Roll No. | | | | | | | | 15

B.E / B.Tech (Full Time) End Semester DEGREE EXAMINATION, NOV / DEC 2011

Fourth Semester

Mechanical Engineering

ME 284 – THERMAL ENGINEERING - I

(Regulation 2004)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART- A (10 x 2 = 20 Marks)

1. Draw the actual P-V diagram of a petrol engine.
2. What is meant by mean effective pressure?
3. Why the governing is needed in steam turbines?
4. What type of nozzles are used in reaction type steam turbines?
5. Define Turbocharging.
6. What is a use of valve timing diagrams?
7. Define Knocking.
8. Why pollution control norms are formed?
9. Define intercooling in gas turbines.
10. What type of material is used for gas turbine blades and why it is used?

Part – B (5 x 16 = 80 marks)

11. a) The compression ratio for a single-cylinder engine operating on dual cycle is 9. The maximum pressure in the cylinder is limited to 60 bar. The pressure and temperature of the air at the beginning of the cycle are 1 bar and 30°C. Heat is added during constant pressure process upto 4 percent of the stroke. Assuming the cylinder diameter and stroke length as 250 mm and 300 mm respectively, determine :
    i) The air standard efficiency of the cycle.
    ii) The power developed if the number of working cycles are 3 per second.

    Take for air c_v = 0.71 kJ/kg K and : c_p = 1.0 kJ/kg K

12. a) A 50% reaction turbine (with symmetrical velocity triangles) running at 400 r.p.m. has the exit angle of the blades as 20° and the velocity of steam relative to the blades at the exit is 1.35 times the mean blade speed. The steam flow rate is 8.33 kg/s and at a particular stage the specific volume is 1.381 m^3 /kg. Calculate for this stage:
    (i) A suitable blade height, assuming the rotor mean diameter 12 times the blade height, and
    ii) The diagram work.

    OR

    b) Explain the construction, working and advantages of multistage steam turbines.

13. a) Explain with a neat sketch the working of diesel fuel ignition system.

OR

b) With a necessary illustration discuss in detail about the electronic ignition system used in IC Engines.

14. a) A 4-cylinder petrol engine has a bore of 60 mm and a stroke of 90 mm. Its rated speed is 2800 r.p.m. and it is tested at this speed against brake which has a torque arm of 0.37 m. The net brake load is 160 N and the fuel consumption is 8.986 litres / h. The specific gravity of petrol used is 0.74 and it has a lower calorific value of 44100 kJ/kg. A Morse test is carried out and the cylinders are cut out in the order 1,2,3,4 with corresponding brake loads of 110, 107, 104 and 110 N respectively. Calculate for this speed:

i) The engine torque
ii) The brake mean effective pressure
iii) The brake thermal efficiency
iv) The specific fuel consumption
V) Mechanical efficiency and
v) Indicated mean effective pressure.

OR

b) Explain the principle construction and working of forced type cooling system used in IC Engine.

15. a) A gas turbine employs a heat exchanger with a thermal ratio of 72%. The turbine operates between the pressure of 1.01 bar and 4.04 bar and ambient temperature is 20°C. Isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The pressure drop on each side of the heat exchanger is 0.05 bar and in the combustion chamber 0.14 bar. Assume combustion efficiency to be unity and calorific value of the fuel to be 41800 kJ/kg.
Calculate the increase in efficiency due to heat exchanger over that for simple cycle.
Assume c_p is constant throughout and is equal to 1.024 kJ/kg K, and assume $\gamma = 1.4$.
For simple cycle the air-fuel ratio is 90 : 1, and for the heat exchange cycle the turbine entry temperature is the same as for a simple cycle.

OR

b) Explain the regeneration and reheating in gas turbines with necessary graphical illustration and also indicate why this process are carry out in high speed gas turbine?