Total No. of Questions : 10]

SEAT No. :

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[4959]-1038

B.E. (Mechanical)

GAS TURBINE & PROPULSION (Elective - II)

(2012 Course) (Semester - I) (402045A) (End Sem.)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Write assumptions made in analysis of compressible fluid flow under steady state conditions and derive continuity equation. **[6]**

b) An aeroplane is flying at a speed of 800 kmph at a high altitude where the atmospheric air temperature is -73°C. Calculate the sonic velocity and its Mach number. Assume R = 287 Nm/kg.K. **[4]**

OR

Q2) a) In an oil gas turbine plant, air is compressed from a pressure of 1 bar and temperature of 300K upto a pressure of 5 bar. The oil used has calorific value of 42500 kJ/kg and the combustor efficiency is 95%. Hot gases leaves the combustion chamber at 1000 K. The isentropic efficiency of the turbine & compressor are 90% and 85% respectively. Assuming the mass flow rate of air at 1kg/s, find power output of the plant. **[6]**

b) With the help of neat diagrams, explain the effect of reheat gas turbine cycle on specific work output and thermal efficiency. **[4]**

Q3) a) Compare the steam & gas turbine power plants. **[6]**

b) Mention the various advantages & disadvantages of the pulse jet engines. **[4]**

OR

Q4) a) In a gas turbine cycle, air at 27°C and 0.98 bar is compressed to 6 bar. The temperature of air is increased to 750°C as it passes through the combustion chamber. The isentropic efficiencies of compressor & turbine are 0.8 and 0.85 respectively. Determine the efficiency of the plant. **[6]**

b) Define:-

i) Propulsive power,

ii) Propulsive efficiency **[4]**

Q5) a) A single stage impulse turbine has the blade velocity of 300 m/s. The gas velocity at entry to stage is at 800 m/s having the nozzle angle of 16°. The rotor blades are symmetrical. Assuming a friction factor of 0.9, find:

i) Work output

ii) Utilisation factor for the stage,

iii) Stagnation temperature drop in turbine,

iv) Stagnation pressure ratio if inlet temperature is 1000 K and the total head isentropic efficiency is equal to utilisation factor. **[10]**

b) Discuss the effect of nozzle angle on work output in case of impulse turbine. **[6]**

OR

Q6) a) Derive the equation of the condition of maximum utilisation factor for a velocity compounded impulse turbine. State clearly the assumptions made. **[10]**

b) Discuss the performance curves of gas turbines. **[6]**

Q7) a) An axial flow compressor having 8 stages and 50% reaction design compresses air in the pressure ratio of 4:1. The air enters the compressor at 20ºC and flows through it with a constant speed of 90 m/s. The rotating blades of the compressor rotates with a mean speed of 180 m/s. Take isentropic efficiency of the compressor as 82%. Calculate:

i) Work done by the machine

ii) Blade angles

Take, $\gamma = 1.4$ & Cp = 1.005 kJ/kg K. **[12]**

b) Differentiate between turbine blading & axial flow compressor blading. **[6]**

OR

Q8) a) Explain the following:

i) flow coefficient,

ii) rotor pressure flow coefficient,

iii) rotor enthalpy drop coefficient,

iv) diffuser enthalpy drop coefficient **[12]**

b) Explain the design and off - design characteristics of an axial flow compressor. **[6]**

Q9) a) Discuss how a reactive mixture is formed in a combustion chamber of a gas turbine with all steps involved. **[8]**

b) What are the factors involved in combustion of liquid fuel in the combustor? What are the aspects considered in design of a combustor? **[8]**

OR

Q10) a) Explain the annular combustion chamber with a neat sketch and also explain which type of method is used in it for flame stabilisation. **[8]**

b) Why cooling of flame tubes is necessary and what are the methods employed? Discuss various methods with the help of neat sketches. **[8]**

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