BTS(C) – V – 11.12 – 057 – M

B.Tech. Degree V Semester Examination November 2012

ME 504 THERMAL ENGINEERING

(*2006 Scheme*)

Time : 3 Hours | Maximum Marks : 100

PART A

(Answer ***ALL*** questions)

(8 × 5 = 40)

I. (a) Discuss the actual cycles of a four stroke petrol engine.

(b) What do we mean by scavenging? List out its objectives.

(c) What are the exhaust emissions of IC engines and how they are controlled?

(d) Differentiate between octane number and cetane number.

(e) What is critical pressure ratio? Explain the effect of friction on it.

(f) Explain velocity compounding of impulse turbine.

(g) Derive an expression for the efficiency of a roots blower.

(h) Compare open and closed gas turbine cycle.

PART B

(4 × 15 = 60)

II. (a) Draw and explain the indicator diagram of a four stroke petrol engine. (5)

(b) A four stroke, four cylinder petrol engine having a bore of 6.5cm, a stroke of 9.5cm, speed 3000 rpm and clearance volume of 65cm^3. Determine the brake mean effective pressure and SFC. Given relative efficiency 0.5 based on brake thermal efficiency . Heating value of fuel = 4200KJ/Kg. The engine develops 68.6 N-m torque when tested on load. (10)

OR

III. (a) Discuss the effect of spark advance on the performance of an otto cycle engine. What is optimum spark advance? (10)

(b) Explain the following: (5)

(i) IHP
(ii) BMEP
(iii) IMEP
(iv) Relative efficiency

IV. (a) Explain the combustion phenomenon in SI engine. (7)

(b) What are the methods of governing employed in IC engines? Explain each. (8)

OR

(P.T.O.)

V. "Factors tending to increasing detonation in SI engines tend to reduce knock in CI engines". Discuss the statement clearly and indicate the methods used to reduce knock in CI engines and detonation in SI engines. (15)

VI. (a) Explain super saturated flow through nozzles. (5)

(b) A steam nozzle is supplied with steam at 7 bar and 250°C and it discharges steam at 1 bar. If the delivering portion of the nozzle is 50mm long and throat diameter is 5mm, determine the cone angle of the divergent portion. Assume 10% of the total available entropy drop to be lost in friction at the divergent part. Also determine the velocity and temperature of steam at the throat. (10)

OR

VII. (a) Explain the degree of reaction of a steam turbine. (5)

(b) Dry saturated steam at a rate of 1Kg/s flows through a convergent nozzle with initial pressure of 8 bar. The exit pressure of the nozzle is 2 bar and the flow is isentropic. Calculate the exit area and dryness fraction. (10)

VIII. The following data refer to a gas turbine having two stages with intercooling and reheat pressure ratio = 4. T_{min} = 27°C, T_{max} = 600°C. Turbine efficiency = 0.8. Compressor efficiency = 0.8. Regenerated effectiveness = 0.8. Determine cycle thermal efficiency, cycle work ratio and cycle air ratio. Assume pressure ratio to be same for both the stages and intake pressure to compressor as 1 bar. Cp = 1.01 KJ/KgK. (15)

OR

IX. In an open cycle gas turbine plant air at 15°C and 1.013 bar is compressed through a pressure ratio of 5 : 1. The maximum temperature of the cycle is 8000°C and the gas expands in two turbine stages to the original pressure with reheating at constant pressure of 2.265 bar to 800°C between the stages. The air is compressed in 2 stages with complete intercooling division being made for optimum conditions. The isentropic efficiencies of turbine and compressors are 0.9 and 0.8 respectively. Determine: (15)

(i) Power for mass flow of 20Kg/s
(ii) Air fuel ratio
(iii) Overall thermal efficiency

Assume Cp = 1.005 KJ/KgK
Calorific value of fuel = 41800 KJ/Kg.

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