Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–VIII EXAMINATION – WINTER 2015

Subject Code:X81901 Date:09/12/2015

Subject Name: Thermal Engineering

Time: 2:30pm to 5:00pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** A gas turbine takes air at 1 bar and 300 K with mass flow of 10kg/sec. the pressure ratio is 6. The compression takes place in two stages with perfect intercooler. The maximum temperature is limited to 1050 K. isentropic efficiency of both compressor and turbine are 0.82 and 0.84 respectively. The regenerator (effectiveness 0.65) is used to increase temperature of air before entering the combustion chamber. Calculate thermal efficiency of plant. Assume Cp = 1 kj/kg k and γ = 1.4. Neglect mass of fuel supplied. **09**

(b) Explain with neat sketch nozzle control governing of steam turbine. **05**

Q.2 **(a)** Steam at a pressure of 10bar and 0.98 dry is passed through a convergent divergent nozzle to a back pressure of 0.1 bar. The mass flow rate is 0.55kg/sec. find (1) the pressure at throat (2) number of nozzles used if each nozzle has a throat area of 0.5 cm^2. The enthalpy drop used for reheating the steam by friction in the divergent part is 10% of the overall isentropic drop. Take index of expansion = 1.13 **09**

(b) For an impulse turbine explain the term power, axial thrust and blade efficiency. **05**

OR

(b) Give difference between impulse turbine and reaction turbine. **05**

Q.3 **(a)** Define the term nozzle efficiency. Derive an expression for mass flow rate of steam through the nozzle. **07**

(b) A 50% reaction turbine stage running at 50 revolution per second, the exit angles are 30^0 and inlet angles are 50^0. the mean diameter is 1 meter. The steam flow rate is 10000 kg/min and stage efficiency is 85%. Determine (1) the power output of the stage, (2) the specific enthalpy drop in the stage and (3) the percentage increase in the relative velocity of steam when it flows over the moving blades. **07**

OR

Q.3 **(a)** Explain general relationship between area-velocity and pressure in nozzle flow. **07**

(b) A simple impulse turbine has one ring of moving blades running at 150 m/s. the absolute velocity of the steam at exit from the stage is 85 m/s at an angle of 80^0 from the tangential direction. Blade velocity co-efficient is 0.82 and flow of steam through the stage is 2.5 kg/sec. if the blades are equiangular, find (1) blade angles (2) nozzle angle (3) absolute velocity of steam issuing from nozzle (4) axial thrust. **07**

Q.4 **(a)** Explain pressure compounded impulse turbine with neat sketch also state its advantages and disadvantages. **07**

(b) Explain reheat cycle used for steam turbine with neat sketch. **07**

OR

Q.4	**(a)**	Explain direct contact regenerative heating cycle used for steam turbine with neat sketch.	**07**
	(b)	Explain any two methods of attachment of blades to turbine rotor.	**07**
Q.5	**(a)**	Explain principle of jet propulsion and give its classification.	**07**
	(b	Explain open cycle gas turbine with regenerator and derive equation of thermal efficiency for the same.	**07**

OR

Q.5	**(a)**	Derive an expression for optimum intermediate pressure in open cycle gas turbine with reheater.	**07**
	(b)	How can thermal efficiency of open cycle gas turbine can be improved? Explain with neat sketch one of any method.	**07**

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