Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3171927 Date:14/06/2022

Subject Name: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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define Turbo machine. Write differences between incompressible and compressible flow machines.	**03**
	(b)	Briefly classify turbo machines.	**04**
	(c)	Define and explain significance of following dimensionless terms employed in incompressible turbo machine analysis, 1) The flow co-efficient, 2) The head co-efficient, 3) The power co-efficient.	**07**
Q.2	**(a)**	Define and explain "total to total efficiency" and "total to static efficiency".	**03**
	(b)	In radial turbine, Explain stage terminal velocity, stage Losses, effect of exhaust diffuser and degree of reaction.	**04**
	(c)	At a 50% reaction stage axial flow turbine, the mean blade diameter is 0.60 m. The maximum utilization factor is 0.85 and steam flow rate is 12 kg/s. Calculate the inlet and outlet absolute velocities and power developed if the speed is 2500 rpm.	**07**
		OR	
	(c)	Explain the necessity of compounding of axial flow turbines and discuss the multistage velocity compounding with neat sketches.	**07**
Q.3	**(a)**	Draw and explain "energy flow diagram" for an axial flow compressor stage.	**03**
	(b)	Explain supersonic and transonic stages in axial flow compressor	**04**
	(c)	With suitable sketch explain the working principle of an axial flow compressor and stage velocity triangles.	**07**
		OR	
Q.3	**(a)**	Define work done factor for an axial flow compressor.	**03**
	(b)	Explain the two-stage axial flow compressor with inlet guide vanes.	**04**
	(c)	An axial flow compressor draws air at 20°C and delivers it at 50 °C. Assuming 50% reaction calculate the velocity of flow if blade velocity is 100 m/s, work factor as 0.85 assume α=10°, β=40°, calculate the number of stages.	**07**
Q.4	**(a)**	Explain the Influence of inlet and outlet blade angles on performance of centrifugal compressor.	**03**
	(b)	Explain need of diffuser and explain different types of diffusers used in centrifugal compressor with simple sketches.	**04**

	(c)	Explain the phenomenon of slip in centrifugal compressors and also explain significance of slip factor in deciding number of vanes.	**07**

OR

Q.4	**(a)**	Explain different type of losses in centrifugal compressor.	**03**
	(b)	Describe principle construction and working of centrifugal compressor.	**04**
	(c)	A centrifugal compressor running at 1440 rpm, handles air at 101 KPa and 20 °C and compress it to a pressure of 6 bar isentropically. The inner and outer diameters of the impeller are 14 cm and 25 cm, respectively, The width of the blade at the inlet is 2.5 cm. The blade angles are 16° and 40° at entry and exit. Calculate mass flow rate of the air degree of reaction, power input and width of the blades at outlet.	**07**
Q.5	**(a)**	Explain Noise problems in fans and Blowers.	**03**
	(b)	State Types of Centrifugal Fans. Explain in brief any one of it.	**04**
	(c)	Explain in details about the flow analysis in impeller blades-volute and diffusers in fans and blowers.	**07**

OR

Q.5	**(a)**	Explain volumetric efficiency of fans and blowers.	**03**
	(b)	List the aerodynamic losses occur in the radial turbine stage.	**04**
	(c)	Draw and explain Entry and exit velocity triangles for impeller with inducer blades, radial-tipped blades, $\beta_2 = 90°$.	**07**

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