FACULTY OF ENGINEERING

B. E. 4/4 (Mech.) I-Semester (**Old**) Examination, July 2010

Subject : **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 Marks)

1. What is the main difference between step and non-steep compression waves? 2
2. What is critical pressure ratio? What is its importance? 3
3. What are the assumptions made for Fanno flow? 3
4. What is the difference between Raybergh flow and Fanno flow? 2
5. What is surging in a centrigufal compressor? 3
6. The blade height in an axial flow turbine is increased towards the low pressure and why? 2
7. Explain why in multistage impulse turbines the first stage is often compounded for velocity and remaining stages have single row wheels. 3
8. Distinguish between operating features of an impulse and reaction turbines. 3
9. What are the advantages of closed cycle gas turbine over open cycle? 2
10. What are the advantages of Ram Jet engine? 2

Part – B (50 Marks)

11. Derive the expressions for the pressure, area and temperature at any section of a nozzle in terms of throat critical conditions.
12. Derive the following ratios between two sections 1 and 2 in terms of their mach number M_1 and M_2 in a Fanno flow.

$$\frac{V_2}{V_1}, \frac{P_2}{P_1} \text{ and } \frac{T_2}{T_1}$$

13. Derive Prandtl-Meyer relation for a normal shock.
14. A centrifugal compressor has an inlet eye 15 cm diameter. The impeller Revolves at 20,000 rpm and the inlet air has an axial velocity of 107 m/s, Inlet stagnation temperature 294 k and inlet pressure 1.03 bar. Determine, Theoretical angle of the blade at this point and mach number of the flow at the tip of the eye.

..2

15. Deduce an expression for work done per stage of a reaction turbine and determine the condition for maximum efficiency.

16. Explain the process of field heating by bleeding. Show that in general, bleeding improves the efficiency of a steem plant.

17. The efficiencies of the compressor and turbine of a gas turbine are 70.42% and 71% respectively. The heat added in the combustion chamber per kg of air is 476.35 KJ/Kg. Find a suitable pressure ratio such that the work ratio is 0.0544. Also find the corresponding temperature ratio. The inlet total temperature of air is 300 K.
