Syllabus for Recruitment to the post of
INSPECTOR OF FACTORIES
Under Labour, Employment, Skill Development &
Entrepreneurship Department-2018

COMPULSORY SUBJECT
(Essay Type & MCQ)

1. General English ........................................ 100 Marks
2. General Studies (MCQ) ............................... 100 Marks

OPTIONAL SUBJECT
(MCQ)

1. Electrical Engineering– I ............................. 200 Marks
   Electrical Engineering – II ............................. 200 Marks
   Electrical Engineering – III ............................ 200 Marks

2. Mechanical Engineering – I ........................... 200 Marks
   Mechanical Engineering – II ........................... 200 Marks
   Mechanical Engineering – III .......................... 200 Marks
General English (3 hours duration)

ESSAY TYPE
(Full Marks : 100)

(i) Comprehension of given passage ........................................ 20 marks
(ii) Precis writing ......................................................................... 20 marks
(iii) Usage and vocabulary ........................................................... 40 marks
(iv) Short Essay ............................................................................. 20 marks

General Studies (2 hours duration)

(MCQ)
(Full Marks : 100)

The nature and standard of questions in the General Studies will be such that a well-educated person will be able to answer them without any specialized study. The questions will be such as to test a candidate’s general awareness of a variety of subjects, which will have relevance for a career in Engineering Services. The questions are likely to test the candidate’s basic understanding of all relevant issues, and ability to analyze, and take a view on conflicting socio-economic goals, objectives and demands.
ELECTRICAL ENGINEERING

PAPER – I (2 hours duration)
OBJECTIVE TYPE (MCQ)
(Full Marks : 200)

a. EM Theory

b. Electrical Materials

c. Electrical Circuits

d. Measurements and Instrumentation
Units and Standards, Error analysis, measurement of current, Voltage, power, Power-factor and energy. Indicating instruments, Measurement of resistance, inductance, Capacitance and frequency, Bridge measurements, Electronic measuring instruments. Digital Voltmeter and frequency counter. Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc. Date acquisition systems, A/D and D/A converters.

PAPER – II (2 hours duration)
OBJECTIVE TYPE (MCQ)
(Full Marks : 200)

1. Control Systems
Mathematical modeling of physical systems, Block diagrams and signal flow graphs and their reduction. Time domain and frequency domain analysis of linear dynamical system, Errors for different type of inputs and stability criteria for feedback systems, Stability analysis using Routh-Hurwitz array, Nyquist plot and Bode plot. Root locus and Nicols chart and the estimation of gain and phase margin. Basic concepts of compensator design, State variable matrix design. Sampled data system and performance of such a system with the samples in the error channel. Stability of sampled data system. Elements of non-linear control analysis, Control system components, electromechanical, hydraulic, pneumatic components.
2. Electrical Machines and Power Transformers
Magnetic Circuits – Analysis and Design of Power transformers, Construction and testing. Equivalent circuits, Losses and efficiency, Regulation, Auto-transformer, 3-phase transformer, Parallel operation.

Basic concepts in rotating machines, EMF, torque, basic machine types. Construction and operation, leakage losses and efficiency.


Induction Machines, Construction, Principle of operation, Rotating Fields, Characteristics and performance analysis, Determination of Circuit model, Circle diagram, Starting and speed control.


3. Power systems
Types of Power Stations, Hydro, Thermal and Nuclear Stations, Pumped storage plants, Economics and operating factors.

Power transmission lines, Modeling and performance characteristics, Voltage control, Load flow studies, Optimal power system operation, Load frequency control, Symmetrical short circuit analysis, Z-Bus formulation, Symmetrical Components, Per Unit representation, Fault analysis, Transient and steady-state stability of power systems. Equal area criterion.

Power system Transients, Power system Protection Circuit breakers. Relays, HVDC transmission.

PAPER – III (2 hours duration)

OBJECTIVE TYPE (MCQ)

(Full Marks : 200)

1. Analog and Digital Electronics and circuits
Semiconductor device physics, PN junctions and transistors, circuit models and parameters, FET, Zener, tunnel, Schottky, photo diodes and their applications, rectifier circuits, voltage regulators and multipliers, switching behavior of diodes and transistors.

Small signal amplifiers, biasing circuits, frequency response and improvement, multistage amplifiers and feed-back amplifiers, D.C. amplifiers, coupling methods, push pull amplifiers, operational amplifiers, wave shaping circuits, Multivibrators and flip-flops and their applications. Digital logic gage families, universal gates combinational circuits for arithmetic and logic operational, sequential logic circuits. Counters, Registers, RAM and ROMs.
2. **Microprocessors**
Microprocessor architecture Instruction set and simple assembly language programming. Interfacing for memory and I/O. Applications of Micro-processors in power system.

3. **Communication Systems**
Types of modulation; AM, FM and PM. Demodulators, Noise and bandwidth considerations. Digital communication systems, Pulse code modulation and demodulation, Elements of sound and vision broadcasting, Carrier communication. Frequency division and time division multiplexing, Telemetry system in power engineering.

4. **Power Electronics**
Power Semiconductor devices, Thyristor, Power transistor, GTOs and MOSFETs Characteristics and operation, AC to DC Converters; 1-phase and 3-phase DC to DC Converters. AC regulators. Thyristor controlled reactors; switched capacitor networks.

Inverters; single-phase and 3-phase. Pulse width modulation. Sinusoidal modulation with uniform sampling, Switched mode power supplies.

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MECHANICAL ENGINEERING

PAPER – I (2 hours duration)
OBJECTIVE TYPE (MCQ)

(Full Marks : 200)

1. Thermodynamics:

2. Heat Transfer, Refrigeration and Air-Conditioning:

3. Fluid Mechanics:
Properties and classification of fluids, Manometry, forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floating bodies. Kinematics and Dynamics.


4. Fluid Machinery and Steam Generators:
Performance, Operation and control of hydraulic Pump and impulse and reaction Turbines, Specific speed, Classification. Energy transfer, Coupling, Power transmission, Steam generators Firetube and water-tube boilers. Flow of steam through Nozzles and

PAPER – II (2 hours duration)

OBJECTIVE TYPE (MCQ)

(Full Marks : 200)

1. Theory of Machines:

2. Machine Design:

3. Strength of Materials:
   Stress and strain in two dimensions, Principal stresses and strains, Mohr’s construction, linear elastic materials, isotropy and anisotropy, stress-strain relations, uniaxial loading, thermal stresses. Beams : Bending moment and shear force diagram, bending stresses and deflection of beams. Shear stress distribution. Torsion of shafts, helical springs. Combined stresses, thick-and thin-walled pressure vessels. Struts and columns. Strain energy concepts and theories of failure.

PAPER – III (2 hours duration)

OBJECTIVE TYPE (MCQ)

(Full Marks : 200)

1. Engineering Materials:

2. Production Engineering:
   Metal Forming: Basic Principles of forging, drawing and extrusion; High energy rate forming; Powder metallurgy.


3. Industrial Engineering:
   Production Planning and Control: Forecasting - Moving average, exponential smoothing, Operations, scheduling; assembly line balancing, Product development, Break-even analysis, Capacity planning, PERT and CPM.


Value Engineering: Value analysis for cost/value.