

## 2<sup>nd</sup> Semester

### *MICROWAVE DEVICES*

#### *MMW 551*

Microwave diodes and circuits , varactor diodes, millimeter wave varactor diodes. Detailed calculations of varactor characteristics, Manley Rowe power relations, Varactor applications in a Parametric amplifier and up and down converter.

P-I-N diodes. Use of P-I-N diode as a microwave switch , limiters and phase shifters.

Schottky barrier devices : Detector and mixer diode circuits. Tunnel diodes.

Avalanche transit time devices, bulk Gallium Arsenide devices.

Microwave linear beamtubes Klystrons, Reflex Klystron , TWTs Crossed feed tubes – magnetrons backward and forward cross feed amplifiers and oscillators.

#### **Books :**

1. S.Y. LIAO “Microwave devices and circuits”, Englewood Cliffs, NJ Prentice Hall 1980.
2. Edited by H.A. Watson, “Microwave Semiconductor devices and their circuit applications”, Mc Graw Hill Book Co. New York 1969.
3. Coleman J.T., “Microwave Devices”, Pesto Va Reston 1982.

## MICROWAVE COMMUNICATION

### MMW 552

Microwave radio system: Transmitter & receivers block diagram, FM microwave repeater, diversity protection, microwave terminal station, repeater station

Microwave links: Block diagram path characteristics, system gain, free space path loss, E/N ratio.

Microwave digital communication block diagram, regeneration repeater, digital modulation & demodulation at microwave frequencies analog & digital multiplexing, line codes. Local microwave distribution system.

Propagation of microwave : line of sight, duct propagation as superrefraction, Troposcatter links.

#### **Books :**

Advance Electronic Comm System. W Tomasi , PH  
Electronic Comm. Systems II Edition Roy Blake Thomsar  
Electronic Comm. Kemealy & Dakis TMH

## *ANTENNA ENGG.*

### *MMW 553*

Radiation, related potential, radiation field from current element antenna, radiation, power and radiation resistance of short dipoles & half dipole antennas, directivity and gain calculation.

Antenna as an aperture, resonant and travelling wave antenna for different wavelength, antenna arrays. Binomial and Dolph-Chebyshev optimum distributors. Image antenna, patterns & principle of pattern multiplication.

Helical antenna, Lens antenna, parabolic reflector frequency independent antenna. Horn antenna.

Moment method and its application to a wire antenna, Hallen's Integral equation & its solution. Surface wave, leaky wave & dielectric corrugated antennas.

Radiation resistance & radiation power of short dipole & half dipole antennas Directivity & gain calculation of short dipole & half wave antenna, endfire & band side arrays, Dolph chebychev optimum distribution Radiation resistance of loops. Radiation efficiency,  $Q$ , Bandwidth & S/N ratio of loop antenna.

Practical design consideration for the mono fitter Axial-Mode helical Antenna .

Radiation from linear periodic structures with travelling waves with particular reference to the Helix as a periodic structure Antenna. Tapered & other forms of Axial-mode helical antennas. Hallen's Integral equation & its solution. Cylindrical antenna with conical input sections. Moment method & its application to a wire antenna. Reflector antennas. Septum horns & corrugated horn antennas. Luneburg & Einstein Lens antennas. Broadband & frequency independent antennas. Surface wave & Leaky wave antennas. Dielectric corrugated antennas. Non- radioactive dielectric antennas.

**Books:**

1. John D Kraus "Antennas" Mc Graw Hill International Edition, Second Edition – 1980.
2. Jordan & Balmain "Electromagnetic Waves & Radiating Systems", Prentice Hall India (Ltd.) Second Edition 1971.

## **RADAR ENGG. MMW 554**

Prediction of range performance, Minimum Detectable signal, Receiver Noise, Probability. Density function, signal to noise ratio, cross section of target, cross section fluctuation, pulse repetition freq. and range ambiguities.

CW and freq. Modulated radar, MTI, Pulse Doppler radar, Tracking radar phased array radar, synthetic aperture radar, Air surveillance radar, millimeter wave, laser radars.

Radar Transmitter power, Various transmitter tubes and their characteristics, modulators, Line type modulator, hard tube modulator solid state transmitter.

Radar Antenna: Antenna parameters, Antenna Radiation pattern, Aperture distribution Pattern synthesis, effects of errors on radiation pattern, stabilization of antenna parabolic reflector antenna, Scanning feed reflector antenna, lens antenna, electronically steered phased array antenna.

Detection of Radar signal in Noise, detection criteria, matched filter receiver, correlation detection, detector characteristics, ECM (Electromagnetic Compatibility), ECCM (Electronic Counter- Counter measurement) CFAR (Constant False Alarm Rate) Receiver, Radar Signal design and corresponding receiver design, Millimeter wave radar.

### **Books:**

1. Introduction to Radar Systems : M. I. Skolnik
2. Radar Handbook: M.I. Skolnik.

## **ELECTIVE –II: 1. COMPUTER COMMUNICATION MMW 561**

Introduction to computer network – Protocols, the layered approach, reference models – OSI and TCP/IP, Example networks – Novell NetWare, ARPANET, the Internet.

Physical Layer – Transmission media, wireless transmission, cellular radio, data link layer, sliding window protocols, example data link protocols.

Medium Access Sublayer – Channel allocation, multiple access protocol, IEEE standards, Ethernet, token bus, token ring, DODB, logical link control high speed LANs, satellite networks.

The network layer – Design series, routing algorithms, congestion control algorithms, IP protocol network layer in ATM networks.

The transport layer – Transport services and clients of protocols, TCP and UDP the application layer, network security, recent key and public key algorithms, SNMP-simple network management protocol.

**Books:**

1. Computer Networks – W.S. Tanenbaum
2. Data and Computer Communication – William Stallings

**ELECTIVE –II: 2. DIGITAL SIGNAL PROCESSING  
MMW 562**

Discrete Time signals – sequences, Discrete Time Systems, LTI systems, Frequency Domain Representation of Discrete Time Signal, Constant - Coeff. Difference, equation.

Z – Transform Properties, R. O.C. Inverse Z- Transform Recursive & Non Recursive System.

D.F.T. – Properties, Linear & Circular Convolution, I.D.F.T- Computation of D.F.T: FFT- Decimation in Time & Decimation in Frequency.

I.I.R Systems: Basic structure of FIR & I.I.R, Bilinear Transformation, Design of Discrete Time I.I.R. filters – Butterworth, chebycheu, Inv. Chebycheu, Elliptic etc. Using MATLAB.

F.I.R. Systems :- Design of F.I.R. filter by windowing – Rectangular, Bartlett , Hann, Hamming , kaiser window filter design method, relationship of Kaiser to other windows, Application of MATLAB for Design of Digital Filters, Effect of Finite Register Length in Filter Design.

**Books :**

1. A.V. Oppenheim and R.W. Schaffer, “Discrete Time signal Processing (2<sup>nd</sup> edition)”, Prentice Hall, 1999.
2. S.Mitra “Digital Signal Processing A computer based approach”, TATA Mc. Graw Hill 1998.
3. Proakis, “ Introduction to Digital Signal Processing “ Maxwell Mcmillan, International Edition 1989.

**ELECTIVE – II: 3. NEURAL NETWORKS  
MMW 563**

History of Artificial Neural Networks (ANN), Neuron models, Network architectures, Learning Processes.

Single layer and Multilayer perceptrons , Backpropagation Algorithm, Generalization, Function Approximations, Network pruning techniques.

Radial Basis Function (RBF) Networks, Regularization theory, Generalized RBF Networks, Estimation of the Regularization parameters, Approximation properties of RBF networks, Comparison of RBF and Multilayer perceptrons.

Recurrent Neural Networks, Computational power of recurrent neural networks, learning algorithms, backpropagation through time, Real time recurrent learning.

Engineering Applications of ANN, System identification, Adaptive filter design, solving interpolation and extrapolation problems using ANN, Classification, Function approximation and pattern recognition problems.

**Books :**

1. J.A. Freeman and B.M.Skapure, "Neural Networks, Algorithms Applications and programming Techniques", Addison – Wesley, 1990
2. Laurence Fausett, "Fundamental of Nerual Networks: Architecture, algorithms and application", Prentice Hall, 1994.