

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



Study Programme	: Bachelor of Science Honours in Engineering / Bachelor of Industrial Studies Honours
Name of the Examination	: Final Examination
Course Code and Title	: TAX5547 Plant Utilities
Academic Year	: 2024/25
Date	: 6 th February 2026
Time	: 0930-1230h
Duration	: 3 hours

General instructions

1. Read all instructions carefully before answering the questions.
 2. This question paper consists of **Seven (7)** questions in **Five (5)** pages.
 3. Answer the compulsory question (Q01) and an additional Five (05) questions.
 4. Question 01 (Q01) carries Forty (40) marks, and questions 02 to 07 (Q02) to (Q07) carry twelve (12) marks each.
 5. The answer for each question should commence on a new page.
 6. This is a Closed Book Test (CBT).
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Compulsory Question

(Q1)

- (a) List four (04) renewable sources of energy. (4 marks)
- (b) The Carnot cycle consists of four ideal thermodynamic processes. Draw the P-V diagram of the Carnot cycle and name each process shown. (6 marks)
- (c) Briefly explain, with reference to the conversion of water into steam, what is meant by 'Liquid enthalpy' and 'Enthalpy of evaporation'. (6 marks)
- (d) High-Intensity Discharge (HID) lamps are commonly used for high-power lighting. List two (02) examples of HID lamps. (2 marks)

- (e) Illustrate the light flow directions of the following types of luminaires. (4 marks)
- (i) Indirect luminaire
 - (ii) General diffuse luminaire
- (f) With the aid of a simple sketch, briefly explain the principle of 'Adiabatic mixing' of air streams. (6 marks)
- (g) Provide three (03) examples for each of the following types of pollutants present in wastewater. (6 marks)
- (i) Organic substances separable by adsorption
 - (ii) Substances separable by precipitation
- (h) State the common causes of fires classified under Class C and Class D. (4 marks)
- (i) List two (02) fire suppression systems used in the industry. (2 marks)

Answer any Five (05) questions from the following questions.

- (Q2) (a) Describe the process of electricity generation using coal as a fossil fuel. Include the main stages from raw material collection to electricity transmission. (6 marks)
- (b) Discuss wind energy as a renewable source of power generation.
Your answer should include the operating principle of a wind turbine and the differences between 'horizontal-axis' and 'vertical-axis' wind turbines.
Also, state the advantages of wind energy. (6 marks)
- (Q3) (a) Explain the importance of water quality in industrial processing.
Your answer should discuss the role of water hardness and dissolved oxygen in industrial applications. (6 marks)
- (b) A residential house has an external brick wall that is 8m long, 3m high, and 25 cm thick. During a hot afternoon, the outside surface temperature of the wall is 38°C, while the inside surface temperature is maintained at 22°C by an air-conditioning system. Calculate the rate of heat transfer through the wall. Thermal conductivity of brick = 0.7 W/m·K (6 marks)

- (Q4) (a) A CFL light bulb emits 1200 Lumens through a solid angle of 10 Steradians. Calculate the Luminous Intensity of the bulb. (4 marks)
- (b) A garment inspection room of size 12m × 9m is required to be illuminated to an average level of 750 lux on the working plane. The lighting design uses lamps with M.S.C.P. = 300. Assuming Coefficient of Utilization (CU) = 0.55 and Depreciation Factor (DF) = 1.4, calculate the total number of lamps required for the inspection room. (8 marks)
- (Q5) (a) Explain the effect of relative humidity on fibre properties.
In your answer, describe the influence of relative humidity on moisture regain, strength, and static electricity. (4 marks)
- (b) Air is supplied to a textile winding room at an initial condition of dry-bulb temperature 30°C and 50% relative humidity. The air is then conditioned in a chamber and leaves at a condition where the dry-bulb temperature is 22°C, and the moisture content is 0.008 kg of water per kg of dry air. Using the psychrometric chart provided at the end of the paper, answer the following questions.
- (i) Plot the following points on the psychrometric chart.
- (A) The initial condition of the supply air (Mark it as Point A) (2 marks)
 - (B) The final condition of the leaving air (Mark it as Point B) (2 marks)
- (ii) Calculate the change in specific enthalpy during the process. (2 marks)
- (iii) Calculate the change in moisture content during the process. (2 marks)
- (Q6) (a) Describe the principle of aerobic and anaerobic oxidation used in the removal of organic matter from wastewater. (4 marks)
- (b) Describe two (02) primary methods used in wastewater treatment.
Your answer should include labelled diagrams where appropriate. (8 marks)

- (Q7) (a) Describe any two (02) fire safety measures practiced in industrial workplaces and explain their importance in preventing fire hazards. (6 marks)
- (b) Discuss the immediate first aid treatments for burn injuries, with reference to the three (03) main types of burns. (6 marks)

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Psychrometric Chart for Question 05 (b) - Attach this chart to your Answer Script.

