

The Open University of Sri Lanka  
Faculty of Engineering Technology  
Department of Textile and Apparel Technology

060



Study Programme	: Bachelor of Technology Honours in Engineering/ Bachelor of Industrial Studies Honours
Name of the Examination	: Final Examination
Course Code and Title	: <b>TAX5547/TAX5534 Plant Utilities</b>
Academic Year	: 2022/23
Date	: 06 <sup>th</sup> February 2024
Time	: 1330-1630hrs

#### General Instructions

1. Read all instructions carefully before answering the questions.
2. This is a Closed Book Test (CBT).
3. Write down your Index Number in all the pages of answer scripts.
4. This question paper consists of Two Sections in five (05) pages. Section A carries **40 marks** and Section B carries **60 marks**.
5. Answer **all compulsory questions from Section A** and **selected Five (05) questions from Section B**.
6. Do not write answers to the additional questions.
7. Answers for each question should commence from a new page. If a question has many parts, all the parts should be answered in the chronological order under the same question.
8. Write down the answered question numbers in the cover page of the answer book.
9. Answers should be in clear handwriting.
10. Do not use red colour pens to write the answers.

**Section A - Answer all questions.**

(Q1)

- (a) List four (04) primary sources of energy. (2 marks)
- (b) Draw the Pressure - Volume (P-V diagram) of 'Carnot cycle' and name the four (04) processes indicated in the paths of Carnot cycle. (4 marks)
- (c) State any two (02) differences between 'Impulse turbine' and 'Reaction turbine'. (2 marks)
- (d) State why is it preferable to have high dissolved oxygen levels for community water supply and low levels for industrial use. (3 marks)
- (e) Using a clear diagram, illustrate the working principle of a 'Cross-flow heat exchanger'. (4 marks)
- (f) Illustrate the light flow directions of following types of luminaires. (4 marks)
  - (i) Semi direct luminaire
  - (ii) General diffuse luminaire
- (g) Create a graph illustrating the impact of varying relative humidity levels such as 25%, 66%, and 100%, on the stress-strain curve of a cotton fiber. (3 marks)
- (h) With the aid of a suitable diagram, briefly explain the method of 'Adiabatic saturation'. (4 marks)
- (i) Provide two (02) examples for each of the following types of pollutants available in the waste water. (4 marks)
  - (i) Organic substances separable by adsorption
  - (ii) Substances separable by precipitation
- (j) List any three (03) effluent treatment processes that can effectively remove pollutant particles smaller than  $10^{-2}\mu\text{m}$ . (3 marks)
- (k) List the three (03) cardinal rules of hazard control that should be practiced in a workplace. (3 marks)
- (l) List any four (04) reasons for ergonomic hazards in a product manufacturing environment. (4 marks)

**Section B - Answer any Five (05) questions.**

- (Q2) (a) State any four (04) benefits of 'Nuclear power', if it is used as a source of producing electricity. (4 marks)
- (b) Briefly explain the below radioactive decays that take place, while generating the nuclear power. (4 marks)
- (i) Alpha emission
  - (ii) Beta decay
- (c) Explain how does the energy available in coal is converted to the electricity. (4 marks)
- (Q3) (a) Explain how does the process of 'Positive ion exchange' functions in removal of the water hardness. (3 marks)
- (b) (i) With the aid of a suitable graph, describe the behavior of water at different temperatures and pressures. Use P(Pressure) as X-axis and T(Temperature) as Y-axis. (6 marks)
- (ii) Explain what do mean by the 'Triple Point'. Mark the triple point as "A" in the graph, which you have drawn in part (i) in this question. (3 marks)
- (Q4) (a) A CFL light bulb emits 800 Lumens, through a solid angle of 12 Steradians.
- (i) Calculate the luminous intensity of the bulb. (3 marks)
  - (ii) Calculate the mean spherical candle power (M.S.C.P) of the bulb. (3 marks)
  - (iii) Using the laws of illumination, determine the illumination at any point at the edge of a working table with a diameter of 6m, given that the bulb is positioned 4m above the table. (Assume the bulb emits light in all directions and the illumination is uniform within the calculated area.) (3 marks)
- (b) Briefly explain the methods, by which the daylight can be effectively utilized in the industry with avoiding its' drawbacks. (3 marks)

(Q5) Use the given Psychrometric chart in the page 5 to answer this (Q5).

Air is supplied to a chamber at 22°C of wet bulb temperature and 60% relative humidity to achieve a final state of 19°C dry bulb temperature and a moisture content of 0.006 kg/kg dry air. Using the given psychrometric chart, answer the following questions.

- (i) Indicate the following conditions in the given psychrometric chart.
  - (a) Condition of supply air( Indicate as A)
  - (b) Condition of leaving air (Indicate as B) (4 marks)
- (ii) Calculate the change in specific enthalpy during the process. (2 marks)
- (iii) Find the dew point temperatures of supply air and leaving air. (2 marks)
- (iv) Determine the relative humidity of the air leaving the chamber. (2 marks)
- (v) Calculate the change in moisture content during the process. (2 marks)

(Q6) (a) Briefly explain the following terms that are used in analyzing the chemical characteristics of waste water. (3 marks)

- (i) Biochemical Oxygen Demand
- (ii) Permanganate Value
- (iii) Alkalinity

(b) Explain the three (03) classes of treatment and their purpose in wastewater treatments. (3 marks)

(c) With the aid of a suitable diagram, explain the process of "Sedimentation", which is employed to remove the pollutants from waste water. (6 marks)

(Q7) (a) Briefly explain any four (04) preventive measures, that can be used in a hospital environment to eliminate biological hazards. (4 marks)

(b) State four (04) different hazardous chemicals used in the industry and the effect of each of them on human beings. (4 marks)

(c) Briefly explain any four (04) actions that you use to develop a fire prevention plan for a production plant. (4 marks)

# PSYCHROMETRIC CHART

## NORMAL TEMPERATURES

SI METRIC UNITS  
 Barometric Pressure 101.325 kPa  
 SEA LEVEL

