Reg. No. :

Question Paper Code : X67603

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2020.

First Semester

Mechanical Engineering

HS 1103 — ENGINEERING CHEMISTRY — I

(Common to All Branches)

(Regulations 2008)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out the difference between soft and hard water.

2. What is break-point chlorination ?

3. What is the limitation of langmuir's adsorption isotherm ?

4. What is heat of adsorption ?

5. Identify the limitations of standard hydrogen electrode.

6. Calculate the equilibrium constant of the reaction :

    $Ag^+ + Fe^{2+} \rightarrow Ag + Fe^{3+}$ at $35°C$. $\left(E°_{Fe^{3+}/Fe^{2+}} = 0.77V \text{ and } E°_{Ag^+/Ag} = 0.80 \text{ V}\right)$.

7. Write the mechanism of the nuclear fission reaction of U^{235}.

8. What are the types of batteries ? Give one example for each.

9. Derive the Beer-Lambert's law.

10. Draw the block diagram of atomic absorption spectrometer.

PART B — (5 × 16 = 80 marks)

11. a) (i). What are the requirements of boiler feed water and explain the troubles of using hard water in boilers?

(10)

(ii). 100ml of a sample of water required 25 ml of 0.01M EDTA solution for titration. The same sample of water (100 ml) after boiling and filtering consumed 15 ml of the same EDTA solution for titration. Calculate the amounts of different type of hardnesses present in the given water sample

(6)

OR

b) (i) Describe the softening of water by zeolite process with suitable diagrams. (8)

(ii) Write briefly about the following disinfection methods
    (1) Chlorination
    (2) UV treatment (8)
    (3) Ozonation.

12. a) (i) Derive Langmuir adsorption isotherm.

(8)

(ii) Explain in detail the role of adsorption in catalysis.

(8)

OR

b) (i) Write informative notes on Ion-exchange adsorption.

(8)

(ii) Discuss the various factors that affects the adsorption of a gas on solid adsorbent.

(8)

13. a) (i) A cell is formed by dipping Zn rod in 0.01 M Zn^{2+} solution and Ni rod in 0.5 M Ni^{2+} solution. The standard electrode potentials of Zn and Ni are –0.76 V and –0.25 V respectively. (8) Write the cell representation, cell reaction and calculate the emf of the cell.

(ii) Explain the construction and working of quinhydrone electrode. Discuss its merits and limitations. (8)

OR

b) (i) What are potentiometric titrations? Show how the end points are obtained in redox and precipitation reactions.

(8)

(ii) Discuss the construction and functioning of a calomel electrode

(8)

14. a) (i) Enumerate the steps involved in the nuclear fission of uranium.

(8)

(ii) Discuss the charge-discharge mechanism of nickel- (8)

X67603

cadmium battery.

<div align="center">OR</div>

b) (i) With a neat sketch of nuclear reactor, explain its parts
and functions.

(8)

(ii) Define fuel cell and discuss the operation of hydrogen-
oxygen fuel cell.

(8)

15. a) Draw the block diagram of IR spectrometer and describe
its parts.

(8)

When a monochromatic light is passed through a cell of 1
cm length, the intensity of the radiation is reduced to
10%. If the same radiation is passed through a cell of
length 8 cm what is the concentration of the solution ?
Calculate the length of the cell in order to have 25%
absorbance.

(8)

<div align="center">OR</div>

b) (i) How would you estimate the concentration of sodium
in the given solution using flame photometry ?

(8)

(ii) How will you estimate the concentration of iron in the
given solution by colorimetry.

(8)

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