RAJASTHAN TECHNICAL UNIVERSITY
SYLLABUS: M.TECH. (DIGITAL COMMUNICATION)

1MDC1 SIGNAL THEORY

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

1MDC2 DIGITAL COMMUNICATION SYSTEM


1MDC3 SATELLITE COMMUNICATION

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

2MDC1 DIGITAL SIGNAL PROCESSING

DFT & its properties. Decimation in time and decimation in frequency FFT algorithms, discrete cosine transform.
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.
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 arithmetic, Basic properties of Galois field GF(2^m) and vector spaces. Channel coding & decoding: Run length limited codes, LBC, cyclic code, BCH code, convolutional code, Trellis coded modulation, Reed-Solomon code.

2MDC3 ADVANCED OPTICAL COMMUNICATION


3MDC1 MOBILE COMMUNICATION


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.
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 calculus, kuhn-tucker conditions.
Dynamic Programming: Multistage decision process, principles of optimality, computational procedures in dynamic programming.

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. Ultrasonic 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.

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.

2MDC4.2 ADAPTIVE SIGNAL PROCESSING

2MDC4.3 ANTENNA THEORY AND TECHNIQUES


3MDC2.1 TELECOMMUNICATION SWITCHING & NETWORKS


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 multi-resolution techniques. Wavelet Transform for Image Processing: Continuous wavelet transform, discrete wavelet transform, multi-resolution analysis, image compression.

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

1MDC5 COMMUNICATION 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.