DETAILED SYLLABUS FOR THE POST OF ENGINEERING ASSISTANT(ELECTRONICS)/OVERSEER GR.I(ELECTRONICS) IN PWD(ELECTRONICS WING)(CATEGORY NO.578/2024)

ELECTRONIC DEVICES AND CIRCUITS (25 Marks)

Diodes: Semiconductors – PN Junction diode – Forward and reverse bias characteristics – specifications – Zener diode – construction and working principle – characteristics – Zener break down – Avalanche break down – Zener diode as a voltage regulator – applications – specifications.

Rectifier:Introduction – Classification of Rectifiers – Half Wave rectifier – Full Wave rectifier – Bridge rectifier – Efficiency – Ripple factor – Applications – Filters – C, LC and PI filters.

Transistor: Transistor as an amplifier –Transistor biasing – Fixed bias, Collector base bias, Self bias – CB, CE, CC Configurations – Characteristics – comparison between three configurations in terms if input impedance, output impedance, current gain, voltage gain – RC coupled amplifier – Load characteristic analysis – Emitter follower and its applications – Negative feed back – Transistor as a switch. Transistor oscillator – classifications – condition for oscillation (Barkhausen criterion) – General form of LC oscillator – Hartley oscillator – Colpitts oscillator – RC phase shift oscillator , Crystal oscillator .

Field Effect Transistor: Construction – working principle of FET – Difference between FET and BJT – characteristics of FET – specifications – FET amplifier (Common source amplifier), FET as CHOPPER, UJT – construction – equivalent circuit – operation -characteristics – UJT as a relaxation oscillator. MOSFET – construction – characteristics – MOSFET as a switch - CMOS basic concept IGBT – Basic principle – IGBT as a

switch.

Opto – Electronics Devices and Waveshaping Circuits: LDR, LED, 7 segment LED, LCD, Opto coupler –Opto interruptor – Infrared transmitter and Receiver – Laser Diode – Solar Cell – Avalanche Photodiode – Photo transistor. Diode clipper – Types – Clamper circuits using diode – Voltage doubler – Astable, Monostable and Bistable operations using Transistor.

Operational Amplifier : Ideal op.Amp – Block diagram and characteristics – (Minus input follows Plus input and no current through Minus and Plus input) – Op-amp parameters- CMRR – Slew rate – Virtual ground – Applications of op-amp-Inverting amplifier – Summing amplifier – Non inverting amplifier – Voltage follower – Comparator – Zero crossing detector – Integrator – Differentiator – Op.Amp specifications. 555 Timer – Functional Block diagram – Astable, Monostable and Schmitt Trigger – Sequence timer. IC voltage regulator – 3 pin IC regulators – 78xx, 79xx, LM 317.

D/A Convertor: Basic concepts – Weighted Resistor D/A convertor – R-2R Ladder D/A convertor – Specification of DAC IC Sampling and quantization – Analog to digital conversion using Ramp method – Successive approximation method – Dual slope method, simultaneous method voltage to frequency convertor – Frequency to voltage convertor specification of A/D convertor.

ELECTRONIC COMMUNICATION (25 Marks)

Networks: Symmetrical and asymmetrical networks, characteristic impedance and propagation constant deviation of characteristic impedance for T and Pi networks using Zoc and Zsc, image and iterative impedances – Derivation of Z_{11} and Z_{12} for assymetrical T and L Networks using Zoc and Zsc, Derivation of iterative impedances for assymetrical T network. Equaliser : Types, applications, constant resistance equalizer. (No derivations)

Attenuator: types, derivations for elements of symmetrical T and Pi networks – application.

Filters: types and definitions – derivations for circuit elements and cut off frequencies of LPF and HPF only. Transmission lines (No equations and derivations): Transmission line equivalent circuit, primary and secondary constants, travelling and standing waves, SWR, Wave guides: types,advantages.

Antennas & Propagation: Basic antenna principle, directive gain, directivity, radiation pattern, broad-side and end-fire array, Yagi antenna, Parabolic antenna. Ground wave propagation, space waves, ionospheric propagation.

Modulation: Electromagnetic Frequency spectrum. Need for modulation, types of modulation. Amplitude modulation: expression, AM spectrum and side bands, types of AM – balanced modulator. SSB generation – phase shift and filter methods, advantages and disadvantages of SSB, AM VSB System. Diode detector AM Transmitter : Types of Transmitters, Block diagram – high level AM transmitter and low level AM transmitter. SSB transmitter, ICW and MCW principles . AM receiver: TRF receiver, superheterodyne radio receiver - explanations of individual stages – AGC types, SSB receiver

Frequency modulation: Expression, wave forms, frequency spectrum , effects of

noise in FM, comparison of AM and FM, varactor diode modulator. FM detectors – slope detector, phase discriminator, ratio detector (no derivation)

FM Transmitters : Direct and Indirect methods – stereophonic FM transmitter.

FM Receiver : Block Diagram – AFC – Stereophonic FM receiver

Phase modulation: Principles, Phase modulator circuit, comparison between FM and PM

Pulse modulation: Types, Sampling Theorem, Generation and detection of PAM, PWM and PPM, PCM – transmitter, receiver, quantizing noise – companding.

Microphones: Construction and performances of the following microphones: carbon, condenser, peizo electric, moving coil and velocity ribbon.

Loud Speakers: Constructional details of dynamic cone type, Horn type and electrostatic loud speakers, woofer, midrange and tweeter ; cross over network, surround – sound systems

Audio recording and reproduction: Magnetic system - Compact Disc system – MP3 system – DVD System – stereophonic system – Hi-Fi- system principles – Dolby – DTS.

Monochrome Television : Scanning principles aspect ratio – composite video signal – TV standards. TV transmitter – TV receiver.

Colour TV : Principles of Colour Transmission and reception –color CCD camera. PAL colour TV receiver (IC details not required) Digital Colour TV receiver LCD display unit – plasma display – principles of Handy Cam , LCD projector principles of CCTV and Cable TV.

Radar: Fundamentals Basic Radar System – Applications – Radar range equation – factors influencing maximum range – Target properties – Pulsed Systems – Basic Pulsed Radar System – Bloc Diagram – Display methods – PPI display - Automatic target detection. Radio aids to navigation – Direction finding – Radio ranges – Radio Compass - Radio Telemetry – Instrument landing system – Ground controlled approach system.

Telephone System : Public Telephone Network –Private Telephone Network – Electronic switching System –Block Diagram — Cordless Phone – Block diagram – Video Phone – Block Diagram- ISDN – Architecture – Features.

Facsimile Communication System: Introduction – facsimile sender – Cyllindrical scanning – Tape scanning - facsimile receiver – synchronisation – phasing – Index of Co-operation (IOC) – photographic recording – Direct recording.

Digital Communication: Fundamental Block Diagram and Basic elements of digital communication system – Advantages, disadvantages of digital communication – characteristics of data transmission circuits – Band Width requirements – speed – Baud rate – Noise – Cross Talk – Distortion – Equalizers – Echo Compressors.

Digital Codes : Baudot Code – ASCII Code – EBCDIC Code – Error detection codes – Parity check codes – Redundant Codes – Constant Ratio Codes – Error correction codes – Retransmission, forward error correcting code - Hamming Code.

Digital modulation techniques : ASK modulation /demodulation – FSK modulation / Demodulation – PSK modulation / demodulation – only block diagram and operation.

Data sets and interconnection: Classification of Modems – Modem interfacing –

serial interface standard.

Optical communication: Optical communication System – Block Diagram –Need and advantages of optical fibers – principles of light transmission in a fibre using Ray theory – Single mode fibers – multimode fibers – step index fibers –graded index fibers (Fabrication details not required) -Attenuation in optical fibers – Absorption losses, scattering losses, bending losses, core and cladding losses, Dispersion – material dispersion, Wave guide Dispersion, Intermodal dispersion – optical sources – LED – semi conductor LASER – principles – optical detectors – PIN and APD diodes – connectors and splices Optical cables – couplers – optical transmitter – Block diagram using laser feed back control circuit – optical receiver – Block diagram using APD – Applications of optical fibers – civil, Industry and Military applications (with descriptive block diagram)

SATELLITE COMMUNICATION (25 Marks)

Satellite System – Kepler's I, II, II Laws – Orbits –types – Geostationary synchronous satellites – Advantages – LEO, MEO – Advantages – Apogee – Perigee – Active and Passive satellite – Earth Eclipse of Satellite – Launching Orbit – Parabolic reflector antenna – cassegrain antenna. Space segment – power supply – Attitude control – station keeping – Transponders – TT and C subsystem – Thermal control – Antenna subsystem. Earth segment – Receive only Home TV system – Block Diagram – Transmit receive earth station – Block Diagram . Satellite Services – INTELSAT – GPS – MSAT

MOBILE COMMUNICATION (25 Marks)

Cellular Telephone – Evolution – Fundamental concepts – simplified cellular telephone system – frequency reuse – Interference –Co – Channel interference –

Adjacent channel Interference – Improving coverage and capacity in cellular systems – cell splitting – sectoring – Roaming and Handoff. Satellite multiple access techniques – TDMA, FDMA, CDMA

Digital Cellular System – Global system for mobile communications (GSM) – GSM services – GSM System Architecture – Radio subsystem.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper.There is no undertaking that all the topics above may be covered in the question paper

****