COMBINED SYLLABUS FOR THE POST OF JUNIOR ENGINEER ELECTRICITY DEPARTMENT AND JUNIOR ENGINEER (E&M) APWD DEPARTMENT

PROPOSED SCHEME OF EXAMINATION

Written Examination: "Objective Type Multiple Choice" questions on the subject as shown below:

S.No	Subject	No.of Questions	Marks per question	Total Marks	Duration
1.	Mechanical, Electrical and Electrical & Electronics	80	01	80	2 Hrs.
2.	General Intelligence & Reasoning	10	01	10	
3	General Awareness	10	01	10	
	MARKING SCHEME				
	Each correct option	01			
	Each wrong option	(-) 0.25			
	Not attempted	0			

*** The questions will be set in English only.**

INDICATIVE SYALLABUS

ELECTRICAL ENGINEERING , ELECTRICAL & ELECTRONICS ENGINEERING

Basic Electrical Engineering & Electrical Measurements: Concept of currents, voltage, resistance power & energy, their units, ohm's law, electrical symbols, circuit laws and theorems.

Electro-Magnetic induction: Self and mutual inductance.

A.C fundamentals: Instantaneous peak, R.M.S and average value of alternating wave, simple Series and Parallel A.C circuits consisting of Resistance, inductance & Capacitance. Analog & Digital ammeters and voltmeters, Wattmeter, Multi-meters, Megger, Low Voltage transformers CT & PT.

Measurement & Measuring Instruments: Moving coil and moving iron ammeters and voltmeters. Extension of range, Watt-meters, Multimeters, Megger, Basic Electronics.

Electrical Machines: Basic principles of D.C. Motors and generators, their characteristics, speed control & Starting of DC Motors, losses & efficiency of D.C Machines, parallel operations of AC generators.

1-Phase & 3 Phase Transformers: Principles of operation, equivalent circuit, voltage regulation O.C. and S.C tests, efficiency, auto transformers, parallel operation of transformers.

Synchronous Machines: Generation of three phase emf, Armature reaction, Voltage regulation, Parallel operation of two alternators, synchronizing, starting and applications of synchronous motors.

3-Phase Induction Motor: Rotating magnetic field, principle of operation, equivalent circuit, torque speed characteristic, starting & speed control of 3 phase induction motors, Fractional KW motors, 1-phase induction motors ac, series motor, reluctance motors.

General, Transmission & Distribution: Different types of power stations, load factor, diversity factor, demand factor, simple problems thereon, cost of generation, inter connection of power stations, power factor improvement, various types of tariffs, types of faults, short circuit current for symmetrical faults.

Battery: Automotive battery- construction and operation, battery capacity & ratings. Battery tests Charging System- Uses, Construction, operation & maintenance of charging system & battery bank. Schematic & working of alternator, starting system, lighting system.

Switchgears: Rating of Circuit breakers, principles of extinction by oil and air, HRC fuses, protection earthier leakage, over current Buchholz relay, Merzprice system of protection of generators & transformers, protection of feeders and bus bars.

Lightning Arrestors in various transmission & distribution systems: Comparison of conductor material efficiency of different systems.

Utilization of Electrical Energy: Illumination, electric heating, Electric welding, Electroplating, Electric Drives & Motors, fire fighting equipments, safety precautions.

Estimation and costing: Estimation of lighting scheme, electric installation of machine and relevant IE rules. Details of illumination system, details of load distribution, Design of electrical installation & its symbols (internal & external). Energy efficient equipment, energy audit, protection systems of Electrical circuit, residential and commercial wiring, safety protocol and equipment handling, Earthling Systems, Testing of Electrical Installations, types of cables –Overhead & underground.

Basic Electronics: Atomic structure of elements, the electron Energy of an electron valence electrons- Free electrons- Voltage source- Constant voltage source- Constant current source.

Electron Emission: Electron emission, types of electron emission-Thermion emission- Thermionic emitter.

Transistors: Transistor action-Transistor symbols-Transistor as an amplifier.

Regulated D.C. Power Supply: Ordinary DC Power supply, Regulated power supply. Types of voltage regulators- Zener diode voltage regulator.

Electronic Instruments: Electronic instruments, Multi-meters, Applications of multi-meter sensitivity of multi-meter, merits & demerits of multi-meter. Meter protection Vacuum tube voltmeter-applications of VTVM-merits and demerits of VTVM.

Semi Conductor Physics: Semi- conductor Bonds in semiconductor-commonly used semiconductors, energy band description of semiconductors-effect of temperature on semiconductor-intrinsic semiconductor-extrinsic semiconductor-properties of pn junction.

Semi Conductor Diode: Semiconductor diode, Half wave rectifier-full wave rectifier, zener diode.

Solid State Switching Circuits: Switching Circuit-Mechanical Switch Electronic Switch, Advantages of Electronic Switches-Switching action of a transistor.

Working Principle, Advantage & Application of field effect transistors.

Working Principle, Advantage & Application of Silicon Controlled Rectifier (SCR).

Working Principle, Advantages & Applications of Triac.

Working Principle. Advantages & Application of Unijunction Transistor(UJT).

Renewable Energy: Solar Energy – Direct Uses, concept, working principle and application of solar thermal systems, Power Generation (On grid & Off Grid System) with simple numericals, Solar Photovoltaic System (SPV) Applications-Solar Lantern, Solar Home System, SPV Street Light, SPV Pumping systems.

MECHANICAL ENGINEERING

Flow of Fluids: Laminar & turbulent flow, equation of continuity. Bernoulli's theorem, measurement of discharge, flow through pipes friction losses. Forces of

jet impinging on vanes, blades, work done and efficiency, classification of turbines & pumps.

Thermal Engineering: Laws of thermodynamics, change in entropy in various processes, properties of steam, uses of steam table & charts, construction & working of Cochran, Lancashire Locomotive & Babcock & Wilcox Boilers, Working of steam turbine, Otto & Diesel Cycles, working of IC Engines, Carburetion, Solex Carburetor, Diesel Fuel Pump & Injector Cooling & Lubrication.

Production Engineering: Foundry different casting processes, concept of patterns, types of mould making, pouring defect in castings, causes & remedies, welding classification and types of welding. Testing & defects in welds, Lathes-working of lathes, various tools, operation on lathes, types of lathes, drilling operations performed on drilling machines.

Description of Principles of working and various operations on machines tools milling machine. Shaper, grinder, boring & slotting machines.

Strength of Materials: Stresses in composite bars, relation between elastic constants, Resilience under different types of loads, SF & BM Diagrams Stresses in beams combined direct & bending stresses, struts & columns Euler's Rankin's theories, Torsion of circular shafts.

Theory of Machines: Simple Mechanisms -Four bar Chain, Slider crank chain, double slider crank chain, flywheel-Turning movement diagrams. Fluctuation of energy. Friction in collar and pivots, plane clutch, conical clutch, journal bearing. Transmission of power through flat and V-belts, Gears, profile of gears, Governors - types and working, cams and followers - types and cam profile.

Applied Mechanics: Concept of Mechanics, explanations, concept of rigid bodies, Law of forces, Bow's notation, types of forces, action and reaction, resultant and components of forces. Lamie's Theorem-concept of moments, varignon's theorem, application of moments to simple mechanism, equilibrium of bodies under coplanar forces, friction, Concept, laws and limitations, center of gravity, centroid for regular lamina and center of gravity for regular solids, moments of inertia, Law of motion concept of machine, mechanical advantage conservation of momentum.

Automobiles: Classification and types of automobile vehicles, two and four wheeler chassis layout and body types. Layout of vehicle such as front engine rear wheel drive, front engine front wheel drive, rear engine rear wheel drive, four wheels drive etc. their advantages, comparisons on Aerodynamic basis.

I.C. Engine: Ignition method of I. C. Engine (C.I & S.I). Two & Four stroke Engines: construction and working. Various terms related to I.C Engine:

scavenging, pre-ignition, detonation, supercharging, turbo charging, air fuel ratio requirements, M.P.F.I., fuel injection pump.

Fuels: Properties, calorific value & ignition temperature of fuels. Characteristics of a good/ ideal fuel. Liquid fuels: fractional distillation, composition, properties, uses. Applications of-Biodiesel. Gaseous fuels- properties, applications of Biogas, LPG, CNG, hydrogen fuel cell, Li-ion battery.

Lubricant: Definition, functions, classification& application of lubricant. Selection of Lubricants.

Industrial Safety: Safety Management, Causes, types, Preventive measures& Safety procedures of Industrial Accidents. Inventory Concept, ABC Analysis - Necessity & Steps, Economic Order Quantity Concept, graphical representation, determination of EOQ, Standard steps in Purchasing, Modern Techniques of Material Management.

Materials Management: Inventory Concept, its classification, functions of inventory, Standard steps in Purchasing, Modern Techniques of Material Management- Material Resource Planning (MRP) - Functions of MRP, Input to MRP, Benefits of MRP, Enterprise Resource Planning (ERP) - Concept, list of modules, advantages & disadvantages of ERP.

Welding Soldering Brazing: General characteristics of welded joints, principle of welding, types of welding process and their brief, gas welding and arc welding, high pressure gas welding and low pressure gas welding, DC welding & AC welding, selection of electrodes, fluxes, current torches and equipment, specification of tools, materials according to IS standard, principles of soldering and brazing, types of solders & soldering fluxes, soldering tools and equipments, defects and remedies, brazing joints, brazing process, description of brazing tools, brazing filler alloys and fluxes, limitations and applications of soldering and brazing.

Advance Welding and Technology: TIG, MIG laser beams and thermal welding.

Materials Science and Technology: Importance of materials Classification, atomic structure, crystal structure and imperfection, properties of materials, strength. ductility, malleability, toughness, resilience, stiffness, hardness stages of deformation, mechanical testing of material, tensile test, hardness test (Brinell HT & Rockwell H.T), impact test, ferrous and non-ferrous materials, insulating materials, fundamental of heart treatment, iron-carbon diagram, TTI curie.

Mechanism: Simple Mechanism, Kinematics links, pairs, chain for bar chain, cams types and followers with classification, loss of friction between dry surface,

coefficient of friction power absorbed in fraction for pivot bearings (flat, collar, conical) power transmission, types of belts, material and specification.

Refrigeration: Meaning, methods units, reverse carnot cycle heat pump, refrigerating systems, refrigerants, system, components and control psychometry dry and wet bulb temperature, saturation, dew point.

Metrology: Types of measurements, linear angular, gear tooth vernier, surface measurements, precision and accuracy, inspection and quality control surface finish.

Quality Management: Meaning of Quality, Quality Control –Concept, Objectives, Functions, Advantages. Meaning of Total Quality and TQM, Components of TQM – Concept, Elements of TQM, & Systems of Quality Management like Kaizen,5'S',6 Sigma, ISO 9001:2000 – Benefits.

GENERAL INTELLIGENCE & REASONING:

The syllabus for General Intelligence would include questions of both verbal and Non-verbal type. The test will include questions on analogies, similarities and difference, space visualization, problem solving analysis, judgment, decision making, visual memory, discrimination observation, relationship concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series, non- verbal series etc. The test will also include questions designed to test the candidate's abilities to deal with abstract ideas and symbols and their relationship, and other analytical functions.

GENERAL AWARENESS:

Questions will be aimed at testing the ability of the candidate's general awareness of the environment around him/her and its application to society. Questions will also be designed to test the knowledge of current events and of such matters of everyday observations and experience in their scientific aspect as may be expected of any educated person and elementary knowledge of computers. The test will also include questions relative to India and its neighbouring Countries especially pertaining to History, Culture, Geography, Economic, Science, General Politic and Scientific research etc. These questions will be such that they do not require a special study of any discipline.

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