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Total No. of Questions : 09

B.Tech. (IE-2008 Batch) / (ME) (Sem.–4th)

APPLIED THERMODYNAMICS-II

Subject Code : ME-208

Paper ID : [A0811]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A

1. **Answer briefly :**

a. What is engine indicator? What function does it perform in IC engine?

b. What is octane number?

c. What is specific fuel consumption? How do we evaluate it?

d. Why do we do supercharging in IC engines?

e. Write the expression for pressure rise in case of axial flow compressor.

f. Define for compressors isothermal, isentropic and polytropic efficiency.

g. What are the advantages of closed cycle gas turbine over the open cycle gas turbine?

h. What is the use of pre-whirl in case of compressors?

i. What are various fuels used for in rocket motors? What are the desirables from them?

j. What is the difference between ram jet engine and the pulse jet engine?

SECTION-B

2. Explain the phenomenon of knocking in CI en
factors those influence knocking? Describe the n

3. What is the criterion for selection of blade
turbines? What are different blade materials?
blade cooling requirements.

4. Draw the valve-timing diagrams for four strok
stroke diesel engine and discuss the various cut

5. Derive the expression for pressure rise per stage
clearing showing the velocity triangles ant inlet
the compression process on the T-s diagram.

6. Derive expressions for thrust power, propulsio
thermal efficiencies for a propulsive system.

SECTION-C

7. A centrifugal compressor is desired to have
3.5:1. The inlet eye of the compressor impeller
axial velocity at the inlet is 130 m/s, and the
velocity in the delivery duct is 115 m/s. the ti
450 m/s and runs at 16,000 rpm with the tota
78% and pressure coefficient of 0.72. The
1.013 bar and 15°C. Calculate :

a) the static pressure ratio.

b) the static pressure and temperature at the in

c) work of compressor per kg of air.

d) the theoretical power required.

8. In a gas turbine installation, air is taken in LP
1.1 bar and after compression, it passed thro
temperature is reduced to 295 K. The cooled a
IP unit and passed in the combustion chambe
increased to 950°C by burning the fuel. The co
in HP turbine which runs the compressor and furt

in LP turbine which runs the alternator. The gases coming out from LP turbine are used for heating the incoming air from IP compressor and then exhausted to atmosphere. Taking the following data determine the power output, specific fuel consumption and thermal efficiency. Pressure ratio of each compressor = 2, isentropic efficiency of each compressor stage = 85%, isentropic efficiency of each turbine stage = 85%, effectiveness of heat exchanger = 0.75, air flow = 15 kg/s, CV of fuel = 45 MJ/kg. Cp (air) = 1 kJ/kgK, Cp (gas) = 1.15 kJ/kg K, γ (air) = 1.4, γ (gas) = 1.33. Neglect the mechanical pressure, pressure and heat losses of the system and fuel mass ratio.

9. Following data were observed from the trial of oil engine. BHP of the engine = 73.55 kW, oil consumption = 16.5 kg/hr, oil fuel contains 84% C and 16% H_2, CV of the oil = 45.2 MJ/kg. The cooling water after passing through the cooling jacket is further passed through the exhaust gas calorimeter. Cooling water flow rate = 1220 kg/hr, temperature of the water entering the-cooling jacket = 18°C, temperature of the water leaving the jacket = 57°C, temperature of the water leaving the exhaust gas calorimeter = 82°C, temperature of the exhaust gases leaving the calorimeter = 100°C, temperature of the exhaust gases leaving the engine = 410°C. Engine room temperature = 18°C. Specific heat of exhaust gases = 1.0035 kJ/kg K. Find the excess air supplied to the engine. Also draw heat balance sheet on minute and % basis.