Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3150102 Date:07/06/2022

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 turbomachine. Name the turbomachines used in Aircraft engines.	**03**
	(b)	Differentiate between axial compressor and centrifugal compressor.	**04**
	(c)	Draw h-s diagram for an axial turbine stage.	**07**
Q.2	**(a)**	How the energy transfer is taking place in turbomachines?	**03**
	(b)	Differentiate between reciprocating machines and turbomachines.	**04**
	(c)	Draw h-s diagram of a radial turbine stage with diffuser.	**07**
		OR	
	(c)	Derive the expression for utilization factor for a fifty percent reaction axial turbine stage.	**07**
Q.3	**(a)**	Explain the phenomenon of choking in centrifugal compressor.	**03**
	(b)	With neat sketch explain the essential parts of a centrifugal compressor.	**04**
	(c)	A centrifugal compressor gave the following data: rotational speed 11,500 rpm, inlet total head temperature 21^{o}C, outlet and inlet total head pressure 4 bar and 1 bar respectively, impeller diameter 75cm and slip factor 0.92. calculate the compressor efficiency.	**07**
		OR	
Q.3	**(a)**	Define degree of reaction. Justify that for a fifty percent reaction stage enthalpy change through rotor and stator are same.	**03**
	(b)	What are the three types of blade shapes possible in centrifugal compressor rotor?	**04**
	(c)	What is slip factor? Explain the Stodola's formula to determine the slip factor.	**07**
Q.4	**(a)**	How the aerodynamic losses are occurred in turbomachines?	**03**
	(b)	With a neat sketch, discuss secondary flow in a cascade of blades.	**04**
	(c)	Draw velocity triangle of an axial compressor stage and derive the expression of work consumed by compressor.	**07**
		OR	
Q.4	**(a)**	How stall is propagated in a compressor blade row.	**03**
	(b)	Write a note on surging in axial compressor stage.	**04**
	(c)	Explain the following performance coefficients. Flow coefficient, rotor pressure flow coefficient, rotor enthalpy loss coefficient, diffuser pressure loss coefficient, diffuser enthalpy loss coefficient and loading coefficient.	**07**

Q.5	**(a)**	Why multistage of turbomachines is required in jet engines?	**03**
	(b)	Write the general matching procedure for a single spool turbojet engine.	**04**
	(c)	Draw velocity diagram of a two-stage axial turbine stage with maximum utilization factor and derive the general expression of work done for multistage turbines.	**07**

OR

Q.5	**(a)**	Explain the conditions for zero percent reaction stage and hundred percent reaction stage.	**03**
	(b)	What is match point? Which are the assumptions to consider to match turbomachines?	**04**
	(c)	Write the steps to find equilibrium point in a turbojet engine.	**07**

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