RM19002096

Registration No: | | | | | | | | | | |

Total Number of Pages :1 **M.TECH**

M.TECH 2ND SEMESTER (AR 18) REGULAR EXAMINATIONS, APRIL/MAY 2019

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

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. [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. [5]

3. a) Prove that the air standard efficiency of a closed cycle gas turbine is

   $(\eta)_{air\ standard} = 1 - (1/r_p^{\ z})$ [5]

   Where r_p = pressure ratio $z = (\gamma - 1/\gamma)$

   b) In a closed cycle gas turbine at the condition of maximum work done the pressure ratio becomes [5]

   $r_p = (T_3/T_1)^{1/2z}$

   Where $z = (\gamma - 1/\gamma)$

4. 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 [10]

5. a) Draw T – S and h – S diagram of centrifugal compressor and calculate compressor efficiency. [5]

   b) Write down different losses in a centrifugal compressor. [5]

6. a) Derive an expression for optimum pressure ratio giving maximum cycle thermal efficiency 'η' of a gas turbine cycle if the compressor efficiency is η_c and turbine efficiency is η_t . The maximum cycle temperature is T_3 and the minimum cycle temperature is T_1. Also draw the h-s diagram of the actual cycle. [8]

   b) Explain elementary theory. [2]

7. a) Consider an ideal jet propulsion cycle in which air enters the compressor at 0.1MPa and 15ºC. The pressure leaving the compressor is 1.0 MPa and the maximum temperature is 1100ºC . The air expands in the turbine to a pressure at which the turbine work is just equal to the compressor work. On leaving the turbine, the air expands in a nozzle to 0.1MPa .The process is reversible and adiabatic. Determine the velocity of the air leaving the nozzle. The model used is ideal gas with constant specific heat, at 300K and each process is steady sate with no potential energy change. [6]

   b) Explain Vortex theory of axial flow turbine. [4]

8. Write short note on:

   a) Slip factor [5]

   b) The cooled turbine [5]

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