Code No. 2243

FACULTY OF ENGINEERING

B.E. 4/4 (Mech.) I-Semester **(Suppl)** Examination, May 2013

Subject : **Thermal Turbo Machines**

Time : 3 Hours Max. Marks: 75

Note: Answer **all** questions of Part - A and answer any **five** questions from Part-B.

PART – A (25 Marks)

1. Define mach number. What is the significance of Mach number in compressible fluid? (3)
2. What is steady flow velocity ellipse? Indicate the various regions of flow on this ellipse. (2)
3. What is Fanning coefficient of friction and Darcy's function factor. (3)
4. In the Rayleigh line, show the region where cooling the fluid increases the temperature and heating the fluid decreases the temperature. Give the reason. (3)
5. Why is the radial tipped impeller most widely used in centrifugal compressor stages? (2)
6. What are the advantages of an axial flow compressor? (3)
7. Explain the essential differences in the functions of moving blades in the impulse and reaction types of turbines. (3)
8. What are the advantages claimed for reheating steam in high pressure plants? (2)
9. Define polytropic efficiency for a gas turbine cycle. (2)
10. What are the advantages of pulse Jet engine? (2)

PART – B (5x10=50 Marks)

11. Air at a stagnation pressure of 7.2 MPa and a stagnation temperature of 1100 K flows isentropically through a converging diverging nozzle having a throat area of 0.01m^2. Determine the velocity at the down stream section where the Mach number is 4.0 Also find the mass flow rate. (10)

12. From the first principles, derive the Fanno equations and sketch on T-s plane, a characteristic Fanno line. (10)

13. Derive Rankine-Hugonoit relation for a normal shock. (10)

14. A rotary compressor absorbs 250 KW, when pumping 1 kg / s of air from static pressure of 1 bar to static pressure of 5 bar. In the inlet pipe the air has a temperature of 25^oC and in the exit pipe the velocity is 150m/s. Calculate : (10)
    (a) Static and total temperatures in the exit pipe.
    (a) Change of entropy and
    (b) Isentropic compression efficiency based on static values. It may be assumed that air at inlet to compressor has a negligible velocity and there is no heat loss to the surroundings.

15. In an impulse turbine the fixed nozzle angle is α, 1m blade inlet and outlet angles are equal, the blade velocity coefficient is ρ, show that maximum blade efficiency is $\left(\frac{1+\rho}{2}\right)\cos^2 \alpha$. (10)

16. Describe the various methods of reducing rotor speed of a steam turbine. (10)

17. The exit velocity from a Jet unit is 650 m/s for an air flow of 40 kg/s through the unit. The air craft is flying at 250 km/hr. Calculate the thrust developed, the thrust power and the propulsion efficiency neglect the effect of fuel. (10)

*****