

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2020

Course: Plant Utilities

Program: B. Tech CE+RP

Course Code: CHEG454

Semester: VIII

Time: 03 hrs.

Max. Marks: 100

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.

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 thermal power plant, turbine is placed **[CO1, 1 Mark]**

- (A) before boiler
- (B) in between boiler and generator
- (C) after generator
- (D) any of the above

Q.2 Which of the following is NOT a positive displacement compressor: **[CO1, 1 Mark]**

- (A) Reciprocating Compressor
- (B) Roots two-lobe Compressor
- (C) Vane type Compressor
- (D) Centrifugal Compressor

Q.3 Range the cooling tower is **[CO1, 1 Mark]**

- ((A) Difference between 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 Hyperbolic towers have been used for **[CO1, 1 Mark]**

- (A) Large Capacity of water
- (B) Small Capacity of Water
- (C) High Efficiency
- (D) Low capital cost

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) Excessive noise from steam traps is not harmful to steam traps.
- (D) A corrosion of valve seat will lead to steam leakage.

Q.6 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.7 Choose the INCORRECT statement about In IC Engine, **[CO1, 1 Mark]**

- (A) In suction stroke, piston moves from TDC to BDC, and suction valve opens.
- (B) In power stroke, the gases undergo compression.
- (C) In compression stroke, the gases are compressed to a high pressure, and their temperature increases.
- (D) In exhaust stroke, hot gases are ejected out of the exhaust valve.

Q.8 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 Large Amount of Energy Per Litre
- (C) The Fuel Must Not Limit The Operability of the Engine at Low Temperatures
- (D) The high sulphur in the diesel fuel will be acceptable, if the diesel fuel of high calorific value.

Q.9 In case of two stage compression process with inter-stage cooler, where suction pressure of first stage is P_1 , suction pressure of second stage is P_2 , and the discharge pressure of second stage is P_3 , the correct value of optimum inter-stage pressure is: **[CO1, 1 Mark]**

- (A) $P_2 - P_1$
- (B) $P_2 + P_1$
- (C) square root ($P_2 \cdot P_1$)
- (D) cube root ($P_3 \cdot P_2 \cdot P_1$)

Q.10 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 45 to function properly.
- (D) The Diesel fuel undergoes spontaneous combustion inside Diesel Engine.

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

Q.11 Water, Air, Steam etc. are common utility streams required in a modern Chemical Engineering plants. Answer in a few sentences, how utility streams are different from process streams in commercial scale production of important chemicals. **[CO2, 5 Marks]**

Q.12 From the phase diagram of water, the critical point is merger of saturated liquid line and the saturated vapour line. What is the value of critical temperature, T_r in Degree Centigrades, and critical pressure, P_r , in bars? Moreover, Answer in a few sentences, changes that would happen in water beyond the critical point. [CO2, 5 Marks]

Q.13 The water is an important utility and its consumption must be well planned. Water is used in large quantities in textile, food processing, pulp and paper, and heavy chemicals units. Answer in a few sentences, how you will plan water consumption in the above-listed units. [CO2, 5 Marks]

Q.14 Please list any 5 desirable properties of steam traps. [CO4, 5 Marks]

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

Q.15 Multistage Air Compressors are preferred because of lower energy consumption. List any 10 advantages of Multistage Air Compressors. [CO4, 10 Marks]

Q.16 . Differentiate between induced draft and forced draft cooling towers, and also give definitions of Range and Approach. [CO2, 10 Marks]

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

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

Q.18 Write in detail about the properties of Fuel used in Chemical Process Industries for Power Generation, for example Natural Gas, Liquid Petroleum Fuels, and Coal. [CO4, 20 Marks]

Q.19 Write in detail about uses of steam for heating purpose. Also write Principles of Steam Distribution, and improvements in steam piping to enhance safety. [CO3, 20 Marks]

Q.20 A typical vapour compression refrigeration cycle is shown below. Its components are, (1) compressor, (2) condenser, (3) Expander Valve, and (4) Evaporator. Describe the cycle in detail, on the following points: Point 1) Role of each equipment with construction and working. Point 2) Description of all 4 steps on T-S diagram. [CO2, 20 Marks]

