Total No. of Questions : 10]

SEAT No. :

P2142

[Total No. of Pages : 3

[5254]-538

B. E. (Mechanical - Heat Power Engg)

GAS TURBINE PROPULSION

(2012 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.***
2) ***Draw Neat diagrams wherever necessary.***
3) ***Use of scientific calculator is allowed.***
4) ***Assume suitable data where ever necessary.***
5) ***Figures to the right indicate full marks.***

Q1) a) State the principle of rocket propulsion. **[2]**

b) What are advantages of co-generation cycle? State minimum of criteria. **[4]**

c) State any four assumptions of Brayton cycle. **[4]**

OR

Q2) a) With the help of neat diagram explain reheat gas turbine cycle. **[4]**

b) A simple gas turbine is to develop 2000kW. Ambient conditions are 0.95bar, 20°C. Stagnation pressure at inlet to compressor is 1 bar and at compressor exit the conditions are 6 bar 220°C. Total head temperature at turbine exit is 450°C. Find out total head isentropic efficiency of compressor and air mass flow for duct diameter of 30cm.

Also find out temperature at inlet to turbine. Neglect fuel mass. Assume standard properties. **[6]**

Q3) a) Give advantages of gas turbine plants over steam power plants. **[5]**

b) What is pulse jet engine? Mention its advantages and drawbacks. **[5]**

OR

Q4) a) A turbo jet unit mounted on aircraft has following data:

Isentropic efficiencies for compressor, turbine and nozzle are 80%, 85%, 90% respectively, inlet conditions are 0.8 bar, 280k, final pressure 4 bar, C_{pa}=1 kJ/kg k, γ=1.4, C_{pg} =1 .2kJ/Kg K, γ_g=l.35, fuel calorific value 42000kJ/kg,nozzle back pressure. 0.6 bar, maximum cycle temperature 550°C, craft speed 720km/hour, air flow 20kg/second. Find out power required to drive compressor and air fuel ratio. **[6]**

b) Define inlet diffuser efficiency and propulsive efficiency. **[4]**

Q5) a) Referring to axial flow turbines, define Degree of reaction static head efficiency and total head efficiency. **[6]**

b) In a single stage impulse turbine nozzle angle is 65° to axial direction, gas leaves blades with absolute velocity 300m/s, at 30° to axial direction. Assume zero axial thrust and find blade velocity, blade angle, power and blade efficiency assuming inlet and outlet angles equal Assume m_g = 16kg/s.**[10]**

OR

Q6) a) Discuss in brief: cooling of gas turbine blades. **[4]**

b) Explain velocity compounding if impulse turbine. **[6]**

c) Discuss performance curves of gas turbine. **[6]**

Q7) a) A 8 stage axial flow compressor with 50 % reaction blading takes air at 20°C at rate of 3 kg/s. pressure ratio is 6 with isentropic efficiency 89%. All stages are similar. Mean blade velocity is 180m/s and axial flow velocity is 110m/s. **[12]**

Find :

i) Power required

ii) Blade angles

b) Draw velocity triangles for axial flow compressor and obtain expression for work input/kg air. **[6]**

OR

Q8) a) Define degree of reaction for a stage of axial flow compressor and prove that $R = \frac{1}{2}\frac{vf}{U}$ (tanB1 + tanB2) Where Bl and B2 are blade angles with respect to axial direction. **[10]**

b) Explain surging and stalling and explain how to avoid them. **[4]**

c) Explain flow coefficient and diffuser enthalpy drop coefficient. **[4]**

Q9) a) What is flame stabilization? List out different methods and explain any one. **[8]**

b) Discuss any four requirements of gas turbine combustion chamber. **[8]**

OR

Q10) a) With help of neat diagram explain tubular combustion chamber. Compare it with annular and Tubo -Annular chambers. **[8]**

b) Discuss methods of cooling flame tubes. Draw neat sketches. **[8]**

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