Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2150102 **Date:06/05/2016**

Subject Name:Fundamentals of Turbo Machines

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.**

Q.1	**(a)**	Following data refers to mean section of free vortex axial turbine stage hub diameter 460mm, tip diameter 780mm, rotational speed 6000rpm, absolute velocity at rotor entry is 267 m/s, air angles at rotor entry and exit 75° and 45° respectively, axial velocity is constant and is 70m/s, calculate followings for the hub section. 1. Air angles and blade angles, 2. Degree of reaction, 3. Flow coefficient, 4. Loading coefficient and 5. Work done by the turbine	**07**
	(b)	Draw and explain the different types or multistage arrangements in axial turbines.	**07**
Q.2	**(a)**	Explain in the detail the losses in turbomachines.	**07**
	(b)	Compare turbomachines and reciprocating machines and axial machines and radial machines.	**07**
		OR	
	(b)	Classify the turbomachines and list the differences between axial and radial turbomachines.	**07**
Q.3	**(a)**	What is degree of reaction? Obtain relations between different velocities and angles in 50% degree of reaction stages of an axial compressor. Also draw velocity triangles for the same.	**07**
	(b)	Draw and explain h-s diagram for the Axial turbine stage.	**07**
		OR	
Q.3	**(a)**	A ninety degree IFR turbine stage has the following data. Total to static pressure ratio: 3.5 Exit pressure: 1bar Stagnation temperature at entry:650°C Blade to gas speed ratio σ =0.66 Rotor diameter ratio: 0.45 Rotor speed :16000rpm Nozzle exit air angle: 20° Calculate: 1) Rotor diameter 2) Rotor blade exit air angle 3) work developed and stage efficiency	**07**
	(b)	Draw the velocity triangle of outward flow reaction turbine.	**07**
Q.4	**(a)**	Explain the general matching procedure for the jet engines.	**07**
	(b)	Define utilization factor and derive the expression for	**07**

maximum utilization factor for 50% reaction stage.

OR

Q.4	**(a)**	Axial flow compressor has following data: Temperature and pressure at inlet : 370°C and 103kpa Degree of Reaction : 0.50 Mean blade ring diameter : 370mm Rotational speed :20000rpm Blade height at entry : 60mm Air angle at rotor and stator exit : 25° Axial velocity : 180m/s Work done factor : 0.88 Stage efficiency : 0.85 Mechanical efficiency : 0.97 Calculate: 1. Air angles at rotor and stator inlet 2. Mass flow rate 3. Specific work	**07**
Q.4	**(b)**	Draw and explain performance charts for axial flow turbines and give concluding remarks.	**07**
Q.5	**(a)**	Write a short note on stalling and surging of compressor.	**07**
	(b)	Discuss the axial turbine stage with radial equilibrium condition.	**07**

OR

Q.5	**(a)**	Draw velocity triangles for the three types of impeller for centrifugal compressor.	**07**
	(b)	Discuss zero reaction stage, 50% reaction stage and the 100% reaction stage in detail.	**07**

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