Exam.Code:0940
Sub. Code: 6417

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1108

B.E. (Mechanical Engineering)
Fourth Semester
MEC-401: Applied Thermodynamics

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I (Section-A) which is compulsory and selecting two questions each from Section B-C.

x-x-x

Section – A (Compulsory) 2x5=10

1 1) What is Prewhirl? Explain with the help of velocity triangles.
2) How Supercharging effect the efficiency of IC engines? What are superchargers?
3) How the IC engine fuels are rated?
4) Write the name of two solid propellants?
5) List out merits of gas turbine over steam turbine.

Section – B (attempt any two) 10x2=20

2. (a) Explain the stages of combustion in a CI engine. (5)
(b) The following results refer to a test on a petrol engine: IP = 30KW, BP = 26 KW, Engine speed = 1000 rpm, fuel per BP Hour = 0.35kg, calorific value of fuel = 43900 KJ/Kg, Calculate: Indicated thermal efficiency, brake thermal efficiency and mechanical efficiency. (5)

3. Air is drawn in a gas turbine unit at 15^0 C, 1.01 bar and pressure ratio is 7:1. The compressor is driven by the HP turbine and LP turbine drives a separate power shaft. The isentropic efficiencies of compressor, HP turbine and LP turbines are 0.82, 0.85 and 0.85 respectively. If the max cycle temperature is 610^0 C, calculate: pressure and temperature of the gases entering the power turbines, net power developed by the unit per kg/sec mass flow, work ratio and thermal efficiency of the unit. Neglect the mass of fuel and assume: for compression process Cpa = 1.005 KJ/KgK and Y = 1.4, for combustion and expansion process: Cpg = 1.15 KJ/KgK and Y= 1.333. (10)

4. The following data pertains to a turbojet flying an altitude of 9500 m: speed of turbojet = 800Km/hr, propulsive efficiency = 55%, overall efficiency of turbine plant = 17%, density of air at 9500 m altitude = 0.17 Kg/m^3, drag on the plane 6100 N. Assuming calorific value of the fuels use as 43000 KJ/Kg calculate, Absolute velocity of the jet, volume of air compressed /Min, diameter of the jet, power output of the unit and air fuel ratio. (10)

Section – C (attempt any two) 10x2=20

5. (a) Explain the phenomenon of 'surging and choking' in a centrifugal compressor. (5)
(b) A single stage reciprocating compressor takes 1m^3 of air per min at 1.013 bar and 15^0 C and delivers it at 7 bar. Assuming that the law of compression is $PV^{1.35}$ = C, the clearance is negligible, calculate the indicated power. (5)

6. (a) Explain the phenomena of slip and drive a relation for the calculation of slip factor using Velocity triangles. (5)
(b) Drive a relation for euler's work in case of centrifugal compressor using velocity triangles. (5)

7. An axial flow compressor with an overall isentropic efficiency of 85% draws air at 20^0 C and compresses it in the pressure ratio of 4:1: The mean blade speed and flow velocity are constant throughout the compressor. Assuming 50% reaction blading and taking blade velocity as 180m/sec and work input factor as 0.82. Calculate: Flow velocity and number of stages. Take $\alpha 1 = 12^0$ $\beta 1 = 42^0$. (10)

x-x-x