Code No. : 6386/N

FACULTY OF ENGINEERING
B.E. 4/4 (M/P) I Semester (New) (Supplementary) Examination, June/July 2010
THERMAL TURBO MACHINES

Time : 3 Hours] [Max. Marks : 75

Note : *Answer* ***all*** *questions from Part A. Answer* ***any five*** *questions from Part* ***B****.*

PART – A 25

1. Explain the phenomenon of choking due to friction in Fanno flow. 2
2. Write area velocity relation for a nozzle flow and show that it is required to have a convergent divergent channel to accelerate subsonic flow to supersonic flow. 3
3. Write down Rankine-Hugoniot relations and explain its significance. 2
4. Show that for sonic flow, the deviation between the compressible flow and incompressible flow values of the pressure coefficient of a perfect gas with $\gamma = 1.4$ is about 27.5%. 3
5. A gear pump is not a turbomachine. Explain why ? 2
6. Explain the concept surging in centrifugal compressors, through its performance characteristics. 3
7. Distinguish clearly between velocity compounding and pressure compounding of steam turbines. 2
8. Draw the velocity triangles of a 50% reaction steam turbine and explain its significance. 3
9. Explain the effect of regeneration on gas turbine output and efficiency through its characteristics. 3
10. Explain inter cooling is gas turbines. 2

PART – B 50

11. The pressure, temperature and Mach number of air at entry to a passage are 0.25 MPa, 27°C and 1.4 respectively. If the exit Mach number is 2.0, determine the stagnation and static temperature of air and flow rate per unit area at inlet and exit.

12. The stagnation temperature of air entering a combustion chamber is increased to 3.5 times to its initial state. If the air at entry is at 500 kPa, 105°C with a Mach number of 0.25, determine exit conditions, change in stagnation pressure, change in entropy and heat added per kg of air.

13. In a centrifugal compressor with guide vanes, air leaves guide vanes at 91.5 m/s at 70° to tangential direction. Determine the inlet relative Mach number and impeller total head isentropic efficiency. The other conditions are :
inlet diameter = 457 mm ;
Exit diameter = 762 mm ; radial component of velocity at exit = 53.4 m/s
Slip factor = 0.9 ; impeller speed = 11000 rpm, static pressure at exit = 223 kPa
T_{01} = 288 K; P_{01} = 1.013 bar.

14. Draw the velocity triangles for a Parson's reaction turbine and derive the expressions for optimum blade speed ratio, maximum work done and blade efficiency.

15. In a Braytan cycle, the maximum and minimum temperatures are 50°C and 950°C respectively. If the compressor and turbine efficiencies are 0.82 and 0.87, determine the pressure ratios, maximum power outlet and thermal efficiency of the plant.

16. a) Explain the working of liquid propellant rocket engines.
b) Compare the working Turbo jet and pulse jet engines with neat sketches.

17. a) Derive Prandtl – Meyer relation and explain its significance.
b) Derive the expressions for critical pressure ratio and maximum mass flow through a nozzle.

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