UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Thermal Engineering **Semester: IV**
Program: B.Tech. Mechanical, MD, PE, TH, MSNT
Time: 03 hrs. **Max. Marks: 100**

Instructions: Attempt all questions from section A (each carrying 5 marks), section B (comprises of four questions each carrying 10 marks) and section C (comprises of two questions each carrying 20 marks)

SECTION A

S. No.		Marks	CO
Q 1	Show the Reheat cycle and regenerative feed water heating cycle on T-S diagram. Highlight their significance on the performance of steam power plant.	**5**	**CO1**
Q.2	What do you mean by supersaturated flow through steam nozzles? Discuss the causes of supersaturation phenomenon	**5**	**CO5**
Q.3	Why steam turbines are compounded? What are the different methods of compounding?	**5**	**CO6**
Q.4	Explain single pass and double pass surface condenser? In steam power plant which types of steam condenser are used and why?	**5**	**CO7**
	SECTION B		
Q.5	The volumetric analysis of flue gas is given as C_2H_6 22.6%, CH_4 73.6%, CO_2 2.4% and N_2 1.4%. Assuming combustion air to be dry and in 25% excess, find (a) The molecular weight of the combustion products, (b) the dry flue gas analysis based on CO_2, O_2 and N_2.	**10**	**CO3**
Q.6	Explain open feed water heater and closed feed water heater. Draw layout of steam power plant including open and closed feed water heater. Also, draw T-S diagram of layout.	**10**	**CO2**
Q.7	Draught produced by the chimney is 2 cm of water column. Temperature of flue gas is 300^0C and ambient temperature 33^0C. The flue gases formed per kg of fuel burnt is 24 kg. Neglect the losses and take the diameter of chimney as 1.75 m. Calculate: (i) Height of chimney in m and (ii) Mass of flue gases flowing through the chimney in kg/min.	**10**	**CO4**
Q.8	Explain is the effect of air leakage in steam condenser (surface type)? Explain the method by which air can be removed from the steam condenser? ***OR*** What is cooling tower? How does cooling tower work and what are the different types of cooling tower?	**10**	**CO7**
	SECTION-C		
Q.9	A convergent divergent nozzle receives steam at 5 bar, 200^0C and expand	**20**	**CO5**

	isentropically into a space at 2 bar. Neglecting the inlet velocity, calculate the exit area required for a mass flow rate 0.3 kg/s in the following cases. (i) When the flow is equilibrium throughout (ii) When the flow is supersaturated with $pv^{1.3}$= constant (iii) Degree of subcooling and degree of supersaturation for part (ii)		
Q.10	In a multi-stage parson's turbine at one of the stages, the rotor diameter is 125 cm and speed ratio 0.72. The speed of the rotor is 3000 rpm. Determine: (i) The blade inlet angle if the blade outlet angle is 22^0. (ii) Diagram efficiency (iii) Percentage increase in diagram efficiency and rotor speed of the turbine is designed to run at the best theoretical speed. ***OR*** The following particulars refers to a two row velocity compounded impulse steam turbine: Steam velocity at nozzle exit = 600 m/s Nozzle angle = 16^0 Mean blade velocity = 120 m/s **Exit angles:** First row of moving blade = 18^0 Fixed guide blade = 22^0 Second row of moving blade = 36^0 Steam flow rate = 5 kg/s Blade friction coefficient = 0.85 Determine: (i) The tangential thrust (ii) The axial thrust (iii) The power developed (iv) The diagram efficiency	**20**	**CO6**