Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3150102 Date:31-05-2024

Subject Name: Fundamentals of Turbomachines

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. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define a turbomachine. What are the main differences between compressible and incompressible flow macines?	**03**
	(b)	Show the arrangements of blades in axial compressor turbine stage.	**04**
	(c)	Show graphical variation in pressure and velocity in impulse stage and reaction stage of an axial turbine.	**07**
Q.2	**(a)**	Derive the expression of work developed by the turbine stage.	**03**
	(b)	Define degree of reaction. Prove that for fifty percent reaction stage, h1-h2 = h2-h3	**04**
	(c)	Draw velocity triangle for an axial turbine stage with maximum utilization factor.	**07**
		OR	
	(c)	Which are the different types of losses occurred in a turbomachine? How loss coefficient in stator and rotor blades in a turbine stage evaluated.	**07**
Q.3	**(a)**	What is an extended turbomachines? Give its examples.	**03**
	(b)	Explain rotating stall in axial compressor stage.	**04**
	(c)	Draw enthalpy entropy diagram of an axial turbine stage and derive the expression of work developed by the turbine.	**07**
		OR	
Q.3	**(a)**	Differentiate reciprocating machines and turbomachines.	**03**
	(b)	How the turbine and compressor are matched in jet engines.	**04**
	(c)	Draw and explain enthalpy entropy diagram of a centrifugal compressor stage.	**07**
Q.4	**(a)**	Explain workdone factor and derive its expression for compressor stage.	**03**
	(b)	Prove that, maximum workoutput is square of peripheral speed for a radial turbine with zero swirl at exit.	**04**
	(c)	Draw velocity triangle for a Centrifugal compressor stage.	**07**
		OR	
Q.4	**(a)**	What is the effect of slip factor on the flow and pressure ratio in the stage?	**03**
	(b)	Explain Multi stage Velocity compounded turbine.	**04**
	(c)	Derive expression for performance terms for two stage velocity compounded turbine with maximum utilization factor.	**07**

Q.5	**(a)**	What is the meaning of zero swirl at exit in a turbomachine?	**03**
	(b)	Inlet guide vanes are important in turbomachines. Justify.	**04**
	(c)	Draw velocity triangle of forward swept and backward swept rotor blade sections.	**07**

OR

Q.5	**(a)**	What is volute casing? Explain its need.	**03**
	(b)	Explain any two methods of turbine blade cooling.	**04**
	(c)	Define the terms: Utilization factor, Slip factor, Flow coefficient, Work loading coefficient, Total to total efficiency and Total to static efficiency	**07**

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