Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as deemed to be university under section 3 of UGC Act 1956, vide notification No.F.9-5/2000-U.3)

Syllabus for Entrance Test for Ph.D. Admissions
Department of ECE, ETE, E&I

ELECTRONICS AND COMMUNICATION SYSTEMS

Baseband Data Transmission: Signal and Systems, probability and Random variables, Digital Electronics, Microprocessor, Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication System – Direct Sequence Spread Spectrum Signals – Error Rate Performance of the Decoder, Some Applications of DS Spread Spectrum Signals, Generation of PN Sequences – Frequency Hopped Spread Spectrum Signals – Performance of FH Spread Spectrum Signals in an AWGN Channel, CDMA System Based on FH Spread Spectrum Signals

FIBER OPTIC COMMUNICATION

OPTICAL FIBER WAVEGUIDES: Transmission Characteristics of Optical

Fibers: Attenuation. Material absorption losses in silca glass fibers: Intrinsic absorption, Extrinsic absorption. Linear Scattering Losses: Rayleigh Scattering, Mie scattering.

Non-Linear Scattering Losses: Stimulated Brillouin Scattering, Stimulated Raman

Scattering. Fiber bend loss, Core and Cladding losses. Dispersion: Intramodal Dispersion: Material and Waveguide Dispersion. Intermodal Dispersion: Multimode Step index Fiber, Multi Mode Graded Index Fiber. Overall Fiber Dispersion.

OPTICAL SOURCES, SPLICES AND CONNECTORS:

Light emitting Diodes (LED'S): Principle.

LED Structures: Planar LED, Dome LED, Surface Emitting LED, Edge Emitting LED, Superluminescent LED. Quantum efficiency and LED power, Modulation of LED.

LED Characteristics: Optical output power, Output Spectrum, Modulation Bandwidth, Reliability.

Laser Diodes: Principle, Optical Feedback and Laser Oscillation, Threshold Condition for laser oscillation. **Laser Types:** Distributed Feedback Laser, Single mode laser.

Non semi conductor Lasers: The Nd:YAG Laser, Glass Fiber Laser.**FIBER**

SPLICING: Splicing Techniques: Fusion, V-groove, Elastic Tube. **OPTICAL FIBER CONNECTORS:** Connector Types. **OPTICAL DETECTORS:** Optical detection principles, Absorption, Quantum Efficiency, Responsivity.

Semi conductor photodiodes without Internal gain: p-i-n photodiode.

Semiconductor photodiodes with Internal gain : Avalanche Photodiodes. Photo conductive Detectors, **Photo Detector Noise:** Noise Sources, Signal-to-Noise Ratio.

OPTICAL FIBER SYSTEMS: The Optical Receiver Circuit: Fundamental Optical Receiver Operation.

Digital system Planning Considerations: The Regenerative Repeater, Channel Losses.

Optical Power Budgeting: Link Power Budget, Rise time Budget, Line Coding.

Demodulation schemes: Heterodyne Synchronous Detection, Heterodyne nonsynchronous detection, Homodyne detection. Receiver sensitivities.

MICRO WAVE ENGINEERING

MICROWAVE TUBES: Limitations of Conventional tubes at Microwave

frequencies, Klystron: Velocity – modulation process. Bunching process, output power and beam loading, Multicavity Klystron amplifiers: beam current density, output current and output power of two cavity Klystron, reflex Klystron, Velocity modulation, Power output and efficiency. Traveling Wave tubes, Microwave crossed field tubes: Cylindrical Magnetron, CFA and BWO (Qualitative analysis only).

MICROWAVE PASSIVE COMPONENTS: Wave guide bends and twists, wave guide Tees, Tee junction parameters, fields and currents in tee junctions, theorems on Tee junctions, shunt or H-plane tee, series of E-plane Tee, Equivalent circuit of magic tee, applications of magic tee. Directional couplers, coupler parameters, directional couplers in use, applications of directional couplers, Ferrite Devices, Faraday Rotation Isolator, Circulator, Gyrator (elementary principles only), Attenuators, microwave resonators, rectangular and cylindrical cavity resonators.

MICROWAVE SOLID- STATE DEVICES: Microwave tunnel diode, Avalanche transit time diodes: Read diode, IMPATT diode, TRAPATT diode, GUNN effect diodes and modes of operation, Pin diodes, Varactor diodes, Crystal detectors. BARITT Diode

MICROWAVE INTEGRATED CIRCUITS: Salient Features of MICS, types of Electronic Circuits, MMIC,HIC,FIC,QMIC,, MMIC materials, Methods of MMIC Fabrication, Steps involved in Fabrication, Transmission lines in MICS, Fabrication of MOSFETS in MMICS, Fabrication of CMOS, fabrication of passive components

RADAR SYSTEM ENGINEERING

OPERATIONAL CHARACTERISTICS OF RADAR: Radar Frequencies, Pulsed Operation, Pulse Repetition Frequency, Radar Range Equation, Minimum Detectable Signal, Receiver Noise, Signal to Noise Ratio, Integration of Radar Pulses, Radar Cross Section, Propagation Losses.

RADAR SYSTEMS: Principles and Block diagrams of Pulse Radar, CW Radar, FMCW Radar, MTI Radar, Non -Coherent MTI Radar, Doppler Radar, Tracking Radar, Synthetic Aperture Radar.

DETECTION OF RADAR SIGNALS: Matched Filter Receiver, Correlation Detection, Likelihood Function, Detector Characteristics, Inverse probability, Optimum Design Criteria, Binary Integrators, Delay-Line Integrators.

TARGET PARAMETER ESTIMATION: Statistical Estimation of Parameters, Maximum Likelihood Estimation, Theoretical Accuracy of Range and Doppler Velocity Measurements, Uncertainty Relation, Angular Accuracy, Ambiguity Function and Radar Transmitter waveform Design, Pulse Compression Radar.

RADAR APPLICATIONS: Direction Finders, Instrument Landing System, Ground control Approach, Radar Beacons, Bi-Static Radar, Detection and Tracking of Extraterrestrial Objects, Ionized Media, Earth Satellites and Space Vehicles, Airborne Weather Avoidance Radar.

ANTENNAS

APERTURE TYPE ANTENNAS :Radiation form a planar Aperture : The Fourier Transform Method, Rectangular and Circular Apertures, Uniform Aperture Field with a Linear Phase Variation, Tapered Aperture Field, Field –Equivalence Principles, Application of Field Equivalence Principles to Pyramidal Horns.ANTENNA TYPES : Principles of reflector Antennas, Lens Antennas and array Antennas – A Comparative study, Dual reflector systems, Theory of images, Radomes-principle and design considerations.ARRAY ANTENNAS:N-Element Linear Array : Broadside Array, Ordinary End-fire Array, Hansen-Woodyard End-Fire Array.N-Element Linear Array : Uniform spacing, Nonuniform Amplitude Array Factor, Binomial Array, Dolph – Tschebyscheff Array,Planar Array : Array Factor, Beam Width, Directivity, Design Considerations.Circular Array:Concept of superdirective Array (SDA),ARRAY

SYNTHESIS: Discretization of continuous source : Schelkunoff polynomial Method, Fourier Transform Method, Woodward-Lawson Method.Linear Array Design Procedures : Taylor Line source (Tschebyshceff Error), Taylor Line – Source (One – Parameter)

COMPUTER NETWORKS

PHYSICAL LAYER: Transmission Media, Wireless Transmission, Multiplexing (FDM, TDM, WDM), Switching. Modems

DATA LINK LAYER: Data Link Layer design issues, Error Detection and Correction (Types of Error, Detection, and Error Correction), Flow and Error Control, Stop and Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Sliding Window Protocols, HDLC.

MEDIUM ACCESS CONTROL SUBLAYER: The channel Allocation problem, Random Access-(ALOHA, CSMA, CSMA/CD, CSMA/CA), Ethernet, Fast Ethernet, IEEE802.4, IEEE802.5, Wireless LANs (IEEE802.11,), Bridges

ROUTING PROTOCOLS: Network layer Design Issues, Routing Algorithms – (Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing).

CONGESTION CONTROL & NETWORK LAYER PROTOCOLS: Congestion Control Algorithms-(Congestion Prevention Policies, Traffic Shaping, Flow Specifications, Choke Packets, and Congestion Control for Multicasting), Internetworking, The Network layer in the Internet- (IP Protocol, IP Address, ICMP, ARP, RARP).

TRANSPORT LAYER: The Transport Service, TCP, UDP, **and APPLICATION LAYER:** DNS, E-mail, SNMP, FTP, WWW (Architectural Overview only) **SATELLITE COMMUNICATION**

MULTIPLE ACCESS TECHNIQUES:FDM / FM Satellite Systems, FDMA: SPADE DAMA Satellite System, TDMA CEPT primary Multiplex frame, CDMA: Encoder decoder, Comparison between CDMA, FDMA & TDMA.

SATELLITE LINK DESIGN: Basic transmission theory, System noise temperature and G / T ratio. Design of uplink and down link models, Design of Satellite links for specified C / N ratio.

SPREAD SPECTRUM TECHNIQUES:PN Sequences, Notion of Spread Spectrum, DSSS: DSSS with CBPSK, Processing gain, Probability of error, Acquisition and tracking, FHSS: Slow frequency hopping, Fast frequency hopping. Acquisition and tracking, Practical Jammer types,

SATELLITE PACKET COMMUNICATIONS: Message transmission by FDMA: The M/G/1 Queue, Message Transmission by TDMA – Pure ALOHA: Satellite packer switching – slotted ALOHA – Packet Reservation – Tree algorithm.