Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2021

Course: Performance analysis of Mechanical Equipment **Semester: VI**
Program: B. Tech. Electrical Engineering **Time 03 hrs.**
Course Code: MECH3020P **Max. Marks: 100**

SECTION A

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

S. No.	**Question** **5 × 6 M= 30 M**	**CO**
Q 1	Write down the five different type of Heat exchangers.	**CO2**
Q2	List the factors on which the Economic Thickness of Insulation depends.	**CO2**
Q3	Do you prefer insulating the Boiler?	**CO2**
Q4	List down the different fuel used in boilers.	**CO3**
Q5	Enthalpy and entropy of dry steam at 300 ºC and 70 bar is?	**CO1**
Q6	List down the parameters (five) considered for running the furnaces economically.	**CO2**

SECTION B

1. **Each Question will carry 10 Marks**
2. **Instruction: Write short / brief notes** **5 × 10 M= 50 M**

Q 7	Explain the working of strainers, filters and the separators in steam distribution system.	**CO3**

Q 8	What is the need of performance test in boilers? Explain the indirect method for determining the performance of the bolier.	**CO3**
Q 9	With the help of neat diagram explain the working of condensate recovery system. List down its application and advantages.	**CO2**
Q 10	Explain the working of Fludized bed combustion process. What are the advantages of Fludized bed combustion as compared to conventional combustion process.	**CO2**
Q 11	What do you mean by Pinch analysis? Draw a suitable temperature curve and explain Pinch analysis.	**CO4**

Section C

1. **Each Question will carry 20 Marks**
2. **Instruction: Write long answer.** **1 × 20 M= 20 M**

Q12	A steam turbine receives superheated steam at a pressure of 16 bar and having a degree of superheat of 109 ºC. The expansion of steam takes place isentropically upto 0.07 bar. Calculate (a) Heat required to raise the temperature of dry steam from saturated temperature to superheated temperature. (b) Work done and (d) change in entropy during work done. OR 4 Kg of dry steam at 6.0 bar pressure and dryness fraction of 0.5 is heated, so that it become (a) 0.95 dry (b) Dry & saturated (c) Superheated to 300 ºC (d) Superheated to 250 ºC Determine the net heat supplied in each case. Take C_{sup} for superheated steam as 2.3 kJ/ kg K.	**CO1**

Saturated water and steam data for Q12

p	T_{sat}	Volume, m^3/kg		Energy, kJ/kg		Enthalpy, kJ/kg			Entropy, kJ/(kg K)		
MPa	°C	v_f	v_g	u_f	u_g	h_f	h_g	h_{fg}	s_f	s_g	s_{fg}
0.0070	39.000	0.00100750	20.524	163.34	2428.0	163.35	2571.7	2408.4	0.55903	8.2745	7.7154
0.0075	40.290	0.00100800	19.233	168.74	2429.8	168.75	2574.0	2405.3	0.57627	8.2501	7.6738
0.58	157.506	0.00109905	0.32585	664.01	2565.7	664.65	2754.7	2090.0	1.9176	6.7707	4.8531
0.60	158.826	0.00110060	0.31558	669.72	2566.8	670.38	2756.1	2085.8	1.9308	6.7592	4.8284
1.65	202.856	0.00116103	0.12010	863.25	2595.5	865.17	2793.7	1928.5	2.3575	6.4089	4.0514
1.70	204.307	0.00116336	0.11667	869.76	2596.2	871.74	2794.5	1922.7	2.3711	6.3981	4.0270
1.75	205.725	0.00116565	0.11343	876.13	2596.7	878.17	2795.2	1917.0	2.3845	6.3877	4.0032

Water/Steam at p = 1.6 MPa (Tsat = 201.370.)

T	v	u	h	s
°C	m^3/kg	kJ/kg	kJ/kg	kJ/kg K
300	0.15866	2781.5	3035.4	6.8863
310	0.16190	2798.8	3057.8	6.9250
320	0.16511	2815.8	3080.0	6.9628
330	0.16829	2832.8	3102.1	6.9997

Superheat steam data Water/Steam at p = 0.60 MPa (Tsat = 158.826 ºC)

T	v	u	h	s
°C	m^3/kg	kJ/kg	kJ/kg	kJ/kg K
240	0.38568	2705.1	2936.5	7.1426
250	0.39390	2721.3	2957.6	7.1832
260	0.40208	2737.3	2978.5	7.2230
290	0.42638	2785.4	3041.2	7.3373
300	0.43442	2801.3	3062.0	7.3740
310	0.44243	2817.3	3082.8	7.4100