C. U. SHAH UNIVERSITY Winter Examination-2019

Subject Name: Turbomachines Subject Code: 4TE07TMA1 Semester: 7 Date : 15/11/2019

Branch: B.Tech (Mechanical) Time : 10:30 To 01:30 Marks : 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.

- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

Q-1		Attempt the following questions:	(14)
-	a)	Write the application of gas turbine.	01
	b)	What is the basic principle involved in turbomachine?	01
	c)	List the different types of combustion chamber.	01
	d)	On which principle jet propulsion engine is working?	01
	e)	What is the degree of reaction R in Parsons turbine?	01
	f)	What is the behind supersaturation in the flow of steam through nozzles?	01
	g)	What is the reason that the first stage of most of steam power plant for utility is an impulse?	01
	h)	What is the value for critical pressure ratio for initially wet steam?	01
	i)	What limit the value of turbine inlet temperature?	01
	j)	What is reheat factor?	01
	k)	Write down the equation for the velocity of steam leaving the nozzle (V) is given by (where $K = Nozzle$ coefficient or nozzle efficiency, and $h_d = Enthalpy$ or heat drop during expansion of steam in a nozzle).	01
	l)	What will happen if there is no combustion chamber in the gas turbine plant?	01
	m)	Write down the equation of optimum pressure ratio for maximum cycle thermal	01
)	efficiency.	•=
	n)	What is the effect of Surging on centrifugal compressors?	01
		Attempt any four questions from Q-2 to Q-8	
Q-2		Attempt all questions	(14)
	a)	Derive equation for propulsive power and propulsive efficiency.	07
	b)	Steam is expanded in a set of nozzles from 10 bar and 200 °C to 5 bar. Is the nozzle convergent or convergent-divergent? Neglecting the initial velocity, find the minimum area of the nozzles to flow 3 kg/s of steam under the given conditions. Assume the expansion of steam is isentropic. Take $C_d = 0.98$	07
Q-3		Attempt all questions	(14)
	a)	Derive Steady flow energy equation for nozzle.	07
	b)	With neat sketch explain in detail pressure compounding of impulse turbine.	07



Q-4	a) b)	Attempt all questions With neat sketch explain in detail about turbine blade attachment. Writhe advantage and disadvantage of jet propulsion over other system.	(14) 07 07
Q-5	a)	Attempt all questions With neat sketch explain in detail about combustion chamber.	(14) 06
	a) b)	With the help of diagram explain about effect of variation of back pressure in nozzle.	08
Q-6	a) b)	Attempt all questions State merits and demerits of closed cycle gas turbine over open cycle. Steam flows from nozzles at the rate of 0.2 kg/s and speed 900 m/s. It then enters the rotor of single stage impulse turbine with symmetric blades. The flow leaves the nozzles at an angle of 20°, the mean radius of the blades is 120 mm, and the rotor speed is 18000 rpm. Due to the frictional loss in the rotor blades, kinetic energy of relative flow at rotor exit is 85% of kinetic energy of relative flow entering the rotor. Determine 1. The relative inlet flow angle	(14) 06 08
Q-7	a)	Attempt all questions The effective jet velocity from a rocket engine is 2900 m/sec. the forward velocity is 1450 m/s and the propellant consumption is 78 kg/sec. Calculate the thrust, thrust power and propulsive efficiency.	(14) 07
	b)	Derive equation for thermal efficiency of Joule cycle.	07
Q-8	a)	actual simple gas turbine cycle.	(14) 07
	b)	With neat sketch explain about working of ram jet engine also draw the T-S	07

diagram.

