



**THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF INDUSTRIAL STUDIES /
BACHELOR OF TECHNOLOGY
FINAL EXAMINATION 2013 / 2014
TTX5234 – PLANT UTILITIES
DURATION - THREE HOURS**

DATE: 25th August 2014

TIME: 1330 - 1630HOURS

Total Number of Questions = 09 Number of questions to be answered = 06

Answer the question 1, which is compulsory, and five (05) additional questions.
Question 1 carries twenty five (25) marks and questions 2 to 09 carry fifteen (15) marks each.

(1)

Compulsory Question

- a) Work Energy is calculated using the following equation. Explain the **notation** and the **units** used in the equation, $1 W = F \cdot d$ (03 Marks)
- b) What do you understand by "Renewable energy"? (02 Marks)
- c) Briefly explain what you understand by "Carnot cycle" (02 Marks)
- d) Explain the terms, "Dry steam", "Wet steam" and "Saturated steam". (03 Marks)
- e) Briefly explain the generation of electric voltage, through Faraday's Law of Induction. (03 Marks)
- f) What are the functions performed by heat exchangers? (02 Marks)
- g) What do you understand by the abbreviations "TDS" and "COD" in relation to water quality? (02Marks)
- h) What do you understand by the terms "Safety engineering" and "Safety management"? (02 Marks)

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- i) State the "Lambert's cosine law of illumination". (02 Marks)
 - J) Briefly explain how you measure the risk of hazards. (02 Marks)
 - k) State four (4) physical processes of water treatment. (02 Marks)

Select any 5 questions from the following questions

- (2) a). Discuss various environmental issues involving the use of coal to generate electricity. (07 Marks)
- b). Briefly explain four different types of cracking processes of hydrocarbons. (08 Marks)
- (3) a). Briefly explain the two terms, "Fission" and "Fusion". (05 Marks)
- b). Briefly explain the advantages and disadvantages of nuclear power compared to other sources of power (10 Marks)
- (4) a). Hardness is one of the properties considered in water used for textile processing. Briefly explain how it is defined and measured? (05 Marks)
- b). Briefly explain what you understand by deaeration. (04 Marks)
- c). Briefly explain two methods of mechanical deaeration. (06 Marks)
- (5) a) What are the physical, chemicals and biological characteristics to be tested to determine the true quality of water. (06 Marks)
- b) Briefly explain Aerobic and Anaerobic oxidation used to remove organic matter from effluents. (09 Marks)

(6) a) Draw Enthalpy-Temperature diagram of water under constant pressure and mark the following in your diagram. (04 Marks)

- i. Liquid enthalpy
- ii. Enthalpy of evaporation
- iii. Enthalpy of dry saturated vapor
- iv. Enthalpy of super heated- steam

b) Briefly explain the following terms in relation to different states of water. (05 Marks)

- i. Saturated liquid line
- ii. Saturated vapour line
- iii. Dryness factor
- iv. Critical point

c) Calculate the specific volume of 90% dry saturated steam at 10 bar. (06 Marks)

(7) a) Explain the following terms in relation to lighting. (06 Marks)

- i. Luminous Flux
- ii. Luminous Intensity
- iii. Luminous Efficiency
- iii. Efficacy

b) Briefly explain three reasons for reducing the efficiency over the time of a lighting system in a garment production factory. (04 Marks)

c) A lamp with a uniform luminous intensity of 400 lumens/second is suspended at a height 4m above a working plane. Calculate the values of illumination at the following points. (05 Marks)

- (i). Directly below the lamp on the working plane
- (ii). On the working plane 4m away from the point mentioned in part (i).

(8) a) Following are some different causes of hazards. Name the form of energy involved in the each case of hazards. (05 Marks)

- i. Flying particles or flying objects
- ii. Excessive noise and vibration
- iii. Poisonous animals and plants
- iv. Extreme cold weather
- v. Ultra-violet ray from sun

b) Briefly explain four (4) types of hazards due to air pollution cause by textile industry. (06 Marks)

c) Briefly explain different types of burns injuring human in the industry and their causes. (04 Marks)

(9) a) Define the terms “Dry Bulb Temperature”, “Wet Bulb Temperature”, “Dew Point Temperature” and “Relative Humidity” (05 Marks)

b) calculate the enthalpy of 1kg of dry air of the temperature 35°C having a humidity of 0.025kg of moisture in one kg of dry air. (04 Marks)

$$C_{p, \text{air}} = 1.04 \text{ kJ/kg } ^{\circ}\text{C}, \quad C_{p, \text{vapour}} = 2.093 \text{ kJ/kg } ^{\circ}\text{C}, \quad r_0 = 2258 \text{ kJ/kg}$$

c) Locate and number the following conditions on the psychometric chart. (06 Marks)

- i) Condition of 40°C dry bulb temperature and 0.007kg moisture in 1kg of dry air.
- ii) Condition of 40°C dry bulb temperature and 21°C wet bulb temperature
- iii) Condition of 55% relative humidity and 0.012 kg moisture in 1kg of dry air.

PSYCHROMETRIC CHART

