

**REVISED SYLLABUS FOR LIMITED DEPARTMENTAL COMPETATIVE
EXAMINATION (LDCE) FOR PROMOTION FROM SEA TO AE**

PAPER – I

BROADCAST ENGINEERING

1. Electronics and Communication

- a. **Semi-conductor devices:** Various type of Diodes, Transistor, Thyristors, FET, MOSFET, Integrated circuits, Solid state microwave devices, Circulators, Isolators & Wave guides.
- b. **DC Power supply:** Rectifier, Voltage regulators, Control of voltage & Switched mode power supply (SMPS), Thyristor controlled HT Rectifiers, Smoothing Circuits, Line Filters etc.
- c. **Amplifiers:** Single stage transistor amplifier in CE, CB, CC configuration, cascaded, transistor biasing, AF and RF small/large signal multistage, Operational Amplifiers (OPAMP) and its application, negative feedback, Push Pull Amplifiers. SSPA (Solid state power amplifier), LASER, MASER.
- d. **Network theory:** AC circuit analysis; series and parallel tuned circuits; power and impedance relations in the networks, network theory and application; two terminal and four terminal networks, attenuators, filters & equalizers.
- e. **Oscillators:** Basic requirements for sustaining oscillations; AF low distortion and RF oscillators; frequency stability and crystal oscillators, Phase locked oscillator, Astable/Monostable/Bistable multivibrators; blocking oscillators; Schmitt trigger; wave shaping; time base generators, Synthesizers, Mixer, Phase comparator.
- f. **Modulation and demodulation:** Analog (AM, FM, PM) & Digital modulation (QPSK, 8PSK, APSK, QAM etc.), COFDM and power distribution in sidebands, various type of detector /demodulators, PLL & Circulators.
- g. **Analog to Digital Conversion, Audio/Video Compression and decompression** (Encoder/Decoder(IRD), SD-SDI, HD-SDI, 4K, 8K, Anti-aliasing filter, data rate, Channel Capacity, Transport Stream, Error detection/correction, FEC, BER etc.
- h. **Optic Fibre Communication System:** Optical Spectrum, losses in optical fibres, Dispersion, Types of Optical Fibres, Optical Sources/Detectors.

2. Fundamentals of Digital Technology & Computer

- a. **Number systems; fundamental of Boolean algebra; basic logic gates; combinational and sequential logic circuits; registers; counters; semi-conductor memories; various logic families; multiplexer, demultiplexer, encoders & decoders, analogue to digital and digital to analogue convertors, Microprocessors.**
- b. **Basic concepts/principles of Computer hardware/Software. Computer Storage Systems like SAN/NAS, Computer Networking(LAN/MAN/WAN), TCP/IP protocol stack, Virtualization of computing resources, Cloud computing and its applications.**

3. Electrical / Electronic Measurements



Measurement of current, voltage, power, impedance, frequency. Associated test and measuring instruments; Digital waveform monitor, cathode ray oscilloscope, its working and applications, spectrum analyser, Audio Analyser, log units dB, dBm, dBu, dBr, dB(uV/m).

4. Radio wave propagation and antenna system:

Radio frequency spectrum allocation for Sound & TV broadcasting in Akashvani & Doordarshan; mechanism of propagation of Radio waves; ground, sky and space wave propagations; ionosphere & its role in long distance communication, Fresnel Zone. Line of sight (LOS), Different types of antenna, radiation patterns, antenna gain, polarization and directivity, beam tilt, null fill etc.

5. Satellite Broadcasting

Orbital concept, various types of satellite orbit, Geo-stationary orbit, concept of satellite communication, RF bands, concept of transponder of the satellite.

6. Media Streaming:

Fundamentals of Media streaming, Streaming Protocols (SRT/HLS/RTMP), Content Delivering Network (CDN), Media Transcoding, OTT applications like Waves, News-on-AIR, YouTube.

PAPER – II (A)

RADIO ENGINEERING

Part 1) Sound Transmitter & Aerial Systems

1. Studio-transmitter Programme Linkage

Working principle and characteristics of Microwave links / IP Link.

2. Signal processing for input to the transmitter

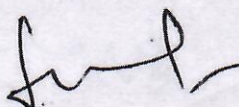
Working principle and characteristics of equalizer and audio processors for AM and FM transmitters.

3. Amplitude Modulated broadcast transmitters.

Amplitude Modulation Principles and Systems. RF and AF stages and their alignments. Additional features in New Generation AM Transmitters. Working Principles and types of Digital Transmitters and D.C.C. Principles of PWM and DSB. Dummy Load, Cooling arrangements in high power transmitter, Control systems in transmitters. AC and DC power supply systems for AM transmitters. Solid state PAs.

4. Transmitting aerials and feeders for AM broadcast transmitters.

Design consideration and characteristics of various types of transmitting aerials and feeders used with MW and SW broadcast transmitters; impedance matching of feeders with aerials; ATU. Directional antenna, beam changing. Basics of Earth radials and guy wires.



Basic principles, fundamentals of transmission line, characteristic impedance, Types of losses in transmission lines, standing wave ratio, return loss, reflection coefficient, quarter and half wave length lines; Reactance properties of transmission lines, Impedance variation on mismatched transmission line. Smith Chart and its use.

5. Frequency modulated transmitters and antennas.

Principles and characteristics of FM. Working of FM Transmitters, Characteristics of Pole/ Panel type Antenna and Feeder line used with the FM Transmitter. RF Combiner, 3dB coupler, Directional Coupler, Power dividers and matching of antenna. Use of Diplexer, Channel Combiner & Dehydrator. Remote operation of FM transmitter, Transmitter performance measurements.

6. Power distribution and earthing arrangements at the transmitting stations:

Salient features of the sub-station and power supply distribution. Power, audio and RF earthing consideration. 3 Phase Power circuits, load balancing, isolation transformer, UPS systems, Battery bank and maintenance, Voltage stabilizer, Safety Devices and standard Measurements.

Part 2) Sound Studio Systems

1. Nature of Sound

Characteristics of the human ear, reverberation of sound in enclosures.

2. Microphones and Speaker system

Working principle; characteristics and application of various type of microphones in radio broadcasting. Cordless microphones, Stereo Microphones. Phantom Power Supply.

Types and characteristics of speakers for quality monitoring and listening of sound, Surround sound systems.

3. Recording/reproduction of sound

Principles of magnetic tape and CD recording, Multi-track / Stereo Recording, Principles of Hard disc based Audio Recording, editing & playback. Concepts of Digital Audio compression. Use of standard audio formats (analog and digital) for Audio measurements. Storage of recording media and archival practices. Digital audio workstation operation and maintenance.

4. Sound Studios

Salient features of a typical sound studio set-up in Akashvani and the technical facilities provided therein, Noise and signal levels in the studio chain of equipment; working principles and characteristics of various type of amplifiers and audio mixers including multi function stereo console. Audio Routine switcher, Active dubbing console, Phone in Equipment, Types of Acoustic Treatment and Control of Reverberation Time and noise in studio. Fundamental of visual studio system.

5. Outside broadcast (OB)

Salient features of the technical arrangements for coverage of outdoor events in the open and auditorium; working principle and characteristics of equipment in the OB Van, Portable OB recorders and mixers. PA system.

6. Reception of radio signals

Principles of AM and FM radio reception; characteristics of the domestic & communication receivers.

7. Performance measurements on sound equipment

Standard measurements required to be made on amplifiers, Mixers, Consoles, CD player, Audio processors, their definitions, tolerance limits, Vector impedance meter (VIM), Operating Impedance Bridge (OIB).

8. Programme Networking Analog/Digital Captive Earth Station and RN Terminal and their performance measurements. Up link/down link chain, link Budget, eclipse, SCPC, MCPC, Satellite Transmitter & receiver, Look angles, Encoders, IRD, HPA.

PAPER – II (B)

TELEVISION ENGINEERING

Part 1) Television Transmitters, Aerials & Satellite Communication Systems

1. Studio – transmitter programme link:

Working principle and characteristics of Microwave links / IP Link.

2. Signal processing for input to the transmitter

Working principles and characteristics of Analogue and Digital transmitters.

3. Type of Modulation in TV transmitters

Types of modulation for the vision and sound RF carriers both in Analogue and Digital transmitters.

4. The High/Medium/Low power VHF/UHF TV transmitters

Circuit considerations for the exciter stage of the vision and sound transmitters, modulation, intermediate frequency; vestigial sideband, power amplification of modulated vision and sound carrier; control, and the cooling system, Diplexer, Combiner, Patch panel, Dummy load; characteristics of the high gain VHF/UHF antennae; RF feeder cable.

5. DTH Setup

Block diagram of earth station of DTH setup, uplink, downlink, management of services, Encoders, mux, IRD (L- Band & ASI), Up convertors, HPA, STB, ASI routers, modulator, related measurements,

DTH PDA tuning, MPEG-2, MPEG-4, HEVC, DVBS/S2, FEC, Antenna feed, LNBC, uplink PDA, wave guide, dehydrator etc.

6. Satellite Communication



Various types of uplink systems (permanent Earth Station, DSNG). Block diagram of earth station. Calculation of Look Angles and Link Budget. Upconverter, redundancy switches. Up link/down link chain, link Budget, eclipse, SCPC, MCPC, Satellite Transmitter & receiver, Digital video broadcasting through satellite (DVB-S/S2), IRD, DSNG, C band/Ku Band, HPA.

7. Performance measurements

Standard measurements required to be carried out for checking the performance of TV transmitters, transmitting antennas/feeder cable SNR, CNR, BER, MER, PER, Link margin, Eb/No, measurement of Uplink/Downlink Chain.

Part 2) Television Studio Systems

1. TV Studio

- a. Salient features of a typical TV studio; video and audio schematic, SPG (sync pulse generator), Trilevel/bilevel sync, FS (frame synchronizer), VDA/DVDA, logo inserter, scroll generator, ARC (aspect ratio convertor).
- b. TV Studio chain; working principles and characteristics of TV camera optics; processing and encoding of video signal. Teleprompter, Charge Coupled Devices (CCD) Cameras, Digital Studio and ENG Cameras, SD-SDI, HD-SDI, UHD, 4K, 8K formats. Other camera accessories, Different video codecs and containers/formats, SD to HD conversion and vice versa.
- c. The working principles of a Video switcher, types of keying, genlocking.
- d. Characteristics of types lights/lamps and fittings used for lighting in TV studios, colour temperature of different light sources, Lux meters, Three Point lighting, DMX Controller.
- e. Characteristics of various types of microphones used for pickup of TV sound and typical sound mixing desk required for TV applications.

2. Video Tape Recording

Principles of magnetic tape recording of television signal, functional details of the tape transport, video and audio signal processing circuits in VTR; timing errors in VTRs; working principles of digital time base corrector; editing systems; characteristics of video tapes and cassettes and types of Digital recorders. Concepts of video digital compression, Digital video library system.

3. TV Monitor / Receiver

Block schematic and working principles, of TV Monitors/ receiver; multi viewer.

4. Outside broadcasts

Working principles of TV OB Van and the link equipment, ENG, arrangement for TV coverage of outdoor events, Backpack.

5. Performance measurements

Various measurements required to be performed on analogue, digital and embedded video signals.



PAPER – III

GENERAL SUBJECTS

1. Safety precautions like Electricity rules, First aid and Firefighting etc.

- a. General information on safety, electricity rules, firefighting equipment and first-aid equipment etc.
- b. Various safety precautions as detailed in section (1) of AIR Manual of Safety precautions.
- c. Safety precautions against electrical hazards as detailed in Section (2) of the Manual referred to above.
- d. Non-electrical hazards.
- e. Fire hazards.
- f. First-aid, Artificial respiration etc.
- g. Reporting procedure for accidents and thefts.
- h. Snake bite kit.

2. Store purchase & other procurement rules,

Stores, indents and purchases, receipt and issue, management of the stores, transit insurance, surplus, defective and unserviceable stores-disposal thereof, inventory control of essential spares. GeM Portal, GFR, PB DFPR, PB procurement manual, GST etc.

3. Principles of Power Supply systems, Diesel Generators, UPS and Air-conditioning Systems:

- a. Power Supply Distribution System (HT/LT Panel) Power factor and power factor correction, Types of HT/LT cables; Power supply systems operation and maintenance thereof. CT, PT, OCB, MOCB, ACB & VCB, Power Supply Safety devices, over current, Earth fault, Series/Shunt trip coils, IDMT relay, Single phase preventer etc.
- b. Internal combustion engines, principles, operation and maintenance thereof. Alternators, types of excitation. Governor. Silent type DG Sets.
- c. Various type of AC plants, principle, operation and maintenance. Psychometric Chart. Airflow & tonnage calculation. Star rating, Inverter/Noninverter Type Air Conditioners. BLDC Technique.
- d. UPS and Battery bank, principles, operation and maintenance thereof, invertors, convertors, CVT, SMPS, AVR, Isolation Transformers.

4. Installation/Projects

- a. Site selection of AIR/DD projects.
- b. Transmitter Installation.
- c. Studio installation.
- d. Installation of AC Plants and Diesel Generator.



- e. Use of measuring instruments like, Theodolite, Field Strength meter, Site Master, Spectrum Analyser, Audio Analyser, Sound level meters.
- f. Monitoring of project and installation activities.
- g. Extensive measurements, Joint Inspection, handing over of project.
- h. Earthing/shielding and earth resistance measurements.
- i. Maintenance of Accounts.
- j. Various installation registers.
- k. Field Strength and Reception Survey
- l. Completion Report.
- m. Tower /Mast: Verticality Concept, Day & Night Markings, Aviation Obstruction Light (AOL), tower apertures, tension in the guyed etc.

5. Station Management

- a. Leadership and Supervision: Nature of Leadership, Leadership Style.
- b. Communication: Communication Process, Barriers of Communication, Semantics of communication, Body Language, Listening.
- c. Inter-personal Relations.
- d. Conduct Rules, Discipline Rules, Vigilance procedures and FR/SR
- e. Budget Management
- f. Security concepts, CCTV.
- g. Bio-metric Attendance System (BAS) management.
- h. E- Governance systems like E-office, GeM, gov mail, PFMS, Government Intranet etc.

