Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Steam and Gas turbines **Semester : VIII**
Program: B. Tech Mechanical **Time : 03 hrs.**
Course Code: MEPD 4004 **Max. Marks : 100**

Instructions: Assume suitable data if required

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Define the following as related to steam turbines (a) Blade velocity co-efficient (b) Stage efficiency	**4**	**CO1**
Q 2	Describe the use of combined velocity triangle of an impulse turbine.	**4**	**CO1**
Q 3	Differentiate clearly between a closed cycle gas turbine and an open cycle gas turbine.	**4**	**CO1**
Q 4	State the assumptions made for thermal efficiency of a gas turbine plant.	**4**	**CO1**
Q 5	Distinguish between the terms ' change of state', ' path', and 'process·.	**4**	**CO1**
	SECTION B **(4Qx10M= 40 Marks)**		
Q6	A simple closed cycle gas turbine plant receives air at 1 bar and 15° C, and compresses it to 5 bar and then heats it to 800^{o}C in the heating chamber. The hot air expands in a turbine back to I bar. Calculate the power developed per kg of air supplied per second. Take c_p for the air as 1 kJ/kg K.	**10**	**CO3**
Q7	Explain with the help of neat diagrams a 'Regenerative cycle'. Derive also an expression for its thermal efficiency.	**10**	**CO2**
Q8	Explain the effects of: (a) intercooling, and (b) reheating, on Brayton cycle.	**10**	**CO2**
Q9	A steam power plant works between 40 bar and 0.05 bar. If the steam supplied is dry saturated and the cycle operation is Rankine, find: (a) Cycle efficiency (b) Specific steam consumption. (OR) In a steam turbine steam at 20 bar, 360^{o}C is expanded to 0.08 bar. It then enters a condensers, where it is condensed to saturated liquid water. The pump feeds back the water into boiler. Assume ideal processes, find per kg of steam the net work and the cycle efficiency.	**10**	**CO3**

SECTION-C (2Qx20M=40 Marks)			
Q10	In a regenerative cycle the inlet conditions are 40 bar and 400^{o}C. Steam is bled at 10 bar in regenerative heating. The exit pressure is 0.5 bar. Neglecting pump work determine the efficiency of the cycle.	**20**	**CO4**
Q11	At a particular stage of reaction turbine, The mean blade speed is 60 m/s and the stream pressure is 3.5 bar with a temperature of 175^{o}C. The identical fixed and moving blades have inlet angles of 30^{o} and outlet angle of 20^{o}. Determine: (a) The blade height, if it is 1/10th of the blade ring diameter, for flow rate of 13.5 kg/s. (b) The power developed by a pair. (c) Specific enthalpy drop if the stage efficiency is 85%. (OR) Air is drawn in a gas turbine unit at 15^{o}C and 1.01 bar and the pressure ratio is 7:1. The compressor driven by the H.P. turbine and the L.P. turbine drives a separate power shaft. The isentropic efficiencies of the compressor, and the H.P. and L.P. turbines are 0.82, 0.85 and 0.85, respectively. If the maximum cycle temperature is 610^{o}C. Calculate: (a) the pressure and temperature of the gasses entering the power turbine, (b) the net power developed by the unit per kg/s of mass flow, (c) the work ratio (d) the thermal efficiency of the unit. For the compression process take c_p = 1.005 kJ/kg K and γ = 1.4 For the combustion process and expansion process, take c_{pg} = 1.15 kJ/kg K and γ = 1.33	**20**	**CO4**