Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

Online End Semester Examination, May 2021

Programme Name: B.Tech- Mechanical **Semester : IV**
Course Name : Applied Thermodynamics **Time : 03 hrs**
Course Code : MECH2024 **Max. Marks: 100**

SECTION A

1. **Each Question will carry 5 Marks**
2. **Instruction: Complete the statement / Select the correct answer(s)**

S. No.	Questions	CO
Q 1	Explain the effect of reheat and regenerative on performance and economic of vapor power cycle?	**CO1**
Q 2	Isothermal compression though most efficient but is not practicable. Illustrate?	**CO3**
Q 3	A sample of air has dry and wet bulb temperatures of 35 ^{0}C and 25 ^{0}C respectively. The barometric pressure is 760 mm Hg. Calculate: (a) Humidity ratio (b) relative humidity and (c) enthalpy of the sample. (Use Psychometry Chart)	**CO1**
Q.4	Explain the effect of intercooling in gas turbine?	**CO2**
Q.5	A reaction turbine is moved primarily by reactive force but also to some extent by direct impulse/thrust. Illustrate?	**CO3**
Q.6	Explain By Pass Factor (BPF) and Apparatus Dew Point (ADP) temperature.	**CO1**

SECTION B

1. **Each question will carry 10 marks**
2. **Instruction: Write short / brief notes**

Q 1	In a vapor compression cycle saturated liquid refrigerant 22 leaving the condenser at 40 ^{0}C is required to expand to the evaporator temperature of 0 ^{0}C in a cold storage plant. (a) Determine the percentage saving in net work done of the cycle per kg of the refrigerant if an isentropic expander could be used to expand the refrigerant in place of the throttling device	**CO3**
Q 2	A 100% outdoor summer air conditioning system has a room sensible heat load of 400 kW and a room latent heat load of 100 kW. The required inside conditions are 24 ^{0}C and 50% RH, and the outdoor design conditions are 34 ^{0}C and 40% RH. The air is supplied to the room at a dry bulb temperature of 14 ^{0}C. Find a) the required mass flow rate of air b) moisture content of supply air, c) Sensible, latent heat loads on the coil, and d) The required cooling capacity of the coil, Coil Sensible Heat Factor and coil ADP if the by-pass factor of the coil is 0.2. Barometric pressure = 1 atm. Comment on the results.	**CO4**

Q.3	Air enters the compressor of a regenerative gas-turbine engine at 300 K and 100 kPa, where it is compressed to 800 kPa and 580 K. The regenerator has an effectiveness of 72 percent, and the air enters the turbine at 1200 K. For a turbine efficiency of 86 percent, determine (*a*) the amount of heat transfer in the regenerator and (*b*) the thermal efficiency.	**CO4**
Q.4	The following particulars refer to a two row velocity compounded impulse wheel: Steam velocity at nozzle exit = 600 m/s Nozzle angle = 16^0 Mean blade velocity = 120 m/s Exit angle; First row moving blade = 18^0, fixed guide blades = 22^0, second row moving blade = 36^0 Steam flow = 5 kg/s Blade friction coefficient = 0.85 Determine (a) the tangential thrust (b) The axial thrust (c) The power developed (e) The diagram efficiency	**CO4**
Q.5	Draw h-s, T-s and P-v diagram, to show the effect of supersaturation on enthalpy drop, temperature and specific volume.	**CO2**
	SECTION C **1. Each Question carries 20 Marks.** **2. Instruction: Write long answer.**	
Q 1	Consider a regenerative vapor power cycle with one open feed water heater. Steam enters the turbine at 8.0 MPa, 480 ^{0}C and expands to 0.7 MPa, where some of the steam is extracted and diverted to the open feed water heater operating at 0.7 MPa. The remaining steam expands through the second-stage turbine to the condenser pressure of 0.008 MPa. Saturated liquid exits the open feed water heater at 0.7 MPa. The isentropic efficiency of each turbine stage is 85% and each pump operates isentropically. If the net power output of the cycle is 100 MW, determine (a) the thermal efficiency and (b) the mass flow rate of steam entering the first turbine stage, in kg/h. ***OR*** A two stage air compressor with perfect intercooling takes in air at 1 bar and 27 ^{0}C. The law of compression in both the stages is $PV^{1.3}$ = constant. The compressed air is delivered at 9 bar. Calculate for unit mass flow rate of air the minimum work done and the heat rejected to the intercooler. Compare the values if the compression is carried out in a single stage compressor with after cooler.	**CO4**