Karunya University
(Karunya Institute of Technology and Sciences)
(Declared as Deemed to be University under Sec.3 of the UGC Act, 1965)

End Semester Examinations - 2015-16 Even Semester - May 2016

14AE3007 Advanced Propulsion

Set B

Time : 3 hrs
Total Marks: 100

1. a. What is perpetual motion machine [2]
   b. Sate the two statement of II law of thermodynamics [4]
   c. Show that the two statements are equivalent to each other [8]
   d. Illustrate with sketch what is flow and non flow process and show the work done. [6]

OR

2. a. State the steady flow energy equation and deduce equation for shaft work done [8]
   b. Explain the concept of stagnation state and derive relationship between stagnation and static values for: Enthalpy, Temperature & Pressure [12]

3. a. Draw a sketch of fluid flow through a rotor and explain various relevant directions [8]
   b. Explain the concept of energy transfer in turbo machines [12]

OR

4. In a gas turbine, the pressure ratio to which air at 15^0 C is compressed is 6. The same air is heated to a maximum permissible temperature of 750^0 C. first in a heat exchanger and them in combustion chamber. It is them expanded in two stages such that the expansion work is maximum. The air is reheated to 750^0 C after the first stage. Determine the cycle thermal efficiency, the work ratio W_N / W_T and net shaft work per kg of air.

5. An ideal open cycle gas turbine plant using air operates in an in an overall pressure ratio of 4 and between temperature limits of 300 K and 1000 K. Assuming the constant specific heats C_P = 1 kJ / kg K and C_V = 0.717 kJ / kg K, evaluate the specific work out put and thermal efficiency for each of the modifications and state the percentage change from the basic cycle. Assuming optimum sage pressure ratios and perfect intercooling and perfect regeneration find for basic cycle; basic cycle with heat exchanger and basic cycle with two stage intercooled compressor.

OR

6. State the 6 performance coefficients in an axial flow compressor and explain each of them

7. A gas turbine having single stage rotates at 10000 rpm. At entry to the nozzle the total head temperature and pressure of the gas is 700^0 and 4.5 bar respectively and at outlet from nozzle the static pressure is 2.6 bar. At the turbine outlet annulus the static pressure is 1.5 bar. Mach no. at outlet is limited to 0.5 and gas leaves in an axial direction. The outlet nozzle angle is 70^0 to the axial direction and the nozzle friction losses may be assumed to be 3% of the isentropic temperature drop from the total head at the entry to static conditions at outlet nozzle pressure. Assume the mean blade diameter as 64 cm, gas mass flow rate as 22.5 kg/s, turbine mechanical efficiency as 99% C_p = 1.147 kJ/kg K and Υ = 1.33. Calculate the gas angles at entry and outlet from the wheel showing them on the velocity diagrams for mean blade section and output power developed by the turbine shaft.

OR

8. a. With a neat sketch explain the variation of pressure and velocity through a two stage velocity compounded impulse turbine [8]
   b. With a neat sketch explain the variation of pressure and velocity through a two stage pressure compounded impulse turbine [8]
   c. Write notes on the similarities and differences. [4]

9. Write notes on (for turbojet engine) 4 X 5

a. Ram efficiency
b. Thermal efficiency
c. Propulsive efficiency
d. After burner

Wishing you All the Best
