Student Exam No: _____

GANPAT UNIVERSITY

B.TECH SEM. **VII -** MECHANICAL ENGINEERING

REGULAR EXAMINATION NOV/DEC 2011

SUBJECT WITH CODE: - ME 701 – TURBOMACHINERY

TIME: - 3 HOURS

TOTAL MARKS:-70

INSTRUCTIONS: 1. Attempt all questions from both the sections.

2. Answers to the two sections must be written in separate answer book.

3. Figures to the right indicate full marks of the question.

4. Draw neat sketches and assume suitable additional data, if necessary.

5. Use of steam table, Calculator and Mollier chart is permissible.

Section – I

Que.-1

(a) For Parson's reaction turbine prove that degree of reaction is 50 %.   06

(b) Steam issues from the 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 blades are equal. The mass of steam flowing through the turbine per hour is 900 kg. Calculate (a) The blade angles (b) The power developed and (c) The blade efficiency Assume that K = 0.8   06

OR

Que.-1

(a) Classify steam turbines. Which are the losses occurred in steam turbines.   06

(b) What do you mean by Governing of steam turbines? Discuss Nozzle control governing with a neat diagram.   06

Que.-2

(a) With usual notations derive the expression for critical pressure ratio in flow through steam nozzles.   06

(b) Calculate the minimum area of the nozzles to flow 3 kg/s of steam under the following conditions: Steam is expanded in a set of nozzles from 10 bar and 200^0C to 5 bar. Is the nozzle convergent or convergent-divergent? Neglect the initial velocity. Assume isentropic expansion. If the coefficient of discharge is 0.95, Calculate the actual throat area.   05

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Que.-2

(a) Describe 'Regenerative feed heating' as used in thermal power plants. 06

(b) Explain the process and purpose of 'Reheating of steam' in steam turbine application. 05

Que.-3

(a) Explain with suitable diagram, the following : 08

(i)Pass out turbine (ii) Back pressure turbine

(b) What is Reheat factor? Explain it with the h-s diagram. 04

Section - II

Que.-4

(a) Discuss briefly the methods employed for improvement of thermal efficiency of open cycle gas turbine plant. 06

(b) The following data refer to a gas turbine using intercooling, regeneration and reheating arrangement. 06

Pressure ration = 64, Compressor inlet temperature = 3000K, Turbine inlet temperature = 1500 K, Compressor efficiency = 0.87, Turbine efficiency = 0.88, Regenerator effectiveness = 0.8, Inlet pressure to compressor = 1 bar,

Determine (a) Cycle thermal efficiency (b) cycle work ratio.

OR

Que.-4

(a) With usual notations derive the expression for the optimum pressure ratio giving maximum specific output in simple cycle gas turbine. 06

(b) The pressure ratio of an open cycle gas turbine power plant is 5.6. Air is taken at 30^0C and 1 bar. The compression is carried out in two stages with perfect intercooling in between. The maximum cycle temperature is 700^0C. Assuming the isentropic efficiency of each compressor stage as 85 % and that of turbine as 90 %.Determine the power developed and efficiency of the power plant if the air flow is 1.2 kg/s. The mass of fuel may be neglected, it may be assumed that C_p = 1.02 kJ/kg k and γ = 1.41 06

Que.-5

(a) What is a Steam nozzle? Discuss the phenomenon of Super saturated flow of steam through nozzle.   06

(b) Differentiate clearly between a closed cycle gas turbine and an open cycle gas turbine.   05

OR

Que.-5

(a) Explain in brief 'Turbo jet Engine' and 'Ram jet engine'   06

(b) For the Turbojet Engine, define the following terms :   05
(i)Thrust power (ii) Propulsive power (iii) Thrust
(iv) Propulsive Efficiency (v) Thermal Efficiency

Que.-6

(a) What do you mean by 'Compounding of steam turbine'? Describe any one method of compounding with a schematic diagram.   07

(b) Classify Gas turbines. Also state its applications.   05

END OF PAPER

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