

SYLLABUS FOR COMPETITIVE EXAMINATION FOR RECRUITMENT OF INSPECTORS OF BOILERS UNDER ASSAM BOILER SERVICE RULES, 1999.

The competitive examination (written) test shall be of only one paper, namely "Applied Engineering-Boiler technology and power plant" carrying 100 marks and the duration of the examination shall be three hours.

Subject : Applied Engineering-Boiler Technology and power plant.

Part-1 : Applied Engineering

(a) Basic Mathematics

Mensuration formula as applicable to surface area and volume measurements in Boiler practice. Application of logarithms, quadratic equation, elementary trigonometry, study of properties of triangle, circles and elliptical surface as applicable to Boiler practice in handling sheet metal and plate cuttings.

(b) Basic physics & chemistry.

Newton's law of motion and equation of motions, heat, temperature, specific heat, pressure, Barometer, Horse power, Energy Evaporation and Boiling point.

Significance of PH value, elementary theory of corrosion, elementary chemistry of calcium, Magnesium and sodium salt as are dissolved in water. Effect of heat on dissolved salt in water.

(C) Fluid Mechanics.

Application of basic equation of flow through orifices, pipes and channels, Factors effecting resistance of passage against fluid flow, measurement of pressure drop and draft, study of straight and inclined manometers, Head discharge characteristics of reciprocating and centrifugal pumps, pressure drop in straight and helically wounded pipes etc, due to fluid flow.

(d) Strength of materials

Elasticity, ductility, rigidity, malleability, stress, strain and elastic modulus, Determination of tensile, compressive, shear and bending stresses, principal stresses in beams with simply supported and fixed ends, cases of uniform loading, strength and efficiency of rivetted joints, welded joints and strength of metal at elevated temperatures.

(e) Applied Metallurgy (Materials of construction)

(f) Mechanical testing.

Tensile test : yield point, yield strength, elongation, reduction of area & modulus of elasticity, stress-strain diagram, true-stresses, true strain, tensile test.

Hardness : Brinell Hardness, Rockwell Hardness, Case Hardening, Vickers hardness, impact and impact test, metal fatigue and endurance.

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(II) Principle heat treatment :

Iron carbon diagram, austenite, pearlite, cementite, dearlite, equilibrium and non-equilibrium, Casting, Hardening, annealing, tempering, quenching(water & oil), Heating method for heat Treating furnace and atmosphere control.

(III) Hot working process of metal :

Rolling, forging, drop and press forging, Roll forming, machine; forging, extrusion, Tube making, Hot spinning.

(IV) Metallurgical Bending of metal :

Fundamental mechanism of bending and practical limitation of bendings.
Fusion bending, Sintering of solid to solid , bending of liquid to solid, pressure welding.

(V) Cold working process of metal :

Rolling, Roll forming, shearing, Deep drawing, Drop hammer forming, Metal spinning, wire Drawing, Impact extrusion, Rotary swaging.

(VI) Welding process :

(a) Various type of weldings.

(b) Basic theory of welding metallurgy, heat distribution during welding, weld metal, Metallurgical effects of welding, slag, thermal effect of welding on parent material, cracking. Weld hardening, weld distortion during welding, Stresses resulted from welding, Multipass welding. Comparative effect of various welding process.

Pt-II. Boiler Technology and power plant :

(a) Theory of steam generation and utilization.

(i) Properties of steam :- Basic principles of thermodynamics, Sensible and latent heat, affect of pressure on boiling point, latent heat and specific volume of steam, critical pressure and temperature, Dryness fraction, Degree of superheat, total enthalpy of steam, effect of compression and expansion on steam parameters.

(ii) Steel Generators, Different type of Boilers and circulation principles, evaporation per unit of heating surface and per unit of fuel, heat FLUX and heat release of natural convection and forced convection boilers, convection circulation in drum type Boilers.

(iii) Steam distribution : Steam flow in main steam piping and optimum diameter, condensation problem, optimum lagging of steam pipes, influence of lagging on heat economy, location of steam traps, layout of piping systems, Expansion joints and their optimum location.

(iv) Exhausting of steam : Methods of condensing of steam, surface and Jet Condensers, preservation of heat of condensate, collecting condensate from appliances, economics of condensate return systems to be used for a plant.

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(b) Theory of combustion and Heat Transmission.

- (i) Theory of Combustion :- Combustion of fuel drop late, effects of automisation and penetration in combustion mixing technique for optimum turbulence, Diffuser, Combustion cane, Flame length and its central, role of primary and secondary air, influence of excess air, effect of flame development and its temperature, study of type of burners for liquid and gaseous fuel.
- (ii) Heat transmission :- Heat transfer through conduction, convection, and radiation methods, conduction equation through composite Brick-Wall of Boilers, overall heat transfer co-efficient, calculation of loss of, heat transfer to water wall of Boilers and Economizers, method of improving overall heat transfer co-efficient in Boilers, heat transfer in economizer units, maximum possible recovery of waste exhaust heat in Boilers.

(c) Boilers operation and performance :


- (i) Steam Economy : Steam leakage in joints, correct method of legging, calculation of optimum thickness of legging, effective condensate handing in a given steam circuit, use of suitable steam traps at correct locations, method of heat recovery of flushing at correct points.
- (ii) Fuel Economy, Efficient management of burning fuel in all oil and coal fired Boilers, control of air and fuel parameters, factors effecting CO₂ and the exhaust temperature at the Boiler exit, Balance draft system, its merits and demerits, study of factors effecting heat transfer, application of optimum use of waste heat of exhaust gases in Boiler plant.
- (iii) Boilers performance : Points of consideration for safe operation of Boilers with reference to operational check-points, firing system, check of instrument parameters, fuel water treatment and its conditions study of principles of Creep apparatus, determination of exhaust gas's analysis etc.
- (iv) Auxiliaries and Maun tinge : Boiler feed water heater, dearator, Air pre-heater, Electrostatic precipitator, soat blower, De-Super heater, Super-heater, Economiser, different type of Valves, different type of feed pumps, steam separators, fuel pump etc.

(d) Power Plants-steam turbine Plant :

Principal of working of turbines, velocity and pressure compounding impulses, steam consumption and efficiency of burners on fuel, load, reheating, bleeding, Determination of H.P. and efficiency of turbines, Steam condensers, cooling system used for condensed water.

Interview/Viva-Voice Text.

There shall an Interview/Viva-Voice Text for 15(fifteen) marks. The candidates declared qualified in the written test shall have to appear for interview/Viva-Voice test and final and the merit list shall be prepared on the basis of mark secured in written test as well as in the interview/Viva-Voice test.


Deputy Secretary

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