Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2171917 **Date:21/05/2019**

Subject Name:Steam and Gas Turbines (For Equivalency)

Time:02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of steam tables, Mollier chart and calculator is permissible.**

Q.1	**(a)**	Describe different types of nozzle with neat sketch. State the function of nozzle.	**03**
	(b)	A nozzle is supplied with dry steam at 12 bar and back pressure is 1 bar. Whether the nozzle is convergent or divergent? Calculate throat and exit diameter if it discharges 15 kg steam per minute.	**04**
	(c)	What is critical pressure? Derive the expression for critical pressure ratio in flow through nozzles. Calculate its value for superheated steam.	**07**
Q.2	**(a)**	Derive an expression for exit velocity of steam in terms of enthalpy of fluid at inlet and at exit and the velocity of steam at inlet.	**03**
	(b)	Explain back pressure turbine with neat sketch.	**04**
	(c)	Show that in a 50 % reaction turbine stage, the maximum efficiency is $\frac{2cos^2\alpha}{1+cos^2\alpha}$. where α is the nozzle angle.	**07**
		OR	
	(c)	A reaction turbine running at 400 rpm with 50 % reaction develops 75 KW per kg per second of steam. The exit angle of the blade is 20º and the steam velocity is 1.4 times the blade velocity. Determine: (i) Blade velocity and (ii) Inlet angle of the blades.	**07**
Q.3	**(a)**	Explain working of mixed pressure turbine.	**03**
	(b)	State various methods of governing and explain with neat sketch the Nozzle Control Governing.	**04**
	(c)	A mean blade ring diameter of a single stage impulse turbine is 0.7 meter. It runs at 3000 R.P.M. The nozzle angle is 21º and blade speed ratio is 0.46. The blade friction factor is 0.95 and the discharge is axial. Calculate blade inlet and outlet angles and Power output per kg of steam.	**07**
		OR	
Q.3	**(a)**	Compare the impulse and reaction turbines.	**03**
	(b)	Explain velocity compounded impulse turbine with neat diagram.	**04**
	(c)	The velocity of steam leaving the nozzle of an impulse turbine is 900 m/s and nozzle angle is 20º. The blade velocity is 300 m/s and the blade friction factor is 0.7. Calculate for mass flow rate of 1 kg/s and symmetric blading: (i) The blade inlet angle (ii) The axial thrust (iii) The tangential force (iv) The diagram power and efficiency.	**07**
Q.4	**(a)**	State the advantages of closed gas turbine cycle over open gas turbine cycle.	**03**
	(b)	Explain ideal gas turbine cycle with regeneration.	**04**

	(c)	In a gas turbine cycle, air at 27º C and 0.98 bar is compressed to 6 bar. The temperature of air is increased to 750º C as it passes through the combustion chamber. The isentropic efficiencies of compressor and turbine are 0.8 and 0.85 respectively. Determine the efficiency of the plant.	**07**

OR

Q.4	**(a)**	What do you understand by combined gas turbine cycle power plants and what are their objectives?	**03**
	(b)	Derive an expression for net work done by gas turbine power plant. Also state the condition of maximum work done.	**04**
	(c)	The compressor and turbine unit of a small gas turbine plant have an isentropic efficiency of 85 %. The inlet temperature to the compressor is at 15º C and the maximum temperature during the cycle is 700º C. The pressure ratio is 4. Assuming c_p = 1.1 kJ/kg K and c_v = 0.786 kJ/kg K, calculate the specific output and the overall efficiency of the cycle. Neglect all other losses.	**07**
Q.5	**(a)**	What are the advantages and disadvantages of jet engine?	**03**
	(b)	Explain Thrust, Thrust Power and Propulsive Power in context to jet propulsion.	**04**
	(c)	Explain with neat sketch “Ram jet engine.”	**07**

OR

Q.5	**(a)**	Explain the Principle of jet propulsion with neat sketch.	**03**
	(b)	What are the advantages and disadvantages of Pulse Jet Engine?	**04**
	(c)	Write a short note on: “Turbo prop engine.”	**07**

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