


Name: Enrolment No:	
<p style="text-align: center;">UNIVERSITY OF PETROLEUM AND ENERGY STUDIES</p> <p style="text-align: center;">End Semester Examination, 2020-2nd Chance</p> <p>Course: Plant Utilities Semester: VIII</p> <p>Program: B. Tech CE+RP Time: 03 hrs.</p> <p>Course Code: CHEG454 Max. Marks: 100</p>	

Optional Instructions:

- 1) Solve this paper for 100 marks.
- 2) As this paper is online, you must be precise.
- 3) As this paper is online, you must spend time wisely.
- 4) If you want to write Greek symbols, use mu, rho, nu etc.
- 5) Make any assumptions if necessary.
- 6) Section A has 10 questions, all compulsory.
- 7) Section B has 4 questions, all compulsory.
- 8) Section C has 3 questions, all compulsory.
- 9) Section D has 3 questions, answer only 2.
- 10) This paper has total 5 pages, including cover sheet.

Section A, Answer ALL : 10 Q x 1 Marks = 10 Marks

This section has Multiple Choice Questions, (MCQ), where only one LETTER choice is correct out of the four given LETTER choices, A, B, C, D. Indicate the correct LETTER choice only.

Q.1 In the steam condensing power plants **[CO1, 1 Mark]**

- (A) The amount of energy extracted per kg of steam is increased
- (B) the steam, converted into water, can be re-circulated with the help of pump
- (C) Both (A) and (B)
- (D) None of the above

Q.2 Which of not true of a Reciprocating Compressor: **[CO1, 1 Mark]**

- (A) It is a positive displacement Compressor
- (B) It has a piston cylindrical assembly
- (C) It has vanes to push the air and provide cooling
- (D) It is used to generate very high pressures

- Q.3** Approach of a Cooling Tower is [CO1, 1 Mark]
(A) Difference in Cold water outlet temperature and Wet bulb temperature
(B) Difference between Hot water Inlet temperature and Wet bulb temperature
(C) Difference between Hot water Inlet temperature and Cold Water Outlet temperature
(D) Difference between Atmospheric temperature and Wet bulb temperature
- Q.4** Type of Cooling tower used in Power plants is [CO1, 1 Mark]
(A) Natural Draft Towers
(B) Forced Draft Counter-flow Towers
(C) Induced Draft Counter-flow Towers
(D) Dry Towers
- Q.5** Choose the INCORRECT statement about steam traps: [CO1, 1 Mark]
(A) Freezing of steam trap is a problem faced only in cold climates.
(B) Air locking interferes with the smooth operation of steam traps
(C) High Delta P(ΔP), between, process steam pressure and downstream pressure, will interfere with draining of steam traps.
(D) A corrosion of valve seat will lead to steam leakage.
- Q.6** In thermal power plant, the role of the turbine is: [CO1, 1 Mark]
(A) To convert Low Pressure steam to High Pressure steam
(B) To convert enthalpy of steam to work
(C) To convert steam to condensate
(D) To release pressure of steam as a safety measure
- Q.7** During which component of vapour compression refrigeration system, the enthalpy remains constant: [CO1, 1 Mark]
(A) Evaporator
(B) Compressor
(C) Throttle valve
(D) Condenser
- Q.8** The Diesel fuel must not contain sediments. Why? [CO1, 1 Mark]
(A) Because presence of sediments will reduce the Calorific Value.
(B) Because presence of sediments will create corrosion.
(C) Because presence of sediments will Plug Orifices and Cause Wear
(D) Because presence of sediments will lead to unpleasant odour
- Q.9** Choose the INCORRECT statement; [CO1, 1 Mark]
(A) Both Diesel Engine and Gasoline Engine use internal combustion for power.
(B) The compression Ratio in Diesel Engine is quite higher than Gasoline Engine.
(C) A Gasoline Engine requires fuel of motor octane 80 to function properly.
(D) The Diesel fuel must not undergo combustion inside Diesel Engine.
- Q.10** Choose the INCORRECT statement about diesel fuels: [CO1, 1 Mark]

- (A) The Fuel Must Release Energy When It Burns
- (B) The Fuel Must Provide A Very Large Amount of Energy Per kilogram
- (C) The Fuel Must Not Limit The Operability of the Engine at Low Temperatures
- (D) The high sulphur in the diesel fuel is desirable because $S + O_2 \rightarrow SO_2$ is exothermic.

Section B, Answer ALL : 4 Q x 5 Marks = 20 Marks

Q.11 Answer in a few sentences, how utility streams are different from process streams in commercial scale production of important chemicals, and how increasing cost of utilities will affect the final product price. [CO2, 5 Marks]

Q.12 In the phase diagram of a pure substance like water, the critical point is merger of saturated liquid line and the saturated vapour line. Below critical point, there exists a two phase region, bounded of saturated liquid line and the saturated vapour line. Explain what is meant by quality of steam, and given values of enthalpy of saturated liquid and that of saturated vapour, how will you calculate enthalpy of a two-phase mixture? Will there be a change in procedure for calculation of entropy of a two-phase mixture, if the values of entropy of saturated liquid and that of saturated vapour are given to you, and also given the fact that $dH = TdS + VdP$? Symbols have their usual contextual meaning. [CO2, 5 Marks]

Q.13 Air is an important utility and its consumption must be well planned. Answer in a few sentences, how you will plan air consumption in process plants. [CO2, 5 Marks]

Q.14 Please list any 3 advantages and 3 disadvantages of bimetallic steam traps. [CO4, 5 Marks]

Section C, Answer ALL: 3 Q x 10 Marks = 30 Marks

Q.15 What are Multistage Air Compressors? What are their major advantages? Write in detail. [CO4, 10 Marks]

Q.16 Differentiate between natural draft, induced draft and forced draft cooling towers. [CO2, 10 Marks]

Q.17 . Write a comparative note between Petrol and Diesel Engine. [CO3, 10 Marks]

Section D, Answer ANY TWO : 2 Q x 20 Marks = 40 Marks

Q.18

a. The major component of India's recent fuel basket consists of conventional 45% coal, conventional 20% petroleum, conventional 20% biomass, and conventional 10 % gas, with the remaining portion being accounted for unconventional fuels. As a utility engineer you have the choice to decide the fuel for your boiler. Write in 4-5 points about each of the conventional fuel, coal, petroleum, biomass, and gas fuel, as to why you will or will not choose as your boiler fuel. [CO4, 12 Marks]

b. Write a detailed note about advantages and challenges in using waste fuel in boilers. [CO4, 8 Marks]

Q.19 Write in detail about uses of steam for power generation and for heating purpose. Write in detail about steam piping to enhance safety, in process equipment and in boilers. [CO3, 20 Marks]

Q.20

- a. Write a note on types and properties of refrigerants. [CO2, 10 Marks]
- b. A typical vapour compression refrigeration cycle is shown below, on P-H diagram. As shown, this cycle is completed in 4 steps. Kindly identify the process associated with each step, and also which equipment or component is associated with each step. Finally, if possible, please write expressions of heat removed, work done, and Coefficient of Performance. [CO2, 10 Marks]

