Total No. of Questions – [3] Total No. of Printed Pages: 2

G.R. No.	

PAPER CODE	V223-262 (ESE)

May 2023 (ENDSEM) EXAM

S.Y. (Mechanical) (AY 2022-23 SEMESTER - II)

COURSE NAME: Applied Thermodynamics

COURSE CODE: MEUA22202

(PATTERN 2020)

Time: [1Hr] [Max. Marks: 30]

(*) Instructions to candidates:

1) **Use of a scientific calculator is allowed**
2) **Use suitable data where ever required**
3) **All questions are compulsory**

Question No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) Discuss how the steam pressure and velocity changes in the Impulse and Reaction turbines with the help of a schematic diagram.	**[4]**	[4]	[2]
	b) For a single-stage impulse turbine operating at 2800 rpm mean blade diameter is 250 cm. The ratio of blade speed to steam speed (V1) is 0.45 and Vr1 = 0.85 Vr2. The steam mass flow rate is 7 kg/sec. The nozzle angle at inlet is 25 ^{0}. Estimate 1. Power Developed 2. Blade efficiency Assume the component of whirl at the outlet as zero	**[6]**	[4]	[3]
	OR			
	c) A nozzle is to be designed to expand steam at the rate of 0.15 kg/s from 600 kPa, 230°C to 101 kPa. Neglect inlet velocity of steam. For a nozzle efficiency of 0.92. Determine the exit area of the nozzle. (Density of air at the outlet is 1.21 kg/m^3) Use: 600 kPa: h1 =2896 kJ/kg 101 kPa: h2=2600kJ/kg	**[6]**	[4]	[3]

Q.2	a) For a particular application an air at a pressure of 10 bar is needed. Analyze work required in the single stage and 2 stage compression with schematic diagram.	**[4]**	[5]	[4]
	b) Following data relates to a performance test of a single acting 15cm (dia) x10cm (stroke). reciprocating compressor: Suction and delivery pressures 1 bar and 7 bar; suction and delivery temps 27C° and 190°C; mass of air delivered 1.8 kg/min; compressor speed 1200 rpm; Estimate volumetric efficiency, indicated power (R= 0.287 kJ/kg K, Neglect clearance volume, index pf expansion = 1.3)	**[6]**	[5]	[3]
	OR			
	c) A single-acting 2-stage air compressor with perfect intercooling delivers 25 kg/min of air at 20 bar pressure. Air from the atm is sucked into the compressor at 1 bar and 27°C. The compression process follows $pV^{1.23}=C$. Illustrate: i) Indicated power ii) Isothermal efficiency (Neglect clearance volume, R= 0.287 kJ/kg K)	**[6]**	[5]	[3]
Q.3	a) Elaborate with a neat sketch variation of the pressure and velocity impeller and diffuser of the centrifugal compressor.	**[4]**	[6]	[2]
	b) Centrifugal air compressor working between 1 and 2.5 bar has Internal and external diameters of 300 mm and 600 mm respectively. The vane angle at the inlet and outlet are 30 ° and 45 ° respectively, if air enters at 15 m/sec. Calculate the speed of the impeller in RPM and Work done by the Compressor per kg of air. Assume flow velocity constant.	**[6]**	[6]	[3]
	OR			
	c) A centrifugal compressor with 80 % isentropic efficiency delivers 25 kg of air per minute at a pressure of 4 bar , at a speed of 13000 rpm. If the compressor receives air at 300 K and at a pressure of 1.01 bar. (Cp= 1.005 kJ/kg K) Calculate 1. The actual temperature of the air at the exit. 2. Power required to drive the compressor	**[6]**	[6]	[3]