D 41367 (Pages : 2) Name.....

Reg. No.....

EIGHTH SEMESTER B.TECH. (ENGINEERING) [2014 SCHEME] DEGREE EXAMINATION, APRIL 2018

Mechanical Engineering

ME 14 802—POWER PLANT ENGINEERING

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

1. A steam turbine receives steam at 15 bar and 350°C and exhausts to the condenser at 0.06 bar. Determine the thermal efficiency of the ideal Rankine cycle operating between these two limits.
2. Discuss about second law analysis of vapor power cycles.
3. Describe with a T-s diagram, the principle of operation of combined gas-vapour power cycles.
4. Describe the steps involved in the inplant handling of coal ?
5. State difference between water tube boiler and fire tube boiler.
6. Explain supersaturated flow in steam nozzles.
7. What do you mean by governing of turbine ?
8. Discuss various types of cooling towers.
9. Describe the working of gas turbine plant with sketch.
10. The peak load on a power plant is 60 MW. The loads having maximum demands of 30 MW, 20 MW, 10 M W and 14 MW are connected to the power plant. Estimate diversity factor.

(8 × 5 = 40 marks)

Part B

Answer **all** *questions.*

11. (a) In a thermal power plant operating on a regenerative Rankine cycle superheated steam at 50 bar and 500°C enters a turbine. A suitable fraction of the steam is withdrawn from the turbine at 10 bar and the rest of the steam expands to the condenser pressure 0.05 bar. Calculate the thermal efficiency of the steam power plant and the mass flow rate of steam if the net power output of the plant is 100 MW. Also compare this efficiency with ideal Rankine cycle efficiency.

Or

Turn over

(b) A gas turbine power plant consists of a two- stage compressor with intercooling and a single stage turbine with a regenerator. Air enters the compressor at 1 bar, 20°C. The maximum temperature of the cycle is limited to 900°C and the maximum pressure ratio is 6. The effectiveness of the regenerator is 0.7. The rate of air flow through the plant is 210 kg/s and the calorific value of fuel used is 40.8 MJ/kg. Take for air C_p = 1 .005 kJ/kgK and γ =1.4 and for gases C_p = 1.08 kJ/kgK and γ = 1.33. Assuming perfect intercooling and neglecting pressure and heat losses, estimate (i) air-fuel ratio and (ii) cycle efficiency.

12. (a) Explain the construction and working of any *one* modern high pressure boiler with a neat sketch.

Or

(b) The following readings were obtained during a boiler trail of 6 hours duration. Mean steam pressure = 12 bar; mass of steam generated = 40000 kg; mean dryness fraction = 0.85; mean feed water temperature = 30°C, coal used = 4000 kg. Calorific value of coal = 33400 kJ/kg. Calculate (i) factor of equivalent evaporation (ii) equivalent evaporation from and at 100°C (iii) efficiency of the boiler.

13. (a) With the help of neat diagrams, explain the working of dry cooling towers. Mention its advantages and disadvantages.

Or

(b) A simple impulse turbine has a mean blade ring diameter of 70 cm and runs at 3000 rpm. The blade speed ratio is 0.46 and discharge is axial. The nozzle angle is 21° and blade friction factor is 0.95. Determine

(i) Blade angles ; and

(ii) Theoretical specific power output.

14. (a) With neat sketch, explain the boiling water reactor power plant and discuss its relative advantages and disadvantages over pressurized water reactor.

Or

(b) A hydro power plant is to be used as peak load plant at an annual load factor of 30%. The electrical energy obtained during the year is 750×10^5 kWh. Determine the maximum demand. If the plant capacity factor is 24% find reserve capacity of the plant.

(4 × 15 = 60 marks)