

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL**

## **Credit Based Grading System**

### **Electronics & Communication Engineering, VII-Semester**

#### **EC- 7001 Microwave Engineering**

##### **Unit-I**

###### **Microwave Transmission System**

General representation of EM field in terms of TEM, TE and TM components, Uniform guide structures, rectangular wave guides, Circular Wave guides, Solution in terms of various modes, Properties of propagating and evanescent modes, Dominant modes, Normalized model voltages and currents, Power flow and energy storage in modes frequency range of operation for single mode working, effect of higher order modes, Strip line and micro strip lines general properties, Comparison of coaxial, Micro strip and rectangular wave guides in terms of band width, power handling capacity, economical consideration etc.

##### **Unit-II**

###### **Microwave Networks and Component**

Transmission line ports of microwave network, Scattering matrix, Properties of scattering matrix of reciprocal, Non reciprocal, loss less, Passive networks, Examples of two, three and four port networks, wave guide components like attenuator, Phase shifters and couplers, Flanges, Bends, Irises, Posts, Loads, Principle of operation and properties of E-plane, H-plane Tee junctions of wave guides, Hybrid T, Multi-hole directional coupler, Directional couplers, Microwave resonators- rectangular. Excitation of wave guide and resonators by couplers. Principles of operation of non reciprocal devices, properties of ferrites, Isolators and phase shifters.

##### **Unit-III**

###### **Microwave Solid State Devices and Application**

PIN diodes, Properties and applications, Microwave detector diodes, detection characteristics, Varactor diodes, parametric amplifier fundamentals, Manley-Rowe power relation MASER, LASER , Amplifiers, Frequency converters and harmonic generators using varactor diodes, Transferred electron devices, Gunn effect, Various modes of operation of Gunn oscillator, IMPATT, TRAPATT and BARITT.

##### **Unit-IV**

###### **Microwave Vacuum Tube Devices**

Interaction of electron beam with electromagnetic field, power transfer condition. Principles of working of two cavity and Reflex Klystrons, arrival time curve and oscillation conditions in reflex klystrons, mode-frequency characteristics. Effect of repeller voltage variation on power and frequency of output. Principle of working of magnetrons. Electron dynamics in planar and cylindrical magnetrons, Cutoff magnetic field, Resonant cavities in magnetron,  $\Pi$ -mode operation Mode separation techniques, Rising sun cavity and strapping. Principle of working of TWT amplifier. Slow wave structures, Approximate gain relationship in forward wave TWT.

##### **Unit-V**

###### **Microwave Measurements**

Square law detection, Broadband and tuned detectors. Wave-guide probes, Probe and detector mounts, Slotted line arrangement and VSWR meter, Measurement of wave-guide impedance at load port by slotted line, Microwave bench components and source modulation. Measurement of scattering matrix parameters,

High, Medium and low-level power measurement techniques, Characteristics of bolometers, bolometer mounts, Power measurement bridges, Microwave frequency measurement techniques, calibrated resonators (transmission and absorption type). Network Analyzer and its use in measurements.

#### **References:**

1. Liao: Microwave Devices and Circuits, Pearson Education.
2. Das: Microwave Engineering, TMH.
3. Rao: Microwave Engineering, PHI Learning.
4. Collins: Foundations of Microwave Engineering, Wiley India.
5. Srivastava and Gupta: Microwave Devices and Circuits, PHI Learning.
6. Reich: Microwave Principles, East West Press.
7. Pozar: Microwave Engineering, Wiley India.
8. Roy and Mitra: Microwave Semiconductor Devices, PHI learning.

#### **List of Experiments:**

**Following illustrative practical should be simulated with the help of any RF simulation software:-**

1. Study the characteristics of Klystron Tube and to determine its electronic tuning range.
2. To determine the frequency and wavelength in a rectangular wave-guide working on TE<sub>10</sub> mode.
3. To determine the Standing Wave-Ratio and reflection coefficient.
4. To measure an unknown impedance with Smith Chart.
5. To study the V-I characteristics of Gunn Diode.
6. To study the following characteristics of Gunn Diode.
  - (a) Output power and frequency as a function of voltage.
  - (b) Square wave modulation through PIN diode.
7. Study the function of Magic Tee by measuring the following parameters.
  - (a) Measurement of VSWR at different ports and
  - (b) Measurement of isolation and coupling coefficient.
8. Study the function of Isolator / Circulator by measuring the following parameters.
  - (a) Input VSWR measurement of Isolator / Circulator.
  - (b) Measurement of insertion loss and isolation.
9. Study the function of Attenuator (Fixed and Variable type) by measuring the following parameters.
  - (a) Input VSWR measurement.
  - (b) Measurement of insertion loss and attenuation.
10. Study the function of Multi Hole Directional Coupler by measuring the following parameters.
  - (a) To measure main line and auxiliary line VSWR.
  - (b) To measure the coupling factor and directivity.
11. Study of a network analyzer and measurements using it.

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

## Credit Based Grading System

### Electronics & Communication Engineering, VII-Semester

#### EC- 7002 Satellite Communication

##### Unit-I

**Overview of satellite systems:** Introduction, Frequency allocations for satellite systems.

**Orbits and launching methods:** Kepler's three laws of planetary motion, terms used for earth orbiting satellites, orbital elements, apogee and perigee heights, orbit perturbations, inclined orbits, local mean solar point and sun-synchronous orbits, standard time.

##### Unit-II

**The Geostationary orbit:** Introduction, antenna look angles, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage, launching orbits.

**Polarization:** antenna polarization, polarization of satellite signals, cross polarization discrimination.

**Depolarization:** ionospheric, rain, ice.

##### Unit-III

**The Space segment:** introduction, power supply, attitude control, station keeping, thermal control, TT&C subsystem, transponders, antenna subsystem, Morelos and Satmex 5, Anik-satellites, Advanced Tiros-N spacecraft.

**The Earth segment:** introduction, receive-only home TV systems, master antenna TV system, Community antenna TV system, transmit-receive earth station.

##### Unit-IV

**The space link:** Introduction, Equivalent isotropic radiated power (EIPR), transmission losses, the link power budget equation, system noise, carrier-to-noise ratio (C/N), the uplink, the downlink, effects of rain, combined uplink and downlink C/N ratio, inter modulation noise, inter-satellite links.

Interference between satellite circuits.

##### Unit-V

###### Satellite services

**VSAT (very small aperture terminal) systems:** overview, network architecture, access control protocols, basic techniques, VSAT earth station, calculation of link margins for a VSAT star network.

**Direct broadcast satellite (DBS) Television and radio:** digital DBS TV, BDS TV system design and link budget, error control in digital DBS-TV, installation of DBS-TV antennas, satellite radio broadcasting.

##### References:

1. Roddy: Satellite Communications, TMH.
2. Timothy Pratt: Satellite Communications, Wiley India.
3. Pritchard, Suyderhoud and Nelson: Satellite Communication Systems Engineering, Pearson Education.
4. Agarwal: Satellite Communications, Khanna Publishers.
5. Gangliardi: Satellite Communications, CBS Publishers.
6. Chartrand: Satellite Communication, Cengage Learning.
7. Raja Rao: Fundamentals of Satellite communications, PHI Learning.
8. Monojit Mitra: Satellite Communication: PHI Learning.

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

## Credit Based Grading System

### Electronics & Communication Engineering, VII-Semester

#### EC- 7003 Optical Communication

##### Unit-I

**Overview of Optical Fiber Communications (OFC):** Motivation, optical spectral bands, key elements of optical fiber systems.

**Optical fibers:** basic optical laws and definitions, optical fiber modes and configurations, mode theory for circular waveguides, single mode fibers, graded-index fiber structure, fiber materials, photonic crystal fibers, fiber fabrication, fiber optic cables.

##### Unit-II

**Optical sources:** Light emitting diodes (LED): structures, materials, quantum efficiency, LED power, modulation of an LED. Laser diodes: modes, threshold conditions, laser diode rate equations, external quantum efficiency, resonant frequencies, structure and radiation patterns, single mode lasers, modulation of laser diodes.

**Power launching and coupling:** source to fiber power launching, fiber to fiber joints, LED coupling to single mode fibers, fiber splicing, optical fiber connectors.

##### Unit-III

**Photo detectors:** pin photo detector, avalanche photodiodes, photo detector noise, detector response time, avalanche multiplication noise.

**Signal degradation in optical fibers:** Attenuation: units, absorption, scattering losses, bending losses, core and cladding losses. Signal distortion in fibers: overview of distortion origins, modal delay, factors contributing to delay, group delay, material dispersion, waveguide dispersion, polarization-mode dispersion. Characteristics of single mode fibers: refractive index profiles, cutoff wavelength, dispersion calculations, mode field diameter, bending loss calculation. Specialty fibers.

##### Unit-IV

**Optical receivers:** fundamental receiver operation, digital receiver performance, eye diagrams, coherent detection: homodyne and heterodyne, burst mode receiver, analog receivers.

**Digital links:** point to point links, link power budget, rise time budget, power penalties.

**Analog links:** overview of analog links, carrier to noise ratio, multi channel transmission techniques.

## Unit-V

### Optical technologies

**Wavelength division multiplexing (WDM) concepts:** operational principles of WDM, passive optical star coupler, isolators, circulators, active optical components: MEMS technology, variable optical attenuators, tunable optical filters, dynamic gain equalizers, polarization controller, chromatic dispersion compensators.

**Optical amplifiers:** basic applications and types of optical amplifiers, Erbium Doped Fiber Amplifiers (EDFA): amplification mechanism, architecture, power conversion efficiency and gain. Amplifier noise, optical SNR, system applications.

**Performance Measurement and monitoring:** measurement standards, basic test equipment, optical power measurements, optical fiber characterization, eye diagram tests, optical time-domain reflectometer, optical performance monitoring.

### References:

1. Keiser: Optical Fiber Communications, TMH.
2. Senior: Optical Fiber Communication- Principles and Practices, Pearson Education.
3. Agarwal: Fiber Optic Communication Systems, Wiley India.
4. Palais: Fiber Optics Communications, Pearson Education.
5. Satish Kumar: Fundamentals of optical Communications, PHI Learning.
6. Khare: Fiber Optics and Optoelectronics, Oxford University Press.
7. Ghatak and Thyagrajan: Fiber Optics and Lasers, Macmillan India Ltd.
8. Gupta: Optoelectronic Devices and Systems, PHI Learning.
9. Sterling: Introduction to Fiber Optics, Cengage Learning.

### List of Experiments:

1. Launching of light into the optical fiber and calculate the numerical aperture and V-number.
2. Observing Holograms and their study.
3. Measurement of attenuation loss in an optical fiber.
4. Diffraction using gratings.
5. Construction of Michelson interferometer.
6. Setting up a fiber optic analog link and study of PAM.
7. Setting up a fiber optic digital link and study of TDM and Manchester coding.
8. Measurement of various misalignment losses in an optical fiber.

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL**

## **Credit Based Grading System**

### **Electronics & Communication Engineering, VII-Semester**

#### **Elective-III EC- 7004 (1) Data Communication**

##### **COURSE CONTENT:**

###### **Unit-I**

Introduction, Switching Techniques: Circuit Switching, Message Switching, Packet Switching, Protocols, Layered Network Architecture and Architecture of OSI & TCP/IP Reference model, ATM Model, ISDN and BISDN, Physical Layer Transmission Medium, Modem, Topologies.

###### **Unit-II**

Data Link Layer: Framing , HDLC, ARQ: Stop and Wait, Sliding Window. Efficiency, Error detection and Correction. CRC, Checksum, MAC Sub layer – LAN Protocols, ALOHA, Slotted, ALOHA, CSMA, CSMA/CD, Token Bus, Ring.

###### **Unit-III**

Network Layer: Routing – Data gram and Virtual Ckt, Dijkstra's, Bellman Ford, DV and Link state routing. Congestion Control and ATM Traffic Management – AAL, X.25, Internet Layer : IP Protocols, ICMP, ARP and RARP.

###### **Unit-IV**

Transport Layer: Connection Oriented transport Protocol Mechanism, TCP, TSAP, Transport Flow Regulation, UDP Fragmentation & Reassembly, Session and Transport Interaction, Synchronization Points, Session Protocols Data Unit.

###### **Unit-V**

Translation, Encryption / Decryption, Data Compression . Application Layer Protocols like: FTP, TFTP, RPC, Remote Login, DNS, SMTP, SNMP.

##### **References:**

1. Data and Computer Communication – W. Stallings, Pearson
2. LANs – Keiser, Tata Mc-Graw Hill
3. Data Communication & Networking – B.A. Forouzan, Tata Mc-Graw Hill
4. Internetworking with TCP/IP – VOL-I – D.E. Comer, PHI
5. ISDN and Broad band ISDN with Frame Relay & ATM – W. Stallings, Pearson

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL**

## **Credit Based Grading System**

### **Electronics & Communication Engineering, VII-Semester**

#### **Elective-III EC- 7004 (2) Power Electronics**

#### **COURSE CONTENTS**

##### **Unit-I**

Advantages and application of power electronic devices characteristics, Symbol & application of power diodes, power transistors, GTO, TRIAC, DIAC, Power MOSFET, IGBT, LASCR, Fast recovery diode, schottkey diode MCTs. Principle of operation of SCR, Two transistor analogy, brief idea of construction of SCR, Static characteristics of SCR, Condition of turn on & off of SCR Gate characteristics, Method for turning on of SCR, Turnoff methods, different commutation techniques (Class A,B,C,D,E, & F Commutation) firing of SCR, Resistance firing circuit, Resistance, capacitance firing circuit, UJT firing cut, protection of SCR over voltage, Over current, Superior firing, Design of snubber circuit and protection of gate of SCR, heating, cooling & mounting of SCR.

##### **Unit-II**

Operation and analysis of single phase (Half wave & Full Wave) and multiphase (Three Phase) uncontrolled and controlled rectifier circuit with resistive, resistive & inductive load (continuous & non continuous conduction, inductive loads and RLE loads. Estimation of average load voltage and load current for above rectifier circuits active and reactive power input. Effect of freewheeling diode and source inductance on performance of this rectifier circuits Comparison of mid-point & Bridge rectifier circuits. Power factor correction, simulation and modeling of convertor topologies in Matlab/Simulink.

##### **Unit-III**

Voltage source & current source inverter, Single phase and three phase bridge inverter, self cumulated inverters, McMurray & McMurray bed ford inverters, Voltage control of single phase and three phase bridge inverter, Harmonics & their reduction techniques. Simulation and modeling of single phase and three phase inverters in Matlab/Simulink.

##### **Unit-IV**

Principle of chopper operation, various control strategies in chopper, Step up & step-up/step down choppers, chopper configuration (Type A, B, C, D, & E), Current & voltage commutation of chopper circuits Jones & Morgens chopper. Simulation and modeling of choppers in Matlab/Simulink.

##### **Unit-V**

Single phase (midpoint & bridge configuration) and three phase cyclic convertor configuration and operating principles. AC voltage controllers (using SCRs & TRIACs) single phase full wave controller with R and RL load, Estimation of RMS load voltage, RMS load current and input power factor, three phase AC voltage controller (Without analysis) Switched mode voltage regulator buck, Boost, Buck & Boost, Cuck regulators.

#### **References:**

1. M.H. Rashid, Power Electronics Circuits, Devices and Applications, Pearson Education, Singapore, 1993.
2. M Ramsmoorthy, An Introduction to transistor and their application, Affiliated East-West Press.
3. Shailendra Jain, Modeling and Simulation using Matlab Simulink, Wiley India Pvt. Ltd.
4. M.D. Singh, K.B. Khanchandani, Power Electronics, TMH, Delhi, 2001.
5. Chakravarti A., Fundamental of Power Electronics and Drives, Dhanpat Ray & Co.
6. Dr. P.S. Bhimbhra, Power Electronics, Khanna Pub.
7. Vedam Subramanyam, Power Electronics New Age International Revised II ed. 2006.
8. Randall Shaffer, Fundamentals of Power Electronics with MATLAB Cengage Learning 2008

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

## Credit Based Grading System

### Electronics & Communication Engineering, VII-Semester

#### Elective-III EC- 7004 (3) Digital Image Processing

##### Unit-I

###### Digital Image Processing (DIP)

Introduction, examples of fields that use DIP, fundamental steps in DIP, components of an image processing system.

**Digital Image Fundamentals:** elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels.

##### Unit-II

###### Image Transforms

Two-dimensional (2D) impulse and its shifting properties, 2D continuous Fourier Transform pair, 2D sampling and sampling theorem, 2D Discrete Fourier Transform (DFT), properties of 2D DFT.

**Other transforms and their properties:** Cosine transform, Sine transform, Walsh transform, Hadamard transform, Haar transform, Slant transform, KL transform.

##### Unit-III

###### Image Enhancement

**Spatial domain methods:** basic intensity transformation functions, fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear), sharpening spatial filters (unsharp masking and high boost filters), combined spatial enhancement method.

**Frequency domain methods:** basics of filtering in frequency domain, image smoothing filters (Butterworth and Gaussian low pass filters), image sharpening filters (Butterworth and Gaussian high pass filters), selective filtering.

##### Unit-IV

###### Image Restoration

Image degradation/restoration, noise models, restoration by spatial filtering, noise reduction by frequency domain filtering, linear position invariant degradations, estimation of degradation function, inverse filtering, Wiener filtering, image reconstruction from projection.

##### Unit-V

###### Image Compression

**Fundamentals of data compression:** basic compression methods: Huffman coding, Golomb coding, LZW coding, Run-Length coding, Symbol based coding.

Digital image watermarking, representation and description- minimum perimeter polygons algorithm (MPP).

###### References:

1. Gonzalez and Woods: Digital Image Processing, Pearson Education.
2. Anil Jain: Fundamentals of Digital Image Processing, PHI Learning.
3. Annadurai: Fundamentals of Digital Image Processing, Pearson Education.
4. Sonka, Hlavac and Boyle: Digital Image Processing and Computer Vision, Cengage Learning.
5. Chanda and Majumder: Digital Image Processing and Analysis, PHI Learning.
6. Jayaraman, Esakkirajan and Veerakumar: Digital Image Processing, TMH.
7. William K. Pratt, Digital Image Processing, Wiley India.



# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL**

## **Credit Based Grading System**

### **Electronics & Communication Engineering, VII-Semester**

#### **Elective-IV EC- 7005 (1) Information Theory & Coding**

##### **COURSE CONTENTS**

###### **Unit I**

Introduction : Information Theory, Information and entropy, joint and conditional entropy, differential entropy, relative entropy, mutual information, relationship between entropy and mutual information.

###### **Unit II**

Source coding: Shannon's source coding theorem, Huffman coding, Shannon Fano coding. Channel Coding Channel capacity, binary symmetric channel, binary erasure channel, Shannon's channel coding theorem.

###### **Unit III**

Linear Block Codes: Definition, properties, matrix description of linear block codes, generator and parity check matrix, encoding of linear block codes, decoding of linear block codes, syndrome decoding, standard array, co-sets, perfect codes, systematic block code, Hamming code.

###### **Unit IV**

Cyclic Codes: Introduction, properties of cyclic codes, polynomials and division algorithm, and decoding of cyclic codes, matrix description of cyclic codes, burst error correction, cyclic redundancy check. Circuit implementation of cyclic codes.

###### **Unit V**

Convolution Codes: Introduction, tree codes and trellis codes, polynomial description of convolution codes, distance notation, generating function, matrix description, viterbi decoding. Course Outcomes: After successfully completing the course students will be able to understand concept of fundamental of Information Theory and Coding. Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.

##### **References:**

1. Das, Mullick and Chatterjee: Principles of Digital Communication, New Age International Publishers.
2. Cover and Thomas: Elements of Information Theory, Wiley India.
3. Ranjan Bose: Information Theory, Coding and Cryptography, TMH.
4. Lin and Costello: Error Control Coding, Pearson Education.
5. Moon: Error Correction Coding, Wiley India. 6. Wells: Applied Coding and Information Theory for Engineers, Pearson Education

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

## Credit Based Grading System

### Electronics & Communication Engineering, VII-Semester

#### Elective-IV EC- 7005 (2) Wireless Communication

##### Unit-I

###### Introduction

**Applications and requirements of wireless services:** history, types of services, requirements for the services, economic and social aspects.

**Technical challenges in wireless communications:** multipath propagation, spectrum limitations, limited energy, user mobility, noise and interference-limited systems.

**Propagation mechanism:** free space loss, reflection and transmission, diffraction, scattering by rough surfaces, wave guiding.

##### Unit-II

###### Wireless Propagation channels

**Statistical description of the wireless channel:** time invariant and variant two path models, small-scale fading with and without a dominant component, Doppler spectra, temporal dependence of fading, large scale fading.

**Wideband and directional channel characteristics:** causes of delay dispersion, system theoretic description of wireless channels, WSSUS model, condensed parameters, ultra wideband channels, directional description.

##### Unit-III

**Channel models:** Narrowband, wideband and directional models, deterministic channel-modeling methods.

**Channel sounding:** Introduction, time domain measurements, frequency domain analysis, modified measurement methods, directionally resolved measurements.

**Antennas:** Introduction, antennas for mobile stations, antennas for base stations.

##### Unit-IV

**Transceivers and signal processing:** Structure of a wireless communication link: transceiver block structure, simplified models. Modulation formats, demodulator structure, error probability in AWGN channels, error probability in flat-fading channels, error probability in delay and frequency-dispersive fading channels.

##### Unit V

**Diversity:** Introduction, microdiversity, macrodiversity and simulcast, combination of signals, error probability in fading channels with diversity reception, transmit diversity.

**Equalizers:** Introduction, linear equalizers, decision feedback equalizers, maximum likelihood sequence estimation (Viterbi detector), comparison of equalizer structures, fractional spaced equalizers, blind equalizers.

##### References:

1. Molisch: Wireless Communications, Wiley India.
2. Taub and Schilling: Principles of Communication Systems, TMH.
3. Haykin: Modern Wireless Communication, Pearson Education.

4. Upena Dalal: Wireless Communication, Oxford University Press.
5. Rappaport: Wireless Communication, Pearson Education.
6. Price: Wireless Communication and Networks, TMH.
7. Palanivelu and Nakkereeran : Wireless and Mobile Communication, PHI Learning.
8. Chidambara Nathan: Wireless Communication, PHI Learning.

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL**

## **Credit Based Grading System**

### **Electronics & Communication Engineering, VII-Semester**

#### **Elective-IV EC- 7005 (3) Operating Systems**

##### **COURSE CONTENT**

###### **Unit-I**

Introduction to System Programs & Operating Systems, Evolution of Operating System (mainframe, desktop, multiprocessor, Distributed, Network Operating System, Clustered & Handheld System), Operating system services, Operating system structure, System Call & System Boots, Operating system design & Implementations, System protection, Buffering & Spooling. Types of Operating System: Bare machine, Batch Processing, Real Time, Multitasking & Multiprogramming, time-sharing system.

###### **Unit-II**

File: concepts, access methods, free space managements, allocation methods, directory systems, protection, organization ,sharing & implementation issues, Disk & Drum Scheduling, I/O devices organization, I/O devices organization, I/O buffering, I/O Hardware, Kernel I/O subsystem, Transforming I/O request to hardware operations. Device Driver: Path managements, Sub module, Procedure, Scheduler, Handler, Interrupt Service Routine. File system in Linux & Windows

###### **Unit-III**

Process: Concept, Process Control Blocks (PCB), Scheduling criteria Preemptive & non Preemptive process scheduling, Scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling, operations on processes, threads; inter process communication, precedence graphs, critical section problem, semaphores, and classical problems of synchronization. Deadlock: Characterization, Methods for deadlock handling, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock, Process Management in Linux.

###### **Unit-IV**

Memory Hierarchy, Concepts of memory management, MFT & MVT, logical and physical address space, swapping, contiguous and non-contiguous allocation, paging, segmentation, and paging combined with segmentation. Structure & implementation of Page table. Concepts of virtual memory, Cache Memory Organization, demand paging, page replacement algorithms, allocation of frames, thrashing, demand segmentation.

###### **Unit-V**

Distributed operating system:-Types, Design issues, File system, Remote file access, RPC, RMI, Distributed Shared Memory(DSM), Basic Concept of Parallel Processing & Concurrent Programming Security & threats protection: Security violation through Parameter, Computer Worms & Virus, Security Design Principle, Authentications, Protection Mechanisms. Introduction to Sensor network and parallel operating system. Case study of UNIX, Linux & Windows,

##### **References:**

1. Silberschatz ,”Operating system”, Willey Pub.
2. Stuart,”Operating System Principles, Design & Applications”, Cengage Learning
3. Tannanbaum, “Modern operating system”,PHI Learning
4. Dhamdhare, ”Operating System”,TMH.
5. Achyut S Godbole,”Operating System”, TMH.
6. William stalling, “operating system” Pearson Edu.
7. Deitel & Deitel, “Operating Systems”, Pearson Edu.
8. Flynn & Mchoes, “Operating Systems”, Cengage Learning
9. Haldar, “Operating System”, Pearson Edu.