GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC – SEMESTER – VIII • EXAMINATION – SUMMER 2014

Subject code: X81901   **Date: 27-05-2014**

Subject Name: Thermal Engineering

Time: 10.30 am to 01.00 pm   **Total Marks: 70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Use of steam table and Moiler chart is permitted.**
4. **Figures to the right indicate full marks.**

Q.1	**(a)**	Give classification of steam turbine and explain any one type of steam turbine.	**07**
	(b)	What do you mean by compounding of steam turbine ? Enlist the different methods for it. Draw a neat sketch for any one.	**07**
Q.2	**(a)**	Define the following : (1) Speed ratio (2) Blade velocity coefficient (3) Nozzle efficiency (4) Critical pressure	**07**
	(b)	The throat diameter of round section of nozzle is 7 mm. Steam with initial pressure of 10 bar and 260°C of temperature is to be expanded down to a back pressure of 1.0 bar. Determine : (1) Throat pressure (2) Velocity at throat (3) Velocity at exit (4) Flow rate (5) Exit diameter (6) Angle of cone for divergent part of nozzle, if the length of divergent portion is 50 mm.	**07**

<div align="center">OR</div>

	(b)	Derive an expression for mass flow rate of steam through nozzle.	**07**
Q.3	**(a)**	For an impulse turbine, explain the following terms and also obtained expression for them (1) Power (2) Axial thrust (3) Blade efficiency	**07**
	(b)	A single stage impulse turbine has a mean blade speed is 220 m/sec and blade speed ratio is 0.5 and discharge is axial. The nozzle angle is 16° and blade friction factor is 0.92. Determine : (1) Blade angles at inlet and outlet (2) Theoretical power per kg of steam	**07**

<div align="center">OR</div>

Q.3	**(a)**	The outlet angle of the blade of a Parson's reaction turbine is 20° and axial velocity of flow of steam is 0.5 times the mean blade velocity. Mass flow rate of steam is 60 kg/sec. If the diameter of ring is 1.50 meter and rotational speed is 3000 r.p.m. determine: (1) Inlet angles of blades (2) Power developed	**07**
	(b)	Write a short note on : Governing of steam turbine	**07**

Q.4 **(a)** Explain the various methods of attachment of blades to turbine rotor. **07**

(b) Explain various losses in steam turbine **07**

OR

Q.4 **(a)** Steam at a pressure of 15 bar and 250°C is expanded through a turbine at first to a pressure of 4 bar. It is then reheated at constant pressure to the initial temperature of 250°C and finally expanded to 0.1 bar. Estimate : **07**
    (1) Amount of heat supplied during reheat
    (2) Work done per kg of steam
    (3) Work done per kg of steam without reheat cycle

(b) Explain regenerative cycle with neat sketch. **07**

Q.5 **(a)** State the classification of gas turbine and explain with neat sketch working of closed cycle gas turbine. **07**

(b) A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 600°C. The isentropic efficiencies of the compressor and turbine are 0.8 and 0.82 respectively. Air enters the compressor at 25°C at the rate of 12 kg/s. Take $C_p = 1.005$ kJ/kg and $\gamma = 1.4$ for compression process, and $C_p = 1.11$ kJ/kg and $\gamma = 1.3$ for expansion process . Determine : **07**
    (1) Compressor work input
    (2) Turbine work output
    (3) Net work out put
    (4) Power developed

OR

Q.5 **(a)** What is the principle of jet propulsion ? Explain turbo pop engine. **07**

(b) Explain Ram jet with T-S diagram **07**

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