Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150102 **Date:29/01/2021**

Subject Name:Fundamentals of Turbomachines

Time:10:30 AM TO 12:30 PM **Total Marks: 56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	What's is mean by turbo machine	**03**
	(b)	Discuss choking in turbo machines	**04**
	(c)	Derive Euler's energy equation for turbo machine	**07**
Q.2	**(a)**	Define Degree of reaction, flow coefficient and loading coefficient	**03**
	(b)	Explain over expansion and under expansion	**04**
	(c)	Draw velocity triangle for an axial turbine stage	**07**
Q.3	**(a)**	What do you understand by The bypass ratio of a turbofan engine	**03**
	(b)	Draw the pressure and velocity variation along the length of axial turbine	**04**
	(c)	Explain Surge and stall in compressor. Also draw surge line by drawing neat sketch	**07**
Q.4	**(a)**	Why diameter of compressor is decreasing along the length	**03**
	(b)	List the losses in centrifugal compressor	**04**
	(c)	A single stage gas turbine operates at its design condition with an axial absolute flow at entry and exit from the stage. The absolute flow angle at the nozzle exit is 70o . At stage entry, the total pressure and temperature are 311 kPa and 850oC respectively. The exhaust static pressure is 100 kPa, the total to static efficiency is 0.87 and mean blade speed is 500 m/s. Assuming constant axial velocity through the stage, determine (a) the specific work done (b) the Mach number leaving the nozzle (c) the axial velocity (d) total to total efficiency (e) stage reaction	**07**
Q.5	**(a)**	Explain difference in multi spool and multi stage	**03**
	(b)	Why centrifugal compressors have volute diffuser?	**04**
	(c)	Draw velocity triangles for forward, backward and radial tipped centrifugal compressor.	**07**
Q.6	**(a)**	Difference between rotor blade and stator blade.	**03**
	(b)	Why multistage of centrifugal compressor is difficult	**04**
	(c)	Air at a temperature of 290K enters a ten stage axial flow compressor at the rate of 3kg/s. the pressure ratio is 6.5 and the efficiency is 90%, the compression process being adiabatic, the compressor has symmetrical blades. The axial velocity of 110m/s is uniform across the stage and the mean blade speed of each stage is 180m/s. determine the direction of the air at entry	**07**

to and exit from the rotor and the stator blades and also the power given to the ai

Q.7	**(a)**	Enlist the cooling technique used for gas turbine blades	**03**
	(b)	Write a short note on stall propagation in a compressor blade row	**04**
	(c)	Draw h-s diagram for an axial turbine stage.	**07**
Q.8	**(a)**	Enlist classification of turbo machines.	**03**
	(b)	Write difference between fan, blower and compressor	**04**
	(c)	Draw stodola's model of flow with slip and Write an equation of Balje's formula	**07**