

# MPAT – 2013

## University of Rajasthan

### Syllabus for Pre-Ph. D. entrance exam in ICT (126)

#### Part A

##### Engineering Mathematics:

*Linear algebra:* Algebra of matrices, determinants, systems of linear equations, eigen values and eigen vectors

*Numerical methods:* LU decomposition for systems of linear equations, numerical solutions of nonlinear algebraic equations by Secant, bisection and Newton Raphson methods, numerical integration by Trapezoidal and Simpson rules,

*Calculus:* Limit, Continuity and differentiability, Mean value theorems, Theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, total derivatives

*Graph Theory:* Connectivity, Spanning trees, cut vertices and edges, covering, matching independent sets, colouring, planarity, isomorphism

*Combinatorics:* Permutations, combinations, counting, summation, generating functions, recurrence relations, asymptotics

*Integral transforms:* Laplace transforms and Fourier transforms

*Special functions:* Legendre Polynomials, Bessel Polynomials, Hermite Polynomials

*Functions of complex variables:* Analytical functions and complex integrations

#### Part B

**Satellite communication:** Orbital mechanics, Geostationary satellites, Satellite sub systems, Satellite link design and analysis, Modulation and multiplexing techniques, Multiple Access techniques: FDMA, TDMA, CDMA & DAMA, VSATs, DBS-TV, GPS.

**Optical Fiber Communication:** Principles of light propagation in fibers, step index and graded index fibres, mono mode & multimode fibres; connectors, splices, bends, Transmission Losses, Fibre Measurement, Opto electronic devices: LEDs, Lasers, Photo-diodes, PIN diodes etc., WDM, DWDM, optical couplers, optical add/drop multiplexers, isolators, circulators, optical filters, tunable sources and tunable filters, arrayed waveguide grating, diffraction grating, Optical switching.

##### Microwave Engineering:

Waveguide: Rectangular waveguides, Circular wave guides

Microwave sources: Klystron, Magnetron, Traveling wave tubes, Gunn oscillator, Read diode, Tunnel diode,

Scattering matrices, Microwave Components: Directional coupler, Attenuators, Resonators, Ferrite devices,

Antenna and arrays: Antenna parameters, dipole antenna, horn antenna, parabolic disk antenna, linear and planar arrays

**Digital Communication:** Digital representation of information: Review of Line Codes: On-Off (RZ), Polar (RZ), Bipolar (RZ), on-off (NRZ),-Polar (NRZ) & their Power spectrum density (PSD), HDB coding, B8ZS signaling, Characterization of communication channels:

Fundamental limits of digital transmission, PCM, DPCM, DM, ADM, comparison of above systems on the basis of performance criterion such as bit transmission, signalling rate, error probability, S/N ratio, bandwidth requirements. Inter-symbol Interference (ISI), Introduction to BPSK, BFSK, QPSK, QAM, MSK and M-ary, PSK, M-ary FSK transmitter and receiving systems and their Probability of error, Power spectra,

### **Part C**

**Modern Operating System:** Different types of O.S.: batch, multiprogrammed, time-sharing, real-time, distributed, parallel. Process Management, CPU scheduling, Process Synchronization, Memory Management, I/O Management

**Mobile Computing:** Different Standards. AMPS, GSM, GPRS, 3G, Wireless LANs: Characteristics, IEEE 802.11: Architecture, Physical Layer, MAC Layer, MAC Management, 802.11a and 802.11b. HIPERLAN, Blue tooth, Mobile Transport and Network Layer: TCP: Congestion Control, Mobile IP: Introduction, IP Packet Delivery, Agent Discovery, Registration, Tunneling and Encapsulation, Optimizations and Reverse Tunneling. Mobile Ad-hoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing and Alternative Metrics, Cellular Networks: Cellular Concept, Frequency Reuse, Channel Allocation Management, Call Setup, Location Management, Cell Handoffs, and Interference: Co-channel and Adjacent Interference. System Capacity, Improving Cell Capacity and Coverage: Cell Splitting, Sectoring, Repeaters and Micro cell Zone Concept.

**Data communication and Networking:** ISO / OSI stack, transmission media, data encoding, multiplexing, flow and error control, LAN technologies (Ethernet, token ring), network devices- switches, gateways, routers, ICMP, application layer protocols – SMTP, POP3, HTTP, DNS, FTP, Telnet, network security – basic concepts of public key and private key cryptography, digital signatures, firewalls

### **Computer hardware:**

*Digital Logic:* Logic functions, minimization, design and synthesis of combinatorial and sequential circuits, number representation and computer arithmetic (fixed and floating point)

*Computer organization:* Machine instructions and addressing modes, ALU and data path, hardwired and micro-programmed control, memory interface, I/O interface (interrupt and DMA mode), Serial communication interface, instruction pipelining, cache, main and secondary storages