# GANPAT UNIVERSITY
## B.TECH SEM. VII MECHANICAL ENGINEERING
## REGULAR EXAMINATION NOV/ DEC -2012
## ME – 701 TURBO MACHINERY

TIME:- 3 HOURS                                                                TOTAL MARKS :- 70

**Instructions:**

1) Attempt all question.
2) Answer of two section must be written in separate answer book.
3) Right figure indicates full marks.
4) Assume required data if necessary.
5) Allow steam table, mollier diagram.

## SECTION – I

**Q-1**

(A) Derive Equation For Mach Number Variation With Area And Explain That For Nozzles & Diffusers.                                                06

(B) Air flowing in a duct has a velocity of 300 m/s . pressure  1.0  bar and temperature 290 K. taking $\gamma$=1.4 and R=287 J/kg K determine for isentropic flow:                06
   1) stagnation pressure and temperature.
   2) velocity of sound in dynamic and stagnation condition.
   3) stagnation pressure assuming constant density.

**OR**

**Q-1**

(A) Explain flow through convergent  nozzles with appropriate plots.                06
(B) Derive the general Euler's expression for a turbo machine.                06

**Q-2**

(A) What is Compounding of impulse turbine? Explain Velocity compounding method for Steam Turbine.                                                05

(B) Steam issues from nozzles of de Laval turbine with a velocity of 1200 m/s . The nozzle angle is $20^0$ ,the mean blade velocity is 400 m/s , and the inlet and outlet angle of blade are equal. The mass of steam flowing through turbine per hour is 900 kg. Assume that K=0.8. Calculate :                                                06
   1) the blade angles.
   2) the relative velocity of steam entering the blades.
   3) the tangential force on blades .
   4) the power developed.
   5) the blade efficiency.

**OR**

**Q-2**

(A) Classify steam turbines. Which are the losses occurred in steam turbines.                05

(B) In a stage of an impulse turbine provided with a single  row wheel, the mean diameter of the blade  ring is 80 cm and the speed of rotation is 3,000 r.p.m . the steam issues from the nozzles with a velocity of 300 m/s and the nozzle angle is $20^0$ . the rotor blades are equiangular and due to friction in the blade channels the relative velocity of  the steam at outlet from the blade is 0.86 times the relative velocity of steam entering the blades. What is the power developed in the blade when the axial thrust on the blades is 140N ?                                                06

**END**

**Q-3**      **Attempt Any Three.**            12
- **(A)** Write short note on pass out turbine.
- **(B)** What is the difference between impulse And reaction turbine? Show the pressure and velocity distribution.
- **(C)** Compare steam and gas turbine.
- **(D)** Write short note on 'Ram jet engine'.

## SECTION – II

**Q-4**

- **(A)** Derive equation of Thermal efficiency of open cycle gas turbine with recuperation method and show that this method improves the efficiency of the plant.    06
- **(B)** An open gas turbine plant works between the fixed absolute temperature limits 300K and 1500K, the absolute pressure limits being 1 bar and 14 bar .The isentropic efficiency of compressor is 0.85 and that of turbine is 0.86 . Estimate the actual thermal efficiency of the plant and the power developed . The calorific value of fuel is 42000 kJ/kg. Assume $\eta_{comb}$ = 0.99, $\eta_m$ = 0.98 for whole assembly. $\eta_{gen}$=0.98 and mass flow rate of air is 500 kg/s.    06

**OR**

**Q-4**

- **(A)** Differentiate clearly between a closed cycle gas turbine and an open cycle gas turbine.    06
- **(B)** What is the reason that impulse-reaction turbine blading is more efficient than that of impulse type?    06

**Q-5**

- **(A)** Explain Principle of working and Turbo jet engine.    05
- **(B)** A simple open cycle gas turbine takes in air at atmospheric pressure and 15 $^0$C and compresses air in the compressor up to 12 bar . Then air enters the combustion chamber and is heated to a maximum temperature of 1350 $^0$C , then it enters the turbine and expands to atmospheric pressure. If the isentropic efficiency of compressor and turbine is 0.86, combustion efficiency is 0.97 , fall of pressure through the combustion system is 0.3 bar , $C_p$ for both air and gas 1.005 kJ/kg K. $\gamma$=1.4. Determine the flow of air and gas for net power of 200 MW developed. Calculate also the heat supplied per kg of air , work ratio, thermal efficiency and specific fuel consumption if C.V of fuel is 42000 kJ/kg.    06

**OR**

**Q-5**

- **(A)** Discuss the methods of increasing output and efficiencies of gas turbines.    06
- **(B)** For the turbo jet engine ,define the following terms:    05
  - i) Thrust
  - ii) Thrust power
  - iii) Propulsive power
  - iv) Propulsive efficiency
  - v) Thermal efficiency

**Q-6**      **Attempt Any Three.**            12
- **(A)** Classify gas turbine. Also state its applications.
- **(B)** Explain the process and purpose of 'Reheating of steam' in steam turbine application.
- **(C)** Governing of reheat steam turbine.
- **(D)** What is reheat factor? Explain it with the h-s diagram.

## END OF PAPER