

ಅನುಬಂಧ-1

ಎಲೆಕ್ಟ್ರಿಷಿಯನ್ ಗ್ರೇಡ್-1 ಮತ್ತು ಎಲೆಕ್ಟ್ರಿಷಿಯನ್ ಗ್ರೇಡ್-2 ಹುದ್ದೆಗಳ ಪಠ್ಯಕ್ರಮ

SYLLABUS FOR SPECIFIC PAPER

ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ- 2 ನಿರ್ದಿಷ್ಟ ಪತ್ರಿಕೆ

I. BASIC ELECTRICAL ENGINEERING AND ELECTRICAL CALCULATIONS

- Fundamentals of electricity – electric current, voltage, resistance, power and energy.
- Units of electrical quantities.
- Ohm's Law and its applications.
- Series, parallel and series-parallel circuits.
- Kirchhoff's Laws – elementary applications.
- Electrical work, power and energy calculations.
- AC and DC fundamentals.
- Frequency, cycle, time period, phase and waveform.
- Single-phase and three-phase AC systems.
- Star and Delta connections – basic concepts.
- Power factor and its significance.
- Basic electrical load calculations.

II. ELECTRICAL SAFETY, TOOLS, MATERIALS AND WORKSHOP PRACTICE

- Electrical safety rules and precautions.
- Electrical hazards and prevention of accidents.
- Personal Protective Equipment (PPE).
- Electric shock – rescue and first aid.
- Electrical fires and fire extinguishers.
- Safe isolation of electrical circuits.
- Hand tools and power tools used by electricians.
- Care and maintenance of electrical tools.
- Conductors, insulators and semiconductors.
- Electrical materials and their properties.
- Soldering, crimping, cable joints and terminations.

III. ELECTRICAL WIRING, CABLES AND INSTALLATIONS

- Types of electrical wires and cables.
- Cable size, insulation, current-carrying capacity and voltage rating.

- Cable joints, lugs, glands and terminations.
- Domestic, commercial and industrial wiring.
- Conduit wiring and other wiring systems.
- Switches, sockets and wiring accessories.
- Distribution boards.
- Single-phase and three-phase wiring.
- Staircase, corridor and godown wiring.
- Wiring of lamps, fans and other electrical appliances.
- Identification and rectification of common wiring faults.
- Load calculation and selection of cables.
- Basic electrical installation in municipal/public buildings.

IV. ELECTRICAL MEASURING INSTRUMENTS, TESTING AND FAULT FINDING

- Ammeter, voltmeter, wattmeter and energy meter.
- Multimeter and clamp meter.
- Insulation resistance tester/Megger.
- Earth resistance tester.
- Measurement of voltage, current, resistance, power and energy.
- Continuity and insulation resistance tests.
- Testing of electrical wiring and installations.
- Detection of open circuit, short circuit and earth leakage.
- Identification of common electrical faults.
- Basic troubleshooting methods.

V. ELECTRICAL MACHINES

Transformers:-

- Principle and working of transformers.
- Single-phase and three-phase transformers.
- Transformer ratio, losses and efficiency.
- Basic transformer maintenance.

Motors:-

- Principle of electric motors.
- AC and DC motors – basic concepts.
- Single-phase induction motors.
- Three-phase induction motors.
- Squirrel-cage and slip-ring induction motors.
- Motor nameplate particulars.
- Star and Delta connections.
- DOL and Star-Delta starters.

- Reversal of direction of motors.
- Common motor faults and basic maintenance.

Generators:-

- Basic principle of generators and alternators.
- Basic operation of generator sets.

VI. SWITCHGEAR, PROTECTION AND CONTROL CIRCUITS

- Switches, isolators and fuses.
- MCB, MCCB, RCCB/ELCB and RCBO.
- Contactors and relays.
- Thermal overload relay.
- Timers.
- Motor starters.
- Basic motor control circuits.
- Short-circuit protection.
- Overload protection.
- Earth leakage protection.
- Single-phasing and phase-failure protection.
- Basic distribution panels and control panels.

VII. EARTHING AND ELECTRICAL SAFETY

- Purpose and necessity of earthing.
- Types and methods of earthing.
- Equipment earthing and system earthing.
- Earth electrodes.
- Earth resistance.
- Testing of earthing systems.
- Leakage current and earth faults.
- Electrical safety in wet areas.
- Safety precautions in pump houses and public places.
- Safe working practices on electrical installations.

VIII. ILLUMINATION AND STREET LIGHTING

- Fundamentals of illumination.
- Lumen and lux.
- Types of lamps and luminaires.
- LED lamps and LED luminaires.
- LED drivers – basic concepts.
- Street-light wiring.
- Street-light feeder panels.
- Timers and contactors.

- Photocell/LDR-based switching.
- Basic automatic street-light control.
- Common street-light faults and their rectification.
- Energy-efficient lighting.

IX. PUMPS AND WATER-SUPPLY ELECTRICAL INSTALLATIONS

- Basic types of pumps.
- Centrifugal and submersible pumps.
- Pump motors.
- Electrical connections of pumps.
- Pump starters.
- Pump control panels.
- Float switches and level controls.
- Dry-run protection – basic concept.
- Common electrical faults in pump installations.
- Basic maintenance of pump motors.
- Electrical safety in water-supply installations.

X. BASIC ELECTRONICS, RENEWABLE ENERGY AND ENERGY EFFICIENCY

- Resistors, capacitors and inductors.
- Diodes and rectifiers – basic concepts.
- Transistors – elementary concepts.
- Relays and sensors.
- Basic solar photovoltaic systems.
- Solar panels, batteries and inverters – basic concepts.
- Solar street lights.
- Energy conservation.
- Energy-efficient motors and lighting.
- Power factor improvement – basic awareness.

XI. ELECTRICAL DRAWING, SYMBOLS AND ESTIMATION

- Standard electrical symbols.
- Reading simple wiring diagrams.
- Basic single-line diagrams.
- Motor wiring diagrams.
- Basic layout of electrical installations.
- Calculation of connected load.
- Basic estimation of wires, cables, switches and other electrical materials.

ಅನುಬಂಧ-2

ನೀರು ಸರಬರಾಜು ಆಪರೇಟರ್ ಮತ್ತು ಸಹಾಯಕ ನೀರು ಸರಬರಾಜು ಆಪರೇಟರ್ ಹುದ್ದೆಗಳ ಪಠ್ಯಕ್ರಮ

SYLLABUS FOR SPECIFIC PAPER

ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ- 2 ನಿರ್ದಿಷ್ಟ ಪತ್ರಿಕೆ

I. MUNICIPAL WATER-SUPPLY SYSTEMS AND OPERATIONS

- Sources of municipal water supply.
- Surface and groundwater sources.
- Intake structures – basic concepts.
- Raw-water transmission.
- Pumping systems.
- Water Treatment Plants.
- Clear-water storage.
- Transmission and distribution systems.
- GLR, sump, overhead tanks and service reservoirs.
- Gravity and pumping systems.
- Water demand and consumption – basic concepts.
- Flow, pressure and head.
- Basic water-supply scheduling.
- Operational requirements of urban water-supply systems.
- Coordination between pumping, storage and distribution.

II. PUMPS, PUMPING SYSTEMS AND TROUBLESHOOTING

- Types and working principles of pumps.
- Centrifugal pumps.
- Submersible pumps.
- Vertical and horizontal pumps.
- Pump components – impeller, casing, shaft, bearings, seals and couplings.
- Suction and delivery arrangements.
- Static head, dynamic head and total head – basic concepts.
- Discharge and pump efficiency.
- Priming.
- Cavitation – causes, effects and prevention.
- Pump characteristic concepts.
- Pumps in series and parallel – basic concepts.
- Selection of pumps – elementary considerations.

- Starting and stopping procedures.
- Dry running and its effects.
- Pump overheating.
- Excessive vibration and noise.
- Low discharge and failure to deliver water.
- Mechanical seal and gland problems.
- Bearing failures.
- Alignment and coupling problems.
- Preventive and breakdown maintenance.
- Systematic troubleshooting of pumping installations.

III. ELECTRICAL MOTORS, STARTERS, PANELS AND PROTECTION

- Basic electrical quantities and calculations.
- Single-phase and three-phase supply.
- Three-phase induction motors.
- Motor ratings and nameplate particulars.
- Star and Delta connections.
- DOL and Star-Delta starters.
- Contactors and control relays.
- Thermal overload relays.
- Timers.
- Motor control circuits.
- Fuses, MCB, MCCB and RCCB/ELCB.
- Short-circuit and overload protection.
- Single-phasing and phase-failure protection.
- Phase sequence and phase reversal.
- Under-voltage and over-voltage – basic concepts.
- Pump control panels.
- Power and control circuits.
- Basic automatic pump-control systems.
- Float/level-controlled pump operation.
- VFD – basic principle and application to pumps.
- Identification of common motor, starter and panel faults.
- Electrical testing and troubleshooting.
- Electrical safety and earthing.

IV. PIPES, VALVES, FITTINGS AND MECHANICAL MAINTENANCE

- Types of pipes used in municipal water supply.
- Pipe fittings and joints.
- Flanges, gaskets and couplings.
- Pipe threading and fitting – basic concepts.

- Sluice/Gate valves.
- Butterfly valves.
- Non-return/check valves.
- Air valves.
- Scour/washout valves.
- Pressure-reducing/control valves – basic awareness.
- Correct operation of valves.
- Common valve defects and maintenance.
- Leakage from pipes and joints.
- Bearings and lubrication.
- Shafts, couplings and alignment.
- Mechanical seals and gland packing.
- Fasteners.
- Basic fitting and maintenance tools.
- Identification and rectification of common mechanical faults.

V. WATER TREATMENT PLANT OPERATION

- Objectives of water treatment.
- Raw-water quality – basic concepts.
- Screening and aeration.
- Coagulation and flocculation.
- Coagulants and basic dosing concepts.
- Sedimentation.
- Filtration.
- Slow and rapid sand filtration – basic concepts.
- Filter operation and cleaning/backwashing.
- Disinfection.
- Chlorination.
- Chlorine demand and residual chlorine – basic concepts.
- Chlorine/bleaching powder dosing.
- Safe handling and storage of treatment chemicals.
- Basic operational problems in treatment units.
- Importance of maintaining treatment process records.
- Prevention of contamination during treatment and storage.

VI. WATER DISTRIBUTION, RESERVOIR AND NETWORK OPERATION

- Transmission mains and distribution networks.
- Service reservoirs.
- Distribution zones – basic concepts.
- Valve operation and regulation.
- Maintaining adequate distribution pressure.

- Water-supply scheduling.
- Reservoir filling and drawdown.
- Balancing pumping and distribution.
- Low-pressure and no-water conditions – causes and remedies.
- Pipeline leakage and bursts.
- Air locking – basic concept.
- Isolation of pipelines during repair.
- Flushing of pipelines.
- Prevention of contamination during repairs.
- Non-Revenue Water (NRW) – basic concepts.
- Water losses and leakage control.
- Equitable distribution of water.

VII. INSTRUMENTATION, MEASUREMENT AND OPERATIONAL MONITORING

- Water meters and flow meters.
- Pressure gauges.
- Level indicators.
- Float switches and level sensors.
- Basic flow and pressure measurement.
- Multimeter and clamp meter.
- Insulation resistance tester/Megger.
- Earth resistance testing – basic awareness.
- Monitoring motor current and voltage.
- Recording pump operating hours.
- Monitoring reservoir levels.
- Maintaining operating logs and records.
- Basic awareness of automatic monitoring/control systems used in water-supply installations.

VIII. PREVENTIVE MAINTENANCE AND FAULT MANAGEMENT

- Preventive, predictive and breakdown maintenance – basic concepts.
- Daily/periodic inspection of pumps and motors.
- Maintenance schedules.
- Lubrication schedules.
- Monitoring vibration, temperature and noise.
- Inspection of electrical panels.
- Inspection of pipelines and valves.
- Fault reporting and recording.
- Identification of recurring faults.

- Basic spare-parts management.
- Maintenance logbooks.
- Safe shutdown and restoration of equipment.

IX. WATER QUALITY, DISINFECTION AND PUBLIC HEALTH

- Basic drinking-water quality parameters.
- Colour, odour and turbidity.
- pH – basic concept.
- Residual chlorine.
- Basic bacteriological contamination awareness.
- Sampling – basic precautions.
- Prevention of contamination.
- Cleaning and disinfection of reservoirs.
- Importance of maintaining safe drinking-water supply.
- Public-health implications of contaminated water.

X. SAFETY AND EMERGENCY PROCEDURES

- Electrical and mechanical safety.
- PPE.
- Safe operation of pumps and panels.
- Lockout/Tagout – basic concept.
- Electrical shock and first aid.
- Fire safety.
- Chemical/chlorine safety.
- Safety in wet locations.
- Confined-space hazards.
- Safety during pipeline repairs.
- Emergency shutdown procedures.
- Basic response to pump/power failure.

XI. BASIC ENGINEERING CALCULATIONS, DRAWINGS AND ENERGY EFFICIENCY

- Units and conversions relevant to water supply.
- Flow/discharge calculations.
- Tank and reservoir capacity calculations.
- Basic head and pressure calculations.
- Electrical power and energy calculations.
- Reading basic pump-house and pipeline layouts.
- Reading motor/pump nameplate data.
- Basic single-line/control diagrams.
- Energy-efficient operation of pumps.
- Power factor – basic concept.
- Avoidance of unnecessary pumping and energy loss.

