circuit and system.

BOOKS

- Max J. Madou: "Fundamentals Of Micro Fabrication"- The science of miniaturization-, Nanogen corporation, USA, CRC press.
- Sergey Edward Lyshevski: "Nano-And Micro Electro Mechanical Systems" – Second edition, CRC press, Boca Ratron London.
- Sherif sedky: "Integrated MEMS"- Artech House, Boston London.
- N. Maluf : Introduction To Micro Mechanical Systems Engineering, Artech House.
- Tai – Ran Hsu: "Mems And Micro Systems: Design And Manufacture" – Tata Mc Graw Hill.

1MDC5 COMMUNICAITON SYSTEM LAB

PART I : PCM AND LINK ANALYSIS

Link establishment, Noise on PCM link, Error detection, BER calculation, Error correction, TDM.

PART II : DIGITAL MODULATION & KEYING

ASK, FSK, PSK, QPSK Modulation and Demodulation.

PART III : CDMA - DSSS

Modulation, Demodulation & BER measurement.

PART IV : SIMULATION IN MATLAB ENVIRONMENT

BPSK, QPSK, FSK Modulation & Demodulation. BER calculation.

2MDC5 MODELING & SIMULATION LAB

EXPERIMENTS USING TMS320C6XXX DSP KITS

1.   FIR Digital Filter Design

2.   IIR Digital Filter Design

3.   FFT of a given signal

4.   Plot PSD/Power Spectrum of a signal

5.   Discrete Cosine Transform

6.   Adaptive Filter Design using Standard LMS Algorithm

7.   Speech analysis using L.P.C.