Q-3 a) What is the need for compounding in an impulse turbine. Discuss various methods of compounding in brief. [8]

b) During a boiler trial the following observations were made : [12

Duration of trial=1 hour ; steam generated=35500 kg ; steam pressure = 12 bar ; steam temperature = 250°C ; temperature of water entering economizer = 17°C, temperature of water leaving economizer = 77°C ; oil burnt = 3460kg ; calorific value of oil = 39500 kJ/kg. Calculate :

(i) Equivalent evaporation per kg of fuel. (ii) Thermal efficiency of plant. (iii) Percentage heat energy of the fuel energy utilised by the economiser.

Q-4 a) What are the advantages of multistage compression. Derive the condition for optimum pressure ratio for a two stage compressor with perfect intercooling and minimum work input. [10]

b) Steam enters the blade row of an impulse turbine with a velocity of 600 m/s at an angle of 25° to the plane of rotation of the blades. The mean blade speed is 255 m/s. The blade angle on the exit side is 30°. The blade friction co-efficient is 10%. For 10 kg/s of steam flow determine : (i) Power output (ii) Diagram efficiency (iii) Axial thrust [10]

Q-5 a) What are the sources of air leakage in a condenser. How does it affect the performance of the condenser. Draw the schematic of a closed loop condensing plant and explain the working of various components of the plant. [10]

b) Derive the condition for optimum speed ratio in an impulse turbine and obtain an expression for maximum efficiency with usual notations. [10]

Q-6 a) At a stage in a reaction turbine the pressure of steam is 0.34 bar and the dryness fraction 0.95. For a flow rate of 36000 kg/h, the stage develops 950 kW. The turbine runs at 3600 r.p.m. and the velocity of flow is 0. 72 times the blade velocity. The outlet angle of both stator and rotor blades is 20°. Determine at this stage : (i)Mean rotor diameter, (ii) Height of blades. [12]

b) Derive an expression for optimum pressure ratio in a ideal gas turbine cycle in terms of maximum and minimum cycle temperatures and hence deduce the maximum net work output. [8]

7 a) . In a gas turbine plant working on the Brayton Cycle with a regenerator of 75 % effectiveness, the air at inlet to the compressor is at 0.1 MPa, 30° C, the pressure ratio is 6 and the maximum cycle temperature is 900° C . If the turbine and compressor have each efficiency of 80% , find the percentage increase in efficiency due to regeneration. [10]

b) Steam expands isentropically in a nozzle from 1 MPa, 250^0 C to 10 kPa. The steam flow rate is 1 kg/s. The exhaust steam from the nozzle flows into condenser and flows out as saturated water. The cooling water enters the condenser at 25^0 C and leaves at 35^0 C . The velocity of steam at inlet to the nozzle is negligible. Determine : (i) Velocity of steam at exit of the nozzle. (ii) Mass flow rate of cooling water. (iii) Exit area of nozzle [10]
