M18002156

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M.TECH 2ND SEMESTER REGULAR EXAMINATIONS, MAY 2018
GAS TURBINE AND JET PROPULSION
Branch: TE, Subject Code:MTEPE2043
Time: 3 Hours
Max Marks : 70

PART-A (10 X 2=20 MARKS)

1. Answer the following questions.

a) State the assumption made in an ideal cycle analysis of gas turbine. (CO1)
b) What are the advantage of closed cycle gas turbine over open cycle gas turbine ? (CO1)
c) Define slip factor for centrifugal compressor. (CO2)
d) What are the basic requirement of compressor for air craft application? (CO2)
e) What do you mean by power input factor for a centrifugal compressor? (CO2)
f) What are the condition of impulse turbine ? (CO3)
g) How do you classify turbine blade cooling ? (CO3)
h) What are the reason for unstable flow in axial flow compressor ? (CO3)
i) Define momentum thrust and pressure thrust. (CO4)
j) Define combustion intensity. (CO4)

PART-B (5 X 10=50 MARKS)

Answer any five questions from the following.

2. a) A turbojet power plant uses aviation kerosene having a calorific value of 43 MJ/Kg. The fuel consumption is 0.18 (Kg/hour Newton) of thrust. The aircraft velocity is 500 m/sec then mass of air passing through the compressor is 27 Kg/sec and thrust is 9 KN. Calculate the air fuel ratio and overall efficiency. (CO1)[5]
   b) The specific power output of a turbine is 336.5 Kw and the exhaust gas leaves from the turbine at 700K. Calculate the pressure ratio. (CO1)[5]

3. a) Prove that the air standard efficiency of a closed cycle gas turbine is
   $(\eta)_{\text{air standard}} = 1 - (1/r_p^{z})$
   Where r_p = pressure ratio $z = (\gamma-1/\gamma)$ (CO1)[5]
   b) In a closed cycle gas turbine at the condition of maximum work done the pressure ratio becomes $r_p = (T_3/T_1)^{1/2z}$
   Where $z = (\gamma-1/\gamma)$ (CO1)[5]

4. a)A gas turbine unit receives air at pressure 1 bar and 300K and compress it adiabatically 6.2 bar . The compressor efficiency is 88%. The fuel has a heating value of 44186 KJ/Kg and the fuel air ratio 0.017. If turbine efficiency is 90% . Calculate turbine work, compressor work and thermal efficiency.
   Assume C_{pg} =1.147 KJ/KgK γ = 1.4 (CO3)[8]
   b) What is effectiveness? Draw T-S diagram of regenerator system. (CO3)[2]

5. a) Draw T – S and h – S diagram of centrifugal compressor and calculate compressor efficiency. (CO2)[5]
   b) Write down different losses in a centrifugal compressor. (CO2)[5]

6. a) A centrifugal compressor has to deliver 35 Kg of air per sec. The impeller is 76 cm diameter revolving at 11500 rpm with an adiabatic efficiency of 80% . If the pressure ratio is 4.2 calculate the axial width of impeller. The radial velocity at the tip is 120 met/sec. The inlet conditions are 1 bar and 47^0C. (CO2)[5]
   b) Briefly explain the surging and chocking of compressor. (CO2)[5]

7 . a) A 10 stage axial flow compressor provide an overall pressure ratio of 5:1 with an overall isentropic efficiency of 87%. When the temperature of air at inlet is 15^0C. The work is equally divided between the stages. A 50% reaction is used with a blade speed of 210 m/sec and constant axial velocity of 170 m/sec . Estimate the blade angles. Assume workdone factor is 1. (CO4)[5]
   b) Draw and explain the performance characteristics curve of a axial flow compressor. (CO4)[5]

8. Write down the short notes of [5 X2]
   a) Degree of reaction (CO3)
   b) Subsonic and Supersonic flow (CO2)

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