

ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED,
VIDYUT SOUDHA : : VIJAYAWADA – 520004.

Memo No.CGM(Adm,IS&ERP)/DS(Adm)/AS(Adm)/PO-A/57/2016-1, Dated: 20.03.2018.

Sub: Estt. – APGENCO – Filling up of the post of Sub-Engineer by way of appointment by transfer – Intimation regarding of Written Test to be conducted by the Corporation – Reg.

- Ref:
1. B.P.(P&G-Per) Ms.No.102, Dated:11.08.1995
 2. B.P.(P&G-Per) Ms.No.208, Dated:30.12.1996
 3. G.O.O.No.74/JS(Per)/2008, Dtd:17.05.2008
 4. G.O.O.No.144/JS(Per)/2008, Dated:24.06.2008
 5. G.O.O.No.164/JS(Per)/2008, Dated:03.07.2008
 6. G.O.O.No.400/JS(Per)/2014, Dated:26.11.2014
 7. Circular Memo No.CGM(Adm,IS&ERP)/AS(Adm)/PO-A/57/16, Dated:29.06.16
 8. Representations from JPAs working at RTPP and Dr.NTTPS dtd:30.10.17 & Dtd:06.11.17.
 9. Circular Memo No.CGM(Adm,IS&ERP)/AS(Adm)/PO-A/57/16-1, Dated:23.11.17
 10. G.O.O.No.8/CGM(Adm,IS&ERP)/2018, Dated:11.01.2018

The attention of all the Chief Engineers/Superintending Engineer/in-charge of Generating Stations is invited to the G.O.O. 10th cited and requested to inform the in-service employees who have applied for the post of Sub-Engineer, the following details pertaining to the written test to be conducted by the Corporation.

1. Date & Time : 15.04.2018 from 3.00 P.M. to 5.00 P.M.
2. Venue : Training Institute/Dr.NTTPS/Ibrahimpattam
3. Break up of Vacancies :

| Zone | Electrical | Mechanical | Electronics | Civil |
|-------|------------|------------|-------------|-------|
| I | 3 | -- | -- | -- |
| II | 48 | 24 | 8 | 1 |
| III | 5 | -- | -- | 2 |
| IV | 18 | 9 | 2 | 2 |
| Total | 74 | 33 | 10 | 5 |

4. Syllabus : Enclosed for Section-A & Section-B separately.

Encl: As above.

M Sujaya Kumar
Chief General Manager (Adm,IS&ERP)

To

All the Chief Engineers/APGENCO
All the Superintending Engineers/APGENCO
All the In-charges of Generating Stations/APGENCO

Copy to:

The Stock File.

//FORWARDED : : BY ORDER //

M. V. N. Gram Babu
PERSONNEL OFFICER

(Syllabus for Sub-Engineer/Electrical)

1. Elements of Electrical Engineering:

- a. Comprehend basic principles of electricity
- b. Know the magnetic effects of electric current.
- c. Understand electromagnetic induction
- d. Understand electric charge and electrostatic field

2. Electrical circuits:

- a. Understand Kirchoff's laws and star delta Transformations and Network Theorems.
- b. Comprehend the relationship between quantities connected with alternating current.
- c. Comprehend the single phase A.C. Circuits
- d. Poly Phase Circuits.

3. D.C.Machines:

- a. Fundamentals of D.C. Generators
- b. Armature Reaction and Characteristics of D.C. Generator
- c. Fundamentals of D.C. Motors
- d. Speed Control and Starters of D.C.Motors
- e. Characteristics and Testing of D.C.Motors

4. Electrical Measuring Instruments & Batteries:

- a. Know the Classification of different measuring instruments.
- b. Understand the construction and working of different electrical measuring instruments
- c. Understand the method of measurement of resistance.
- d. Transducers and sensors
- e. Understand Batteries

5. A.C.Machines:

- a. Understand the working of Single Phase Transformers
- b. To understand Three Phase Transformers.
- c. Know the classification, construction, working and testing of alternators
- d. Comprehend the procedure for voltage control and synchronization.
- e. Comprehend the working of synchronous motors
- f. Comprehend the working of three phase induction motor
- g. Comprehend the working of single phase induction motor
- h. Comprehend the working of single phase commutator motor

6. Power Systems:

- a. understand the various sources of Power Generation
- b. understand working of Thermal Power station
- c. understand hydroelectric power station
- d. understand the working of Nuclear & Gas Power stations
- e. Comprehend combined operation and economics of power stations.
- f. Comprehend the need for transmission and choice of supply system
- g. Line structure for transmission and distribution
- h. Underground cables.
- i. Understand different types of switchgear, fuses and reactors and their working
- j. Protective relays
- k. Protection of alternators, transformer and transmission line.
- l. Lighting arrestors and neutral grounding

7. Electronics:

- a. passive components (Resistors, Capacitors and Inductors)
- b. Know the semi-conductor Devices.
- c. Understand the working principle of Power supply circuits
- d. Understand the performance of special devices.
- e. Understand the principle of working of Amplifiers.
- f. Understand the principle of working of Small Signal Amplifiers.
- g. Understand the principle of Oscillators
- h. Appreciate the need for Modulation and Demodulation
- i. Electronic instruments and industrial applications
- j. Know the basics of ICs
- k. Know the basics of digital electronics
- l. Understand the working of combination logic circuits
- m. Understand the working of sequential logic circuits
- n. Understand working of registers and memories

8. Electrical Utilization and traction:

- a. understand the principles of lightings
- b. understand principle of electric heating, welding and its industrial application
- c. electric traction systems

9. General Mechanical Engineering:

- a. I.C. Engines – Boilers – Turbines
- b. Understand the working of the centrifugal pumps

10. Information Technology:

- a. understand the features of MS-word
- b. understand working of MS-Excel
- c. Understand MS-Power Point
- d. Understand working with MS-Access

11. Industrial Management and Entrepreneurship:

- a. understand the principles of management as applied to industry
- b. Know the organization structure of an industry and the behavior of an individual in an organization.
- c. Understand the different aspects of production management
- d. Understand the role of material management industries.
- e. Understand marketing, sales and feasibility study.
- f. Comprehend the provisions of industrial legislation in India and safety procedures.
- g. Understand ISO 9000 and TQM
- h. Understand the role of entrepreneur in economic development and in improving the quality of life.

SECTION – A

(Syllabus for Sub-Engineer/Mechanical)

1. Electrical Engineering & Basic Electronics:

- a. comprehend basic Electrical Fundamentals
- b. Understand D.C.Machines
- c. Understand A.C. Fundamentals and A.C. Machines
- d. Understand storage batteries
- e. Understand the principles of semi-conductor devices
- f. Understand electrical measuring instruments and safety procedures

2. Thermal Engineering –I:

- a. understand the Fundamentals and Laws of Thermodynamics
- b. understand the laws of perfect gases
- c. understand Thermodynamic Processes on gases
- d. know the fuels and Combustion
- e. appreciate the study of air standard cycles
- f. Comprehend the construction, working and performance of Internal Combustion engines.

3. Thermal Engineering – II:

- a. understand the Properties of Stream
- b. understand the working of steam boilers
- c. steam Nozzles and Turbines
- d. comprehend the construction and working of Air Compressors
- e. Understand the working and applications of gas turbines and Jet Propulsion.
- f. To appreciate the measuring devices used in instrumentation.

4. Hydraulics & Hydraulic Machinery:

- A. Hydraulics:
 - a. understand the various properties of Fluids
 - b. understand the behaviour of liquids in motion
 - c. evaluate frictional losses during flow of liquids through pipe
- B. Hydraulic Machines:
 - a. analyze forces during the impact of jets
 - b. understand the working of water turbines
 - c. know the working of pumps.

5. Energy Sources and power plant Engineering:

- a. introduction of Renewable Energy Sources
- b. solar and wind energy
- c. fuel cells and MHD Generator
- d. Bio and Tidal Energy
- e. Analyse the elements of Thermal and Nuclear Power Plants
- f. To understand the impact of pollutants on Environment

6. Industrial Management & Entrepreneurship:

- a. understand the principles of management as applied to industry
- b. Know the organization structure of an industry and the behavior of an individual in an organization.
- c. Understand the different aspects of production management
- d. Understand the role of material management industries.
- e. Understand marketing, sales and feasibility study.
- f. Comprehend the provisions of industrial legislation in India and safety procedures.
- g. Understand ISO 9000 and TQM
- h. Understand the role of entrepreneur in economic development and in improving the quality of life.

7. Estimating and Costing:

- a. List out the elements of costing
- b. Understand the fundamentals of estimation
- c. Estimate the weight of material required for a product and machining times
- d. Estimate the fabrication cost
- e. Estimate the forging cost
- f. Estimate foundry cost

8. Manufacturing Technology –I:

- a. Lathe & Lathe Work
- b. Illustrate the working of Shaper, Slotter, Planner and Broaching Machine
- c. Cutting Fluids, Coolants & Lubricants
- d. Metrology
- e. Understand the different welding methods and technique

9. Manufacturing Technology –II:

- a. milling and Gear Making
- b. grinding and finishing processes
- c. modern machining processes
- d. plastic processing
- e. press Tools, Jigs and Fixtures
- f. Jig Boring

10. Refrigeration and Air Conditioning:

- a. understand the various methods of Refrigeration
- b. Understand vapour compression and Vapour absorption in Refrigeration systems.
- c. Know the refrigerants, refrigeration Equipment and applications of Refrigeration
- d. Understand fundamentals of A/C and A/C equipment
- e. Understand psychometry, cooling and heating loads.
- f. Appreciate the applications of A/C servicing and maintenance of refrigeration and A/C equipment.

11. Information Technology:

- a. understand the features of MS-word
- c. understand working of MS-Excel
- d. Understand MS-Power Point
- e. Understand working with MS-Access

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SECTION – A

(Syllabus for Sub-Engineer/Electronics)

1. Electronic Components and Devices:

Inductors, Transformers, switches, connectors and relays. PN Junction Diode, BJT configurations, JFET and MOSFETs – Rectifiers and Regulators.

2. Elements of Combinational and sequential logic circuits:

Flip-flops, counters, registers, memories, A/D and D/A converters.

3. Fundamentals of Instrumentation and Transducers:

Accuracy, precision, errors, LVDT, RVDT, Synchros, RTD, Thermistors, Thermocouples pressure and flow measurement.

4. Basics of DC machines, AC machines and transformers

5. Measuring instrumentation:

Analog Instruments – bridges – DVMS – Q-meter – logic analyzer – signal and function generators.

6. Process instrumentation:

pH and conductivity measurement – viscosity and density measurements – spectrophotometers – gas analyzer – auto analyzer – chromatographs.

7. Power plant instrumentation and unit operation:

Introduction power plant: Unit operation and Unit processes, material balance and energy balance. Introduction to thermal power plant, significance of instrumentation in power plant, principle and working and salient features of hydro electric, nuclear gas turbine plant.

Processes in Thermal Power plant: evaporation: distillation: leaching and extraction: gas absorption: humidification and dehumidification adsorption: drying: size reduction: crystallization: mixers.

Boiler instrumentation and control: measurements and control loops, drum level control, fuel flow control, furnace draft and excess air control, combustion control, steam pressure control, boiler safety interlocks.

Turbine monitoring and control: turbine – supervisory system for monitoring of mechanical parameters – speed, vibration, eccentricity, axial shift, shell temperature monitoring, lube oil temperature control, turbine trip condition.

Instrumentation and control of alternator, steam heaters, pumps and compressors, condenser.

Auxiliaries in power plants: soot blowers, electrostatic precipitator, oil automation system, water treatment plant, cooling towers.

8. Power Electronics:

SCR, Triac, UJT, Single and three phase converters – inverters – cycloconverters, SMPS and UPS.

SECTION - B

(Syllabus on power plant related topics for Sub-Engineers (except Sub-Engineer/Civil))

A. Thermal Power Stations - Process

1. Boiler
 - a. Boiler construction
 - b. Pressure Parts
 - c. Fans – types
 - d. Mills – types
 - e. Air Preheaters
 - f. Fuels – Supply Systems
 - g. Firing and Arrangements in power House
 - h. ESP – Construction – Operation – Details
 - i. Safety Valves and their importance
2. Turbine
 - a. Turbines – Parts – Details
 - b. CWPs, Cooling Towers, Condenser Cooling and Vacuum System – Details
 - c. LP Heaters, DA, CEPs and Condensate system
 - d. BFPs, HP heaters and feed water system
 - e. PRDS, HFO and Light oil systems
3. Generator
 - a. Electrical Power – Energy – Voltage – Current – Explanation.
 - b. Turbo – Generator construction – details
 - c. Excitatom systems
 - d. Transformers – working – cooling systems – types
4. Protection

Protection of Generators, Generator Transformers etc., circuit breakers.
5. Economic aspects

Generation Costs and their classification, PLF, Plant base load and Peak load operation and optimul operation of thermal and Hydel stations.
6. switch-yard

Switch – yard – Equipment – Details
7. Electrical circuits:

Storage batteries, classification of cells, construction chemical action of cells, lead acid, NI – Cadmium Cells, VRLA batteries (maintenance free batteries) concept of trickle charging and boost charging.
8. Electrical measuring instruments:
 - a. measurement of voltage current, power, energy etc.
 - b. principles of measurement of pressure, flow, level, diff pressure, temperature (thermocouple, RTD) etc.
 - c. Principle of measurement of PH, conductivity, oxygen using Zircona principle.
9. AHP

Ash handling plant – Equipment – Functions
10. CHP

Coal handling plant – Equipment – Functions
11. WTP

Water treatment plant – Flow Charts/Diagrams

B. Hydel Power Stations – Process

1. Functions of various Equipment of Hydel Power Stations
2. Layout of equipment in Hydel Power Stations
3. Symbols of various tools and Tackles, Fasteners and their functions.
4. General knowledge about various works, abbreviations pertaining to Hydel power stations.

5. Various Equipment of Hydel Power Stations.
 6. Types of turbines.
 7. Penstock.
 8. Surge Tank.
 9. Turbine.
 10. Governing system
 11. Trash rack
 12. Generator – Construction details – Function.
 13. Electrical Energy, Power, Voltage, Current – Definition.
 14. Transformers – Details and Functions.
 15. Switch-yard - Important Equipment - Functions
 16. Electrical circuits: Storage batteries, classification of cells, construction chemical action of cells, lead acid, NI – Cadmium Cells, VRLA batteries (maintenance free batteries) concept of trickle charging and boost charging.
 17. Electrical measuring instruments:
 - a. measurement of voltage current, power, energy etc.
 - b. principles of measurement of pressure, flow, level, diff pressure, temperature (thermocouple, RTD) etc.
- C.**
1. Industrial Electronics
To understand PLC and programming – logic with relays, PLC ladder logic, timers, counters, input output modules, digital, analog I/O s.logic functions – OR, AND, EX-OR etc.
 2. BASIC communication Engineering
 - a. Understanding the work of power line carrier communication (PLCC) technique
 - b. Understanding the principle of working of EPABX
 3. Understand the distributed control system DCS.
- D.**
1. FPS - Fire protection Systems – Types – Functions
 2. Fire accidents - Fire accidents and preventive measures
 3. Safety aspects - Safety of personnel and equipment – Safety measures and precautions.
 4. House keeping - House keeping and its importance.

(Syllabus for Sub-Engineer/Civil)

1. Surveying:**A. Surveying-I:**

- a. know basic facts about surveying
- b. understand the principles of Chain Surveying
- c. principle of Compass Surveying
- d. Understand the principles of Plane Table Surveying to fill in details of the field.

B. Surveying-II:

- a. understand the principles of theodolite surveying preparation of plants and alignment.
- b. understand the principles of Tacheometry to find the elevations and distances of stations.
- c. understand the method of setting out simple curves
- d. understand the Electronic Surveying instruments

2. Surveying Practicals II:

- a. Performs Theodolite surveying
- b. Performs Trigonometric leveling
- c. Performs Tachometric Surveying
- d. Sets out simple curves in the field
- e. To understand the method of setting out of building on the ground
- f. Applies principles of Surveying of Land Development
- g. Knows the principle of surveying for Land Development
- h. Knows the principle of Operation of Electronic Survey Instruments
- i. Applies principles of mapping from the field work, potting of the field work
- j. Applies knowledge of different methods of surveying in overcoming different field problems.

3. Quantity Surveying –I:

- a. Understands basic concepts of Quantity Surveying, units and specifications
- b. Understands different types of estimates and detailed estimates of buildings.
- c. Understands the analysis of rates and abstract estimations
- d. Computes the volumes of earth work and reservoir capacity
- e. Compute the material required for construction of a structure

4. Construction Materials:

- a. understands selection of stones and their acceptability for construction work
- b. understands the acceptability of bricks for construction work
- c. understands suitability of tiles, pipes and building sand for construction
- d. to check the quality of cement for construction work
- e. understands the principles of preparation of mortars and concrete
- f. understands the selection and applications of wood, plastics, Glass and Asbestos for construction work

5. Construction Practice:

- a. knows the classification of Buildings and design of foundation as per NBC
- b. Understand the construction of masonry work
- c. Understands the types and principles of doors, windows, ventilators and Lintels, Sunshades.
- d. Understands methods of construction and finishes of different types of roofs and floorings.
- e. Understands scaffolding and types of stair cases
- f. Protective, decorative finishes and Termite proofing

6. Theory of Structures:

A. Theory of Structures-I:

- a. Understands the effect of Loading on Beams
- b. Understands Deflection of Beams under loading
- c. Understands the effects of Internal pressure on unriveted and riveted thin cylinders
- d. Understand the effects of Pure Torsion on solid and hollow Circular Shafts and closely coiled helical spring under given axial loading
- e. Understands the behaviours of columns under vertical loads

B. Theory of Structures-II:

- a. understands the stability of retaining walls and dams under the action of lateral pressures.
- b. Understands the effects of loading on propped, continuous, fixed and continuous beams.
- c. Understands effect of Dead and live loads on statically determinate frames

7. Hydraulics:

- a. knows the properties of Fluids
- b. understands fluid pressure and its Measurement
- c. understands the General principles of flow of the liquids
- d. understands the flow through Orifices and mouth pieces
- e. Comprehends the flow over different types of notches and weirs.

8. Transportation Engineering:

- a. introduction to Highways and Soil mechanics
- b. understands highway survey and traffic engineering
- c. understands highway construction and maintenance
- d. understands introduction and permanent way of Railways
- e. understands station yard and maintenance of Railways
- f. Understands Bridges, Culverts and cause ways.

9. Environmental Studies:

- a. Knows the importance of the environmental studies and Natural Resources.
- b. Understands ecosystems and Biodiversity and its conservation
- c. Know environmental Pollution, Social issues and the environment.
- d. Understand Human Population and the Environment
- e. Field work

10. Design of RC structures:

- a. understand the basic ideas of concrete, reinforcing steel and philosophy of limit state design
- b. Understand the principles of analysis and design of singly reinforced and doubly reinforced R.C.C. rectangular beams by limit state method.
- c. Understand the principles involved in the design of R.C.C. slabs by limit state method.
- d. Understand the principles involved in design of lintels, sunshades, T-Beams, continuous slabs and beams
- e. Understand analysis and design of columns, footings and staircases.

11. Information Technology:

- a. understand the features of MS-word
- b. understand working of MS-Excel
- c. Understand MS-Power Point
- d. Understand working with MS-Access

Thermal/Hydel plants related syllabus for Sub-Engineer (Civil)

| | | | |
|----|--------------------------------|---|--|
| 1 | Reservoirs | - | Inflows, Outflows, live storage capacity, gross storage capacity, FRL, MDL Water spread, catchment area, annual rainfall. |
| 2 | Dams | - | Masonry dam, Earthen Dam, Gravity Dam, Height of Dam, Crest level, Arch dam, Max flood discharge, Crest gates. |
| 3 | Penstocks | - | Head, Pipe diameter, Plate thickness, Valves (Butterfly valves). |
| 4 | Survey | - | North, South, Latitude, Longitude, Reduced levels, marking of buildings etc. |
| 5 | Power House | - | Types of Turbines, PH Crane, Turbo generator, Boiler, Electro Static Precipitators, LP turbines, HP turbine, Coal pulverization mills etc. |
| 6 | Gates | - | Stop log gate, regulator sluice, Crest gates, butterfly valves, D.T. gates, radial gates. |
| 7 | Canals | - | Carrying capacity, bed slopes, side slopes, variation of velocity w.r.t height, trash rack. |
| 8 | Makeup Water Reservoirs | - | Capacity, raw water pipelines. |
| 9 | Water Treatment Clarifiers | - | Alumn dozing, chlorination, filtration, DM plants. |
| 10 | Marshalling yard | - | Rails, sleepers, points and crossings, ballast, keys etc. |
| 11 | Coal Plant | - | Conveyor, Wagon tippler, crushers etc. |
| 12 | Ash Ponds | - | Earthen embankment, decanting wells, spillways. |
| 13 | Chimney, cooling towers | - | Deashing, Acid and Fire Resistant Bricks & mortar, desilting, troughs, flashcups. |
| 14 | Roads, Buildings, Maintenance. | - | Storm water drains, Maintenance, drinking water supply, Roof leakages, painting, drainage, sanitary. |
| 15 | Construction of Plant | - | Earth work excavating PCC, raft, bearing capacity of soils, piles, backfilling, plinth beams, Design mix, Bridges, strength of concrete, steel, bricks, st. steel etc. |
| 16 | Safety | - | CO2 cylinders, application of foam, firefighting lines, burning of dry Jungle, GIS, EPF, etc. |
| 17 | Stores Materials | - | Storage of cement, Steel. |
| 18 | Carpentry material | - | Carpentry material, their usage. |
| 19 | FPS | | Fire protection Systems – Types – Functions |
| 20 | Fire accidents | | Fire accidents and preventive measures |
| 21 | Safety aspects | | Safety of personnel and equipment – Safety measures and precautions. |
| 22 | House keeping | | House keeping and its importance. |

