Roll No. R _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

University of Petroleum & Energy Studies, Dehradun

Examination	**: End Semester Examination May 2019**
Program Name	**: B. Tech Chemical (Spl. Refining & Petrochemicals)**
Semester	**: VI**
Subject Name	**: Plant Utilities**
Duration	**: 3 hrs.**
Subject Code	**: CHCE 3017**
Max. Marks	**: 100**
Pages	**: 2**

Instructions:

1. **Put your Roll No. immediately on the question paper. Do not put any other comments .**
2. **Answer all parts of a question at one place only. Mark question number and part number clearly in the left margin.**
3. **The question paper is self-sufficient and self-evident and needs no extra data and clarification. But in case you need, assume data, and justify your assumptions.**
4. **No student is allowed to leave exam hall in the first hour of exam.**
5. **Use of unfair means will lead to immediate disqualification.**

Section A: 4 Q x 5 m = 20 Marks [Answer ALL]

Q1. List some common impurities present in water. Write a note on water hardness and explain how you can express hardness in appropriate units. **[CO1][5]**

Q2. Explain how ion exchange resins can remove the undesired ionic impurities from water, and transfer it to a solid. Also differentiate between cation and anion exchange resins. **[CO1][5]**

Q3. Explain typical Rankine Power Cycle with all the components and also show on T-S coordinates. **[CO2][5]**

Q4. Describe salient features of open recirculating cooling water system. **[CO3][5]**

Section B: 4 Q x 10 m = 40 Marks [Answer Any 4]

Q5. What are the desirable properties of steam trap. Explain the construction, working, merits and demerits of any one of bimetallic or thermodynamic steam trap in detail. **[CO3][10]**

Q6. Describe the construction, and working of a centrifugal compressor. Also explain the velocity diagram of centrifugal compressors. **[CO4][10]**

Q7. List some examples of CFC and HCFC. Discuss the environmental impact of CFC and need to replace those by HCFC. Also explain the advent of hydro fluoro carbons and their superiority in environmental performance. **[CO3][10]**

Q8. Compare and contrast diesel and petrol engine in construction and working. **[CO2][10]**

Q9. Discuss Liquefaction cycles and Joule Thompson Effect in detail. **[CO4][10]**

Section C: 2 Q x 20 m = 40 Marks [Answer ALL]

Q10. (a) Describe the components of a typical practical vapor compression cycle is working between temperatures of T1 and T2 on T-S and P-h diagram. Give the formula for heat removed, work done and CoP in terms of the respective enthalpies. **[CO2][10]**

(b) A refrigerator unit is to be used to form ice with a final temperature of -4 °C from water at 35 °C. The temperature of cooling brine is -10 °C. The latent heat of freezing ice is 334 kJ/kg and the specific heat of frozen ice is half of that of liquid water. List all your assumptions clearly and find the weight of ice formed per hour if 20,000 kJ work is required to run the unit for one hour. **[CO2] [10]**

Q11. (a) Give governing principles of efficient distribution of steam, and what are the methods of steam piping improvement. **[CO4] [10]**

(b) What are different kind of boiler fuels. Give classification of coal and oil, and give salient features of combustion of coal. **[CO4] [10]**