

Name:

Enrolment No:



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

Course: Steam Generator (MEPD 4003)

Semester: VI

Program: B. Tech Mechanical

Time: 3 Hours

Max. Marks: 100

SECTION A

Note: For Q-1 to Q-6, Type the final answer only.

(a) Write precisely and to the point.

(b) Use of Steam table and Mollier chart is allowed.

S. No.		Marks	CO
Q-1	Write short notes on (a) Coal oil Mix and (b) Coal Water Mix.	5	CO1
Q-2	Write short notes on (a) topping cycle and bottoming cycle (b) open and closed feed water heater.	5	CO1
Q-3	Differentiate between Boiler accessories and Boiler mounting.	5	CO1
Q-4	What do you understand from mean temperature of heat addition in the boiler? What are the different methods of improving it?	5	CO1
Q-5	What do you mean by a super-saturated flow? Explain with the help of h-s diagram.	5	CO1
Q-6	Define the term "steam Nozzle". Explain various types of nozzles. What is the effect of friction on the flow through a steam nozzle? Explain with the help of a h-s diagram.	5	CO1

SECTION B

Q-7	Dry saturated steam at 5 bar enters a convergent-divergent nozzle at a velocity of 100 m/s. the exit pressure is 1.5 bar. The throat and exit areas are 1280 mm ² and 1600 mm ² respectively. Assuming isentropic flow upto throat and taking the critical pressure as 0.58. Estimate the mass flow rate and nozzle efficiency.	10	CO2
Q-8	A 10 MW steam turbine operates with steam at 40 bar, 400 °C at the inlet and exhaust at 0.1 bar. 10000 kg/h of steam at 3 bar is to be extracted for process work. The turbine has 75% isentropic efficiency throughout. Find the boiler capacity required.	10	CO3
Q-9	Write in detail on the following: a. Supercharged boilers b. Supercritical Boilers	10	CO2

Q-10	What do you understand from Pass-out turbine? In a power plant, the efficiencies of electric generator, turbine (mechanical), boiler, cycle and overall plant are 0.97, 0.95, 0.92, 0.42 and 0.33 respectively. What percentage of total electricity generated is consumed back in running the auxiliaries.	10	CO3
Q-11	<p>An unknown hydrocarbon fuel, C_xH_y was allowed to react with air. An Orsat analysis was made of a representative sample of gases with the following results: CO_2 12.1%, O_2 3.8%, and CO 0.9%, Determine (a) The chemical equation for the actual reaction, (b) the composition of the fuel (c) the air fuel ratio during the test, and (d) the excess or deficiency of air used.</p> <p style="text-align: center;">OR</p> <p>Explain with neat sketch the construction and working of any two of the high pressure boiler (a) La Mont boiler (b) Velox Boiler (c) Benson Boiler</p>	10	CO3
SECTION C			
Q 12	<p>(a) A boiler generates 7.5 kg of steam per kg of coal burnt at a pressure of 11 bar from feed water having a temperature of 70 °C. The efficiency of the boiler is 75% and factor of evaporation is 1.15 specific heat of steam at constant pressure is 2.3 kJ/kgK. Calculate</p> <ol style="list-style-type: none"> i. Degree of superheat and temperature of steam generated ii. Calorific value of coal in kJ/kg iii. Equivalent evaporation in kg of steam per kg of coal <p>(b) Write in detail the most important features of modern boiler.</p> <p style="text-align: center;">OR</p> <p>(a) Define Chimney Efficiency and find out the expression for the same.</p> <p>(b) A boiler is provided with a chimney height of 24 m. the ambient temperature is 25 °C. The temperature of the flue gases passing through the chimney is 300 °C. If the airflow through the combustion chamber is 20 kg/kg of fuel burnt, find (a) the theoretical draught in cm of water, (b) velocity of flue gases passing through the chimney if 50 % of the theoretical draught is lost in friction of grate and passage.</p>	20	CO4