

CBCS SCHEME

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18CHE12/22

First/Second Semester B.E. Degree Examination, Dec.2023/Jan.2024 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define free energy and entropy. Derive Nernst equation for single electrode potential. (07 Marks)
- b. Define electrolyte concentration cell. Represent the cell formed by coupling of two copper electrodes immersed in cupric sulphate solutions. The concentration of cupric ions in one electrode system is 100 times more than the other. Write cell reactions and calculate potential at 298 K. (06 Marks)
- c. Discuss the construction of glass electrode. Explain the determination of pH of a solution using glass electrode. (07 Marks)

OR

- 2 a. Define battery. Give complete classification of batteries with examples. (07 Marks)
- b. What is reference electrode? Explain construction and working of calomel electrode. Mention its applications. (07 Marks)
- c. Explain construction, working and applications of lithium ion battery with discharging reactions. (06 Marks)

Module-2

- 3 a. Define corrosion. Explain the rusting of iron based on electrochemical theory of corrosion. (07 Marks)
- b. Discuss the following factors affecting the rate of corrosion:
(i) Ratio of anodic area to cathodic area.
(ii) Nature of corrosion product
(iii) pH (07 Marks)
- c. Define metal finishing. Give technological importance of metal finishing. (06 Marks)

OR

- 4 a. Define anodizing. Explain anodizing of aluminium. Mention its applications. (07 Marks)
- b. Define electroplating. Distinguish between electroplating and electroless plating. (07 Marks)
- c. Define electroless plating. Describe the electroless plating of copper. (06 Marks)

Module-3

- 5 a. Define GCV. Explain the determination of calorific value of a solid fuel by using Bomb Calorimeter. (08 Marks)
- b. Define fuel cell. Distinguish between conventional cell and fuel cell. (06 Marks)
- c. Define photovoltaic cell. Explain the construction and working of photovoltaic cell. Mention any two advantages. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. On burning 0.92×10^{-3} kg of solid fuel in a Bomb calorimeter, the temperature of 2.4 kg of water is increased from 24°C to 27.8°C . The water equivalent of calorimeter and latent heat of steam are 1.2 kg and 587×4.2 kJ/kg. Specific heat of water is 4.187 kJ/kg $^{\circ}\text{C}$. If the fuel contains 4.5% of hydrogen, calculate its gross and net calorific values. (07 Marks)
- b. Define knocking in petrol engine. Give its mechanism in chemical terms and mention its ill effects. (07 Marks)
- c. Explain construction, working and applications of Solid Oxide Fuel Cell (SOFC). (06 Marks)

Module-4

- 7 a. Discuss the sources, effects and control methods of following air pollutants:
(i) Carbon monoxide (ii) Oxides of sulphur (12 Marks)
- b. Define BOD and COD. In COD test 28.5 cm 3 and 12.3 cm 3 of 0.045 N FAS solution are required for blank and sample titration respectively. The volume of the test sample used is 25 cm 3 . Calculate the COD of the sample solution. (08 Marks)

OR

- 8 a. Discuss the sources and any two disposal methods of solid waste. (07 Marks)
- b. Define softening of water. Explain softening of water by ion-exchange process. (07 Marks)
- c. Define sewage. Explain secondary treatment of sewage by activated sludge process. (06 Marks)

Module-5

- 9 a. Discuss the principle and instrumentation of colorimetry. (08 Marks)
- b. Explain different applications of atomic absorption spectroscopy and flame photometry. (06 Marks)
- c. Define nanomaterials. Explain the synthesis of nanomaterials by sol-gel method. (06 Marks)

OR

- 10 a. Discuss theory and instrumentation of conductometry. (06 Marks)
- b. Explain any four size dependent properties of nanomaterials. (08 Marks)
- c. Discuss properties and applications of graphenes. (06 Marks)

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18CHE12/22

First/Second Semester B.E. Degree Examination, June/July 2023 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define single electrode potential and derive Nernst equation for single electrode potential. (07 Marks)
- b. Two silver electrodes separately placed in AgNO_3 solutions of equal concentrations to form a cell.
- i) What is the cell voltage? (06 Marks)
- ii) What is the voltage of the cell if one of the solutions concentrations is 100 times more than the other? (07 Marks)
- c. What are reference electrodes? Describe the construction and working of calomel electrode. Mention its advantages. (07 Marks)

OR

- 2 a. Describe the construction and working principle of Li-ion battery. Mention its applications. (07 Marks)
- b. Calculate the emf of a cell formed by coupling of zinc electrode in 0.05M ZnSO_4 solution and cadmium electrode in 0.25M CdSO_4 solutions. Write the cell representation and reactions. Given standard electrode potential Z_n and C_d are -0.76 and -0.40V respectively. (06 Marks)
- c. Explain how P^{H} of the given solution measured using a glass electrode. Mention the advantages of glass electrode. (07 Marks)

Module-2

- 3 a. What is Corrosion? Explain electro chemical theory of corrosion taking iron as an example. (07 Marks)
- b. What is Cathodic protection? Explain sacrificial anode and impressed current methods. (06 Marks)
- c. What is electroless plating? Explain electroless plating of Nickel. (07 Marks)

OR

- 4 a. Explain the type of corrosion taking place in the following case
- i) Copper bolt in iron vessel (07 Marks)
- ii) Dust deposition on a metal surface for a long time. (06 Marks)
- b. What is metal finishing? Mention the technological importance of metal finishing. (06 Marks)
- c. Explain the effect of the following factor on the rate of corrosion.
- i) Nature of corrosion product (07 Marks)
- ii) Relative area of anode and cathode (06 Marks)
- iii) Temperature. (07 Marks)

Module-3

- 5 a. How is Calorific value of a solid fuel measured using a Bomb calorimeter. (07 Marks)
- b. What are fuel cells? Explain the construction and working of solid oxide fuel cell. (06 Marks)
- c. What is Biodiesel? Explain the synthesis of Biodiesel. Mention the advantages of Biodiesel. (07 Marks)

OR

- 6 a. Define GCV and NCV.
0.75g of a coal sample containing 70% C, 5% H₂ and 6% ash was burnt in a Bomb calorimeter. The rise in temperature of 2500g of water was 3°C. Find GCV and NCV if water equivalent of calorimeter is 500g, specific heat of water is 4.187 kJ/Kg°C and Latent heat of steam is 2454 kJ/Kg. (07 Marks)
- b. What is knocking in IC engine? Explain the mechanism of knocking and mention its ill effects. (06 Marks)
- c. Describe the synthesis of solar grade silicon by union-carbide process. (07 Marks)

Module-4

- 7 a. Explain the mechanism of ozone depletion. Mention its ill effects. (07 Marks)
- b. What are scales and Sludges? Mention their ill effects and explain the method of prevention. (06 Marks)
- c. What are the sources, effects and control methods of oxides of sulphur. (07 Marks)

OR

- 8 a. Write a note on Fluoride estimation in drinking water. Mention its ill effect. (07 Marks)
- b. What is desalination of water? Explain reverse osmosis method of desalination. (06 Marks)
- c. Define BOD and COD.
25cm³ of waste water with 10ml of 0.1N K₂Cr₂O₇ under acidic conditions required 15ml of 0.05N FAS solution, under similar conditions, 10ml of same K₂Cr₂O₇ and 20ml distilled water required 35ml of 0.05N FAS solution. Calculate COD. (07 Marks)

Module-5

- 9 a. Explain the theory, instrumentation of flame photometry and its application in the estimation of Na. (07 Marks)
- b. What are nano-materials? Explain the synthesis of nano-materials by Sol-gel method. (06 Marks)
- c. Explain the theory of conductometry for the estimation of a mixture of strong acid and a weak acid against a strong base. (07 Marks)

OR

- 10 a. Explain the theory of calorimetry and its application in the estimation of Cu in CuSO₄ solution. (07 Marks)
- b. Write a note on fullerenes. (06 Marks)
- c. Explain the theory and instrumentation of potentiometry. (07 Marks)

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18CHE12/22

First/Second Semester B.E. Degree Examination, July/August 2021 Engineering Chemistry

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1
 - a. Define free energy and derive Nernst equation for single electrode potential of an electrode. (06 Marks)
 - b. Calculate the emf of a Fe-Ag cell in which Fe is in contact with 0.1M FeSO₄ solution and Ag is in contact with 0.1M Ag NO₃ solution. The standard reduction potentials of Fe and Ag are -0.44V and +0.80V respectively. (07 Marks)
 - c. Explain the construction and working of Lithium - ion battery. Mention its applications. (07 Marks)

- 2
 - a. Explain the construction and working of Ni-metal hydride battery. Mention its applications. (07 Marks)
 - b. What are ion-selective electrodes? Describe the construction and working of glass electrode. (07 Marks)
 - c. The emf of a cell Ag|Ag NO₃(0.001M)||AgNO₃(XM)|Ag is 0.0591V at 25°C. Find the value of X. (06 Marks)

- 3
 - a. Explain electrochemical theory of corrosion taking iron as an example. (07 Marks)
 - b. Explain the process of :
 - i) Galvanising
 - ii) Anodizing. (07 Marks)
 - c. Define the term :
 - i) Polarization
 - ii) Decomposition potential
 - iii) Overvoltage. (06 Marks)

- 4
 - a. Explain the following factors affecting rate of corrosion
 - i) Nature of corrosion product
 - ii) Ratio of anodic to cathodic area. (07 Marks)
 - b. What is meant by metal finishing? Mention (any 5) technological importance of metal finishing. (07 Marks)
 - c. Describe electroless plating of copper with plating reaction and mention its application. (06 Marks)

- 5
 - a. Describe the Bomb calorimetric method for determination of calorific value of fuel. (07 Marks)
 - b. What do you mean by knocking in IC engine? Explain mechanism of knocking. (07 Marks)
 - c. What are fuel cells? Mention advantages and limitations of fuel cell. How the fuel cell differs from battery (conventional cell). (06 Marks)

- 6 a. What are Photovoltaic cell? Describe construction, working and application of typical PV cell. (07 Marks)
- b. Explain the preparation of solar grade silicon by union Carbide process. (07 Marks)
- c. Calculate the higher and lower calorific value of a coal sample from the following data obtained in bomb calorimetric experiment.
- i) Weight of coal = 0.65 g
 - ii) Weight of water in calorimeter = 1200 g
 - iii) Water equivalent of calorimeter W = 400 g
 - iv) Latent heat of steam = 587×4.2 kJ/kg
 - v) Hydrogen in coal sample = 2%
 - vi) Rise in temperature = 1.8°C
 - vii) Sp-heat of water = $4.187\text{kJ/kg}/^\circ\text{C}$. (06 Marks)
- 7 a. What are the sources, effects and control method of oxides of sulphur. (07 Marks)
- b. What are the sources, effects and control of oxides of nitrogen pollution? (07 Marks)
- c. In COD test 25ml and 14ml of 0.05N FAS solution are required for blank and sample titration respectively. The volume of test sample used was 25ml. Calculate the COD of sample solution. (06 Marks)
- 8 a. What do you mean by desalination of water? Explain the reverse osmosis process for desalination of water. (07 Marks)
- b. Explain the determination of sulphate content in water by gravimetric method. (07 Marks)
- c. What are the sources and ill effect of secondary pollutant ozone? Explain ozone depletion. (06 Marks)
- 9 a. Explain theory, Instrumentation and Application of flame photometry. (07 Marks)
- b. Explain the theory and instrumentation of potentiometer. (07 Marks)
- c. Write a note on fullerene. Mention its application. (06 Marks)
- 10 a. Explain the theory, instrumentation and application of conductometry in the titration of mixture of strong acid and weak acid with a strong base. (07 Marks)
- b. Explain the synthesis of nanomaterials by sol-gel process. (07 Marks)
- c. Describe the properties and application of :
- i) Carbon nature
 - ii) Graphenes. (06 Marks)

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21CHE12/22

First/Second Semester B.E. Degree Examination, Jan./Feb. 2023 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What is electrode potential? Derive Nernst equation for single electrode potential. (07 Marks)
b. Explain construction, working and applications of glass electrode. (07 Marks)
c. Explain the classification of batteries with suitable examples. (06 Marks)

OR

- 2 a. Discuss the construction, working and applications of Li – ion battery. (07 Marks)
b. Explain Recycling of Li – ion battery by direct cycling method. (07 Marks)
c. An electrochemical cell consists of a copper electrode dipped in 0.5M CuSO₄ and silver electrode dipped in 0.25M AgNO₃ solution. Write the cell scheme, cell reaction. Also calculate the emf. (Standard electrode potential of Cu and Ag are 0.34 and 0.80V respectively). (06 Marks)

Module-2

- 3 a. Explain electrochemical theory of a corrosion by taking Fe as an example. (07 Marks)
b. What is cathodic protection? Discuss sacrificial anodic method. (07 Marks)
c. Discuss electroplating of chromium with applications. (06 Marks)

OR

- 4 a. Define electroless plating. Discuss electroless plating of copper. (07 Marks)
b. What is metal finishing? Mention any 5 technological importance. (07 Marks)
c. Explain the influence of following factors on corrosion rate :
i) Ratio of anodic to cathodic area
ii) Nature of corrosion product
iii) pH. (06 Marks)

Module-3

- 5 a. Explain the synthesis and applications of polyurethane. (07 Marks)
b. What are biodegradable polymer? Explain the synthesis and applications of polylactic acid. (07 Marks)
c. Give the properties and applications of carbon nanotubes. (06 Marks)

OR

- 6 a. Explain synthesis of nanomaterials by Sol-Gel method. (07 Marks)
b. What are conducting polymers? Explain the mechanism of conduction in polyaniline. (07 Marks)
c. What are polymer composites? Explain the synthesis and properties of Kevlar Fiber. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Explain any six basic principle of green chemistry. (07 Marks)
b. Explain the synthesis of Adipic acid from benzene and green synthesis from glucose. (07 Marks)
c. Discuss the construction and working of photovoltaic cell. (06 Marks)

OR

- 8 a. Explain the construction and working of methanol-oxygen fuel cell. (07 Marks)
b. Briefly explain the impacts of oxides of nitrogen and oxides of sulphur on environment. (07 Marks)
c. Write short notes on microwave synthesis and bio catalyzed reaction with examples. (06 Marks)

Module-5

- 9 a. What is hard water? Explain the determination of hardness using EDTA titration. (07 Marks)
b. In a COD test, 28.1 and 14.0 cm³ of 0.05N FAS (Ferrous Ammonium Sulphate) solution was required for blank and sample titration respectively. The volume of test sample taken was 25cm³. Calculate the COD of the sample. (07 Marks)
c. Explain conductometric titration method for the determination of mixture of strong acid and weak acid with strong base. (06 Marks)

OR

- 10 a. Explain the principle and instrumentation of colorimetry. (07 Marks)
b. Define the terms normality, molarity and molality. (07 Marks)
c. Define primary and secondary standard solutions, explain briefly the requirement of primary standard solution. (06 Marks)

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21CHE12/22

First/Second Semester B.E. Degree Examination, Dec.2023/Jan.2024 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define standard electrode potential. Obtain the expression for single electrode potential. (07 Marks)
- b. What are ion-selective electrodes? Describe the construction and working of glass electrodes. (07 Marks)
- c. Explain the construction and working of Lithium-ion battery. Mention its applications. (06 Marks)

OR

- 2 a. Define battery. Give the classification of batteries with suitable examples. (07 Marks)
- b. What are reference electrodes? Explain the construction and working of Calomel electrode. Mention its applications. (07 Marks)
- c. Define cell potential. Calculate the standard electrode potential of copper at 25 °C when the potential of copper electrode is 0.296 V and $[Cu^{2+}] = 0.015M$. (06 Marks)

Module-2

- 3 a. Define corrosion. Explain the electrochemical theory of corrosion by taking iron as an example. (07 Marks)
- b. Explain with suitable example :
 - (i) Differential metal corrosion
 - (ii) Differential aeration corrosion (06 Marks)
- c. What is electrolessplating? Explain the electroless plating of copper. (07 Marks)

OR

- 4 a. What is meant by metal finishing? Mention any six technological importance of metal finishing. (06 Marks)
- b. Distinguish between electroplating and electrolessplating. (07 Marks)
- c. What is cathodic protection? Explain sacrificial anode and impressed current methods. (07 Marks)

Module-3

- 5 a. What are conducting polymers? Explain the mechanism of conduction in polyaniline. (07 Marks)
- b. Explain the synthesis and applications of polyurethane. (06 Marks)
- c. What are nanomaterials? Explain the synthesis of nanomaterial by precipitation method. (07 Marks)

OR

- 6 a. Explain any two size dependent properties of nano-materials. (06 Marks)
- b. Write a note on carbon nanotubes. Mention its properties and applications. (07 Marks)
- c. What are polymer composites? Explain the synthesis and applications of Kevlar fibre. (07 Marks)

1 of 2

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Briefly explain any six basic principles of green chemistry. (06 Marks)
b. Explain the synthesis of paracetamol by conventional and green route from phenol. (07 Marks)
c. What is photovoltaic cell? Explain the construction and working of photo voltaic cell. Mention its applications. (07 Marks)

OR

- 8 a. Describe the hydrogen production by photocatalytic water splitting method. (07 Marks)
b. Explain microwave synthesis and Biocatalyzed reactions with suitable examples. (07 Marks)
c. What is fuel cell? Explain construction and working of methanol-oxygen fuel cell. (06 Marks)

Module-5

- 9 a. Explain the theory, instrumentation and applications of potentiometry. (07 Marks)
b. What is hardness of water? Explain the determination of hardness of water by EDTA method. (07 Marks)
c. Define BOD. In a COD test 30.5 cm³ and 19.3 cm³ of 0.05 N FAS solution are required for blank and sample titration respectively. The volume of test sample is 30.0 cm³. Calculate the COD of the waste water sample. (06 Marks)

OR

- 10 a. Define the following units of standard solution :
(i) Normality
(ii) Molarity
(iii) Mole fraction (06 Marks)
b. What is COD? Explain the experimental determination of COD. (07 Marks)
c. Explain the theory, instrumentation and applications of calorimetry. (07 Marks)

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21CHE12

First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What are Reference Electrodes? Explain the construction and working of Calomel Electrode. (07 Marks)
- b. Define Single Electrode Potential. Derive Nernst equation for Single Electrode Potential. (07 Marks)
- c. Explain the construction and working of Li – ion battery. Mention its applications. (06 Marks)

OR

- 2 a. Explain Primary , Secondary and Reserve batteries with an example. (06 Marks)
- b. Explain the experimental determination of pH by using glass electrode. (07 Marks)
- c. A cell consists of Copper rod dipped in 5M CuSO₄ solution and Iron rod dipped in 0.05 M FeSO₄ solution. Given $E_{Cu}^0 = +0.34V$ and $E_{Fe}^0 = - 0.44V$. Write Cell representation , Cell reactions and calculate Emf of the cell. (07 Marks)

Module-2

- 3 a. Define Corrosion. Describe Electrochemical theory of corrosion by taking Iron as an example. (07 Marks)
- b. What is Cathodic Protection? Explain Sacrificial Anodic method and Impressed Current method of Cathodic protection. (07 Marks)
- c. What is Metal Finishing? Mention technological importance of Metal Finishing. (06 Marks)

OR

- 4 a. Explain the factors affecting the corrosion rate :
 - i) Ratio of anodic to cathodic areas.
 - ii) Nature of the corrosion product.
 - iii) pH. (06 Marks)
- b. What is Corrosion Penetration Rate? A piece of corroded plate was found in the submerged ocean vessel. It was estimated that the original area of the plate was 10 inch² and that approximately 2.6kg had corroded away during the submersion for a period of 10 years. Calculate Corrosion Penetration Rate (CPR) in terms of mpy and mmy. Given density (ρ) of iron = 7.9 g/dm³
 mpy $\rightarrow k = 534$
 mmy $\rightarrow k = 87.6$. (07 Marks)
- c. What is Electroless Plating? Write the differences between Electroplating and Electroless plating. (07 Marks)

Module-3

- 5 a. What are Conducting Polymers? Explain the mechanism of conduction in Polyaniline. (07 Marks)
- b. Explain the synthesis , properties and applications of Poly Lactic Acid. (06 Marks)
- c. What are Nanomaterials? Explain the synthesis of Nanomaterials by Sol – gel process. (07 Marks)

OR

- 6 a. What are Polymer Composites? Explain the synthesis and applications of Kevlar fibre. (07 Marks)
 b. Explain any two size dependent properties of Nanomaterials. (06 Marks)
 c. Write a note on Fullerene and mention its applications. (07 Marks)

Module-4

- 7 a. What is Green Chemistry? Explain briefly any six basic principles of Green Chemistry. (07 Marks)
 b. Describe the production of hydrogen by Photocatalytic Water Splitting Method. (06 Marks)
 c. Explain the synthesis of Paracetamol by Conventional and Green Route Method. (07 Marks)

OR

- 8 a. Explain the impacts of Oxides of Nitrogen (NO_x) and Oxides of Sulfur (SO_x) on the Environment. (06 Marks)
 b. Explain the working of Photovoltaic cell, with a neat diagram. (07 Marks)
 c. Describe working of Methyl alcohol – Oxygen fuel cell [$\text{CH}_3\text{OH} - \text{O}_2$] with a neat diagram. Mention its applications. (07 Marks)

Module-5

- 9 a. Explain Theory, Instrumentation and Applications of Colorimeter. (07 Marks)
 b. Explain the principle of Volumetric analysis and requirement of Volumetric analysis. (06 Marks)
 c. Define Biological Oxygen demand and Chemical Oxygen demand. 25 ml of waste water required 18.0ml and 25.2ml of 0.1N FAS solution for sample and blank titration respectively. Calculate COD of the waste water sample. (07 Marks)

OR

- 10 a. Explain applications of Conductometry :
 i) Strong acid Vs Strong base ii) Weak acid Vs Strong base. (07 Marks)
 b. Define the following units of Standard Solution :
 i) Normality ii) Molarity iii) PPM. (06 Marks)
 c. 25m³ of hard water sample titrated against 0.01M EDTA solutions consumed 18.0 cm³ of EDTA solution. 25cm³ same sample of hard water was boiled, filtered and titrated against 0.01M EDTA solution consumed 12.0 cm³ EDTA solution. Calculate Total, Permanent and Temporary hardness of the water sample. (07 Marks)

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21CHE12/22

First/Second Semester B.E. Degree Examination, June/July 2023 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- Define single electrode potential. Derive Nemst equation for single electrode potential. (07 Marks)
 - What are ion selective electrodes? Explain the determination of pH using Glass Electrode. (07 Marks)
 - Distinguish between primary, secondary and reserve batteries. (06 Marks)

OR

- Describe the construction and working of Li-ion battery. Mention its applications. (07 Marks)
 - What voltage will be generated by a cell that consists of iron electrode immersed in 0.1M FeSO₄ solution and a silver electrode immersed in 0.05M AgNO₃ solution at 298K. given standard electrode potentials of Fe and Ag are -0.44V and 0.80V respectively. Write the cell representation and cell reactions. (07 Marks)
 - What are reference electrodes? Explain the construction and working of calomel electrode. (06 Marks)

Module-2

- What is corrosion? Describe the electrochemical theory of corrosion by taking iron metal as an example. (07 Marks)
 - Explain the factors affecting the rate of corrosion :
 - Nature of corrosion product
 - Ratio of anode to cathodic areas
 - pH.(07 Marks)
 - What is electroless plating? Outline the electroless plating of copper. (06 Marks)

OR

- What is meant by metal finishing? Mention (any five) technological importance of metal finishing. (06 Marks)
 - What is electroplating? Discuss the electroplating of chromium. (07 Marks)
 - Explain the process of :
 - Galvanizing process
 - Anodizing of Aluminium. (07 Marks)

Module-3

- What are polymer composites? Explain the synthesis and application of Kevlar fibre. (06 Marks)
 - What are conducting polymers? Describe the mechanism of conduction in poly Aniline. (07 Marks)
 - Briefly explain the carbon nanotubes with properties and applications. (07 Marks)

OR

- 6 a. Describe the synthesis of nano-material by sol-gel technique. (07 Marks)
b. Explain any three size dependent properties of nano material. (06 Marks)
c. Explain the synthesis, properties and application of polyurethane. (07 Marks)

Module-4

- 7 a. Briefly explain any six basic principles of green chemistry. (06 Marks)
b. Explain the synthesis of paracetamol by conventional and green route from phenol. (07 Marks)
c. What are PV cells? Describe the construction and working of photovoltaic cells. (07 Marks)

OR

- 8 a. With a neat diagram, explain the production of hydrogen by photocatalytic method. (07 Marks)
b. Explain the following with example :
i) Solvent free reaction
ii) Micro wave synthesis. (07 Marks)
c. Describe the construction and working of methanol-oxygen fuel cell. (06 Marks)

Module-5

- 9 a. Explain the theory, instrumentation and application of colorimetry. (07 Marks)
b. Explain the determination of hardness of water by EDTA method. (07 Marks)
c. In c COD test 28.5cm^3 and 13.5cm^3 of 0.05N FAS solutions are required for blank and sample titration respectively. The volume of test sample used is 25cm^3 . Calculate the COD of the sample solution. (06 Marks)

OR

- 10 a. Define the following units of standard solution :
i) Normality
ii) Molarity
iii) PPM. (06 Marks)
b. Define COD. Explain the determination of COD of waste water sample. (07 Marks)
c. Explain the theory, instrumentation and application of flame photometry. (07 Marks)

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17CHE12/22

First/Second Semester B.E. Degree Examination, July/August 2022 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What is single electrode potential? Derive Nernst equation for electrode potential. (07 Marks)
- b. What are concentration cells? Calculate the emf of the following concentration cell at 298 K consisting of zinc electrodes immersed in a solution of zinc ions 2.5 m and 0.05 m concentrations. Write cell notation and electrode reactions. (07 Marks)
- c. Write the cell reactions, construction and working principle of Zin-Air battery. Mention its applications. (06 Marks)

OR

- 2 a. What are batteries? Explain construction and working principle of Li-MnO₂ battery. Mention its applications. (07 Marks)
- b. What are Fuel cells? Describe construction and working of Methanol-oxygen Fuel-cell. (07 Marks)
- c. What are reference electrodes? Explain construction and working Calomel electrode. (06 Marks)

Module-2

- 3 a. What is Corrosion? Explain electrochemical theory of corrosion. (07 Marks)
- b. Define differential metal corrosion. Explain differential metal corrosion with examples. (07 Marks)
- c. What is metal finishing? Write any four technological importances of metal finishing. (06 Marks)

OR

- 4 a. What is electroplating? Give an account of electroplating Nickel by Watts-Bath. (07 Marks)
- b. What is electroless plating? Describe electroless plating of copper in PCB. (07 Marks)
- c. What is cathodic protection? Explain sacrificial anodic method. (06 Marks)

Module-3

- 5 a. What are chemical fuels? Give the classification of fuels with examples. (07 Marks)
- b. Define calorific value of a fuel. A coal sample with 93% C, 5% H₂ and 2% ash is subjected to combustion in a bomb calorimeter. Calculate the gross and net calorific value given that mass of coal sample taken is 0.95 g, mass of water in calorimeter is 2000 g, water equivalent of calorimeter is 700 g, rise in temperature of water is 2.8°C. Latent heat of steam is 2457 KJ/kg and specific heat of water is 4.187 kJ/kg/°C (07 Marks)
- c. Write a brief note on module, panels and array of photovoltaic cell. (06 Marks)

OR

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- 6 a. What are solar cells? With neat diagram, explain the construction and working of photovoltaic cell. (07 Marks)
- b. Explain production of solar grade silicon by union-carbide method. (07 Marks)
- c. What is cracking? Explain fluidized bed catalytic cracking process. (06 Marks)

Module-4

- 7 a. What is polymerization? Explain free radical mechanism of addition polymerization taking polyvinyl chloride as example. (07 Marks)
- b. What is number average molecular mass? A polymer sample contains 5 molecules having a molecular weight of 2000 g/mol, 4 molecules having a molecular weight of 3000 g/mol and 3 molecules having a molecular weight of 4000 g/mol. Calculate number average (\overline{M}_n) and weight average molecular mass (\overline{M}_w). (07 Marks)
- c. Explain synthesis and applications of,
 (i) Poly methyl metha acrylate and
 (ii) Poly urathane. (06 Marks)

OR

- 8 a. What are conducting polymers? Explain mechanism of conducting in polyaniline. (07 Marks)
- b. What is silicon rubber? Explain synthesis, properties and applications of polymethyl siloxane. (07 Marks)
- c. What is Epoxy group? Explain the synthesis and applications of Epoxy resin. (06 Marks)

Module-5

- 9 a. What are boiler scales? Explain formation of boiler scales and its disadvantages. (07 Marks)
- b. What is COD? In a COD test 28.1 cm³ and 14.0 cm³ of 0.05 N FAS solution were required for blank and sample titration respectively. The volume of test sample used is 25 cm³. Calculate COD of the sample. (07 Marks)
- c. Explain any three size dependent properties of nano materials. (06 Marks)

OR

- 10 a. What is softening of water? Explain ion exchange process with neat diagram. (07 Marks)
- b. What is bottom up approach for synthesis of nano materials? Explain Sol-gel method of synthesis of nano materials. (07 Marks)
- c. Explain with neat diagram Carbon Nano Tubes (CNT's) and Fullerenes. (06 Marks)

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First/Second Semester B.E. Degree Examination, July/August 2021
Engineering Chemistry

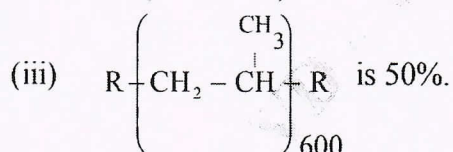
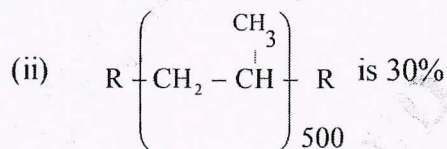
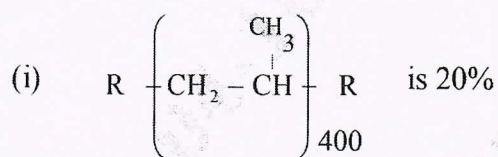
Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

1.
 - a. Derive Nernst equation for single electrode potential. (05 Marks)
 - b. What are reference electrodes? Describe the construction and working of Ag|AgCl electrode. (05 Marks)
 - c. Explain the following characteristics of battery:
 - (i) Cell potential
 - (ii) Energy efficiency
 - (iii) Shelf life
 (06 Marks)
 - d. Discuss the construction and working of Zinc-air battery. (04 Marks)
2.
 - a. Explain the determination of pH of a solution using glass electrode. (05 Marks)
 - b. What is electrolyte concentration cell? Calculate the potential of the cell at 298 K. $\text{Ag}|\text{AgNO}_3(0.001\text{M})||\text{AgNO}_3(0.5\text{M})|\text{Ag}$. What will be the cell potential, when the concentration of AgNO_3 in the above cell is changed from 0.001 M to 0.0005 M at same temperature? (05 Marks)
 - c. Describe the construction and working of Li-MNO₂ battery. (04 Marks)
 - d. Explain the construction and working of methanol oxygen fuel cell. Mention the advantages of fuel cells. (06 Marks)
3.
 - a. Define corrosion. Explain electrochemical theory of corrosion by taking iron as example. (06 Marks)
 - b. Explain the following :
 - (i) Water line corrosion
 - (ii) Pitting corrosion.
 (04 Marks)
 - c. What is electroplating? Discuss briefly polarization and decomposition potential which govern the electroplating. (05 Marks)
 - d. Discuss the electroplating of chromium. (05 Marks)
4.
 - a. Explain the following process:
 - (i) Galvanizing
 - (ii) Tinning
 (06 Marks)
 - b. Discuss briefly on corrosion control by design and selection of materials. (04 Marks)
 - c. Explain the following factors which influence nature of electrodeposit:
 - (i) Concentration of metal ion
 - (ii) Complexing agent.
 - (iii) pH of plating bath
 (06 Marks)
 - d. Write any four differences between electroplating and electrolessplating. (04 Marks)
5.
 - a. Explain the determination of calorific value of a solid fuel using bomb calorimeter. (05 Marks)
 - b. Write a note on:
 - (i) Unleaded petrol
 - (ii) Power alcohol.
 (05 Marks)
 - c. What is PV cell? Describe the construction and working of PV cell. Mention the advantages of PV cell. (05 Marks)
 - d. Explain with neat diagram, module, panel and array of PV cell. (05 Marks)
6.
 - a. What is gasoline knocking? Explain the mechanism of gasoline knocking. (05 Marks)
 - b. On burning 0.85×10^{-3} kg of a solid fuel in a bomb calorimeter. The temperature of 2.1 kg water is raised from 24°C to 27.6°C. The water equivalent of calorimeter and latent of steam are 1.1 kg and 2457 kJ/kg respectively. Specific heat of water is 4.187 KJ/kg/°C. If the fuel contains 2% hydrogen, calculate its gross and net calorific values. (05 Marks)
 - c. Discuss the physical and chemical properties of silicon, relevant to photovoltaics. (05 Marks)
 - d. What is doping? Explain the doping of silicon by diffusion technique. (05 Marks)

- 7 a. What is polymerization? Explain the free radical mechanism of addition polymerization by taking vinyl chloride as example. (06 Marks)
- b. What are elastomers? Give the synthesis and applications of silicon rubber. (04 Marks)
- c. Explain the following structure property relationship of polymer:
(i) Crystallinity (ii) Elasticity. (05 Marks)
- d. What is conducting polymer? Explain the mechanism of conduction in polyaniline. (05 Marks)
- 8 a. What is glass transition temperature (T_g)? Explain any two factors which influence the T_g . (05 Marks)
- b. Give the synthesis and uses of the following polymers:
(i) Polyurethane (ii) Teflon (05 Marks)
- c. What are polymer composites? Give the preparation and uses of carbon fibre. (05 Marks)
- d. A polymer polypropylene is found to have the following composition:



Calculate the number average and weight average molecular weight of the polymer (atomic mass of $C_1 = 12$, $H = 1$ and neglect the molecular mass of R). (05 Marks)

- 9 a. What are natural sources of water? Discuss the types of impurities present in natural water. (05 Marks)
- b. Write a brief note on priming and foaming in boilers. (05 Marks)
- c. What are nanomaterials? Explain the synthesis of nanomaterials by sol-gel process. (05 Marks)
- d. Write a note on nanorods. (05 Marks)
- 10 a. Explain the primary and activated sludge methods of sewage treatment. (05 Marks)
- b. What is desalination? Explain the desalination of water by reverse osmosis. (05 Marks)
- c. What are nano composites? Mention their properties and applications. (05 Marks)
- d. Write a note on carbon nanotubes. (05 Marks)

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06CHE12/22

First/Second Semester B.E. Degree Examination, December 2011
Engineering Chemistry

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer FIVE full questions choosing at least two from each part.
 2. Answer all objective type questions only in OMR sheet page 5 of the Answer Booklet.
 3. Answers to objective type questions on sheets other than OMR will not be valued.

PART - A

- 1 a. Choose the correct answer : (04 Marks)
- i) Which of the following is a fossil fuel? (A) Wood (B) Wind (C) Tides (D) Petrol
 - ii) A photovoltaic device, by which, high voltage current can be produced (A) cell (B) module (C) panel (D) none of these
 - iii) The efficiency of an IC engine increases as compression ratio (A) increases (B) decreases (C) remains constant (D) none of these
 - iv) The petrol fuel is (A) solid (B) liquid (C) gas (D) both B & C
- b. Define the terms : i) Octane number ii) Cetane number iii) Knocking. (06 Marks)
- c. What is meant by doping of silicon? Illustrate the vapour phase technique of doping of silicon. (05 Marks)
- d. Calculate the mass of air required for complete combustion of 1kg of coal which has the following % composition : C – 78.5% ; H – 7.5% ; S – 1.0% and remaining is ash. [Atomic mass of C = 12, H = 1, S = 32 and O = 16]. (05 Marks)
- 2 a. Choose the correct answer : (04 Marks)
- i) Voltmeter in an electrochemical cell is used to measure (A) concentration (B) voltage (C) current (D) none of these
 - ii) Calomel electrode produces a potential of ± 0.2422 volt when filled with (A) Sat.Kel (B) 1NKel (C) 1MKel (D) 0.1NKel
 - iii) The electrical sign of anode of concentration cell is : (A) + ve (B) - ve (C) Neutral (D) none of these
 - iv) A uniform fixed electrical double layer is known as (A) Guoy–Chapman (B) Helmholtz (C) Both A & B (D) None of these
- b. Differentiate electrode potential and cell potential, with a suitable example. (04 Marks)
- c. How is the potential of Fe determined experimentally, using calomel electrode? (06 Marks)
- d. Two copper electrodes placed in CuSO₄ solution of equal concentration are connected to form a concentration cell. Write the cell scheme, reaction and calculate the cell voltage. One of the solutions is diluted until the concentration of Cu²⁺ ions is 1/5th of its original volume. What will be the voltage after dilution? (06 Marks)
- 3 a. Choose the correct answer : (04 Marks)
- i) Lead – acid battery is (A) Reserve (B) Re - chargeable (C) Non - chargeable (D) Both A & B
 - ii) The electrolyte used in the H₂ – O₂ fuel cell is (A) Alcoholic KOH (B) Warm KOH soln (C) Sat KOH (D) None of these

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- iii) Graphite powder in Ni – Cd battery is used to
 (A) Increase efficiency of the cell (B) Increase the conductivity
 (C) Increase the voltage (D) None of these
- iv) In a dry battery, the graphite rod acts as
 (A) Anode (B) Cathode (C) Both A & B (D) Stabilizer
- b. Explain the construction, working and applications of a Li-MnO₂ battery. (05 Marks)
- c. What are fuel cells? How are they classified? Outline the principle and working of any one fuel cell. (06 Marks)
- d. Discuss the construction and working of Lead – acid battery. (05 Marks)
- 4 a. Choose the correct answer : (04 Marks)
- i) A part of the nail inside the frame undergoes corrosion of the type
 (A) water line (B) stress (C) differential aeration (D) none of these
- ii) A type of corrosion occurs when two different metals are welded and exposed to corrosive environment is
 (A) chemical (B) stress corrosion (C) galvanic (D) pitting
- iii) Impressed current method of preventing corrosion is
 (A) Anodic protection (B) Cathodic protection
 (C) Both A & B (D) None of these
- iv) When the ratio of anodic area to the cathodic area increases, the rate of corrosion
 (A) Decreases (B) Increases (C) attains constancy (D) None of these
- b. Define corrosion. Explain the type of corrosion that occurs when an Fe structure is exposed to atmospheric conditions. (06 Marks)
- c. Account for the following :
- i) Zn in contact with Ag undergoes corrosion factor than Zn in contact with Cu. (03 Marks)
- ii) The hull of a ship suffers from severe corrosion, when partially dipped in sea water. (04 Marks)
- iii) Galvanized sheets are more preferable than tin coated sheets. (03 Marks)

PART - B

- 5 a. Choose the correct answer : (04 Marks)
- i) In electroplating of gold generally, platinum is used as anode because the electrode is
 (A) inert (B) soluble (C) reactive (D) none of these
- ii) In chromium plating, the anode of the metal used is
 (A) Pb (B) Cu (C) Au (D) Cr
- iii) The electrical energy produced due to decrease in free energy of a spontaneous redox reaction, under reversible conditions is
 (A) polarization (B) decomposition (C) overvoltage (D) none of these
- iv) The metal salt concentration in the bath must be kept
 (A) low (B) high (C) medium (D) none of these
- b. Define metal finishing. Mention the technological importance of metal finishing. (05 Marks)
- c. Explain the influence of the following in electroplating :
 i) current density ii) metal ion conc. iii) throwing power (06 Marks)
- d. Discuss the electroplating of gold by cyanide bath. (05 Marks)
- 6 a. Choose the correct answer : (04 Marks)
- i) Thermotropic liquid crystals are those which depend on
 (A) pressure (B) concentration (C) temperature (D) none of these
- ii) The nematic crystals have geometrical shape like
 (A) rod (B) thread (C) plane (D) none of these

- iii) In gravimetric estimation of SO_4^{2-} , one of the following is used as a precipitating agent
 (A) $\text{Ba}(\text{NO}_3)_2$ (B) BaCO_3 (C) BaCl_2 (D) BaSO_4
- iv) The measurement of optical density of light in colorimetric determination of Nitrate involves
 (A) UV range (B) I R range (C) visible (D) All of these
- b. What are thermotropic liquid crystals? What are the phases in which they can exist? (04 Marks)
- c. Explain the applications of liquid crystals in LCD. (04 Marks)
- d. Write a brief note on the following :
 i) Colorimetric estimation of Cu ii) Potentiometric estimation of FAS. (08 Marks)
- 7 a. Choose the correct answer : (04 Marks)
- i) The functionality of $\text{CH}_2 = \text{CH}_2$ is
 (A) one (B) two (C) three (D) four
- ii) The chemical name of natural rubber is
 (A) Isoprene (B) Neoprene (C) Polyisoprene (D) None of these
- iii) Polyacetylene as a conducting polymer when doped with HCl forms
 (A) Oxidative doping (B) Productive (C) Protonic acid (D) None of these
- iv) A polymer containing alternate substituents / groups in the polymer chain will have the geometry called
 (A) Isotactic (B) Syndiotactic (C) Atactic (D) None of these
- b. Define the following terms : i) Monomer ii) Polymer iii) Functionality
 iv) Degree of polymerization and v) Co - polymer (05 Marks)
- c. Describe the production and uses of i) Teflon ii) polyurethane iii) Neoprene (06 Marks)
- d. What are conducting polymers? Write the structure and applications of conducting polyaniline. (05 Marks)
- 8 a. Choose the correct answer : (04 Marks)
- i) Which of the following is potable water?
 (A) Spring (B) River (C) Reservoir (D) None of these
- ii) A treatment involving the removal of phosphate is
 (A) Primary (B) Secondary (C) Tertiary (D) All of these
- iii) Reverse osmosis means flow of solvent molecules from a region of concentration
 (A) Higher to lower (B) Lower to higher
 (C) Both A & B (D) None of these
- iv) The function of HgCl_2 in the estimation of COD is to act as a
 (A) Catalyst (B) Oxidizing agent
 (C) Producing agent (D) Suppressing agent for chlorides
- b. Explain the following :
 i) Determination of fluoride content in water using SPADANS reagent.
 ii) BOD determination in effluent sample by Winkler's method.
 iii) Purification of water by electrodialysis. (12 Marks)
- c. 20cm^3 of sewage sample for COD is reacted with 25cm^3 of $\text{K}_2\text{Cr}_2\text{O}_7$ solution and the unreacted $\text{K}_2\text{Cr}_2\text{O}_7$ requires 9.0cm^3 of N/4 FAS solution. Under similar conditions in blank titration 15.0cm^3 of FAS is used up. Calculate the COD of the sample. (04 Marks)

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06CHE12/22

First/Second Semester B.E. Degree Examination, December 2011
Engineering Chemistry

Time: 3 hrs.

Max. Marks:100

- Note:1. Answer FIVE full questions choosing at least two from each part.**
2. Answer all objective type questions only in OMR sheet page 5 of the Answer Booklet.
3. Answers to objective type questions on sheets other than OMR will not be valued.

PART - A

- 1 a. Choose the correct answer : (04 Marks)**
- i) Which of the following is a fossil fuel?
 (A) Wood (B) Wind (C) Tides (D) Petrol
 - ii) A photovoltaic device, by which, high voltage current can be produced
 (A) cell (B) module (C) pannel (D) none of these
 - iii) The efficiency of an IC engine increases as compression ratio
 (A) increases (B) decreases (C) remains constant (D) none of these
 - iv) The petrol fuel is
 (A) solid (B) liquid (C) gas (D) both B & C
- b. Define the terms : i) Octane number ii) Cetane number iii) Knocking. (06 Marks)**
- c. What is meant by doping of silicon? Illustrate the vapour phase technique of doping of silicon. (05 Marks)**
- d. Calculate the mass of air required for complete combustion of 1kg of coal which has the following % composition : C – 78.5% ; H – 7.5% ; S – 1.0% and remaining is ash. [Atomic mass of C = 12, H = 1, S = 32 and O = 16]. (05 Marks)**
- 2 a. Choose the correct answer : (04 Marks)**
- i) Voltmeter in an electrochemical cell is used to measure
 (A) concentration (B) voltage (C) current (D) none of these
 - ii) Calomel electrode produces a potential of ± 0.2422 volt when filled with
 (A) Sat.Kel (B) 1NKel (C) 1MKel (D) 0.1NKel
 - iii) The electrical sign of anode of concentration cell is :
 (A) +ve (B) -ve (C) Neutral (D) none of these
 - iv) A uniform fixed electrical double layer is known as
 (A) Guoy–Chapman (B) Helmholtz (C) Both A & B (D) None of these
- b. Differentiate electrode potential and cell potential, with a suitable example. (04 Marks)**
- c. How is the potential of Fe determined experimentally, using calomel electrode? (06 Marks)**
- d. Two copper electrodes placed in CuSO₄ solution of equal concentration are connected to form a concentration cell. Write the cell scheme, reaction and calculate the cell voltage. One of the solutions is diluted until the concentration of Cu²⁺ ions is 1/5th of its original volume. What will be the voltage after dilution? (06 Marks)**
- 3 a. Choose the correct answer : (04 Marks)**
- i) Lead – acid battery is
 (A) Reserve (B) Re - chargeable (C) Non - chargeable (D) Both A & B
 - ii) The electrolyte used in the H₂ – O₂ fuel cell is
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- b. Explain the construction, working and applications of a Li-MnO₂ battery. (05 Marks)
- c. What are fuel cells? How are they classified? Outline the principle and working of any one fuel cell. (06 Marks)
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- 4 a. Choose the correct answer : (04 Marks)
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 (A) Anodic protection (B) Cathodic protection
 (C) Both A & B (D) None of these
- iv) When the ratio of anodic area to the cathodic area increases, the rate of corrosion
 (A) Decreases (B) Increases (C) attains constancy (D) None of these
- b. Define corrosion. Explain the type of corrosion that occurs when an Fe structure is exposed to atmospheric conditions. (06 Marks)
- c. Account for the following :
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- ii) The hull of a ship suffers from severe corrosion, when partially dipped in sea water. (04 Marks)
- iii) Galvanized sheets are more preferable than tin coated sheets. (03 Marks)

PART - B

- 5 a. Choose the correct answer : (04 Marks)
- i) In electroplating of gold generally, platinum is used as anode because the electrode is
 (A) inert (B) soluble (C) reactive (D) none of these
- ii) In chromium plating, the anode of the metal used is
 (A) Pb (B) Cu (C) Au (D) Cr
- iii) The electrical energy produced due to decrease in free energy of a spontaneous redox reaction, under reversible conditions is
 (A) polarization (B) decomposition (C) overvoltage (D) none of these
- iv) The metal salt concentration in the bath must be kept
 (A) low (B) high (C) medium (D) none of these
- b. Define metal finishing. Mention the technological importance of metal finishing. (05 Marks)
- c. Explain the influence of the following in electroplating :
 i) current density ii) metal ion conc. iii) throwing power (06 Marks)
- d. Discuss the electroplating of gold by cyanide bath. (05 Marks)
- 6 a. Choose the correct answer : (04 Marks)
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 (A) pressure (B) concentration (C) temperature (D) none of these
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iii) In gravimetric estimation of SO_4^{2-} , one of the following is used as a precipitating agent
(A) $Ba(NO_3)_2$ (B) $BaCO_3$ (C) $BaCl_2$ (D) $BaSO_4$

iv) The measurement of optical density of light in colorimetric determination of Nitrate involves

(A) UV range (B) I R range (C) visible (D) All of these

- b. What are thermotropic liquid crystals? What are the phases in which they can exist? (04 Marks)
- c. Explain the applications of liquid crystals in LCD. (04 Marks)
- d. Write a brief note on the following :
 - i) Colorimetric estimation of Cu ii) Potentiometric estimation of FAS. (08 Marks)

7 a. Choose the correct answer : (04 Marks)

i) The functionality of $CH_2 = CH_2$ is

(A) one (B) two (C) three (D) four

ii) The chemical name of natural rubber is

(A) Isoprene (B) Neoprene (C) Polyisoprene (D) None of these

iii) Polyarutinine as a conducting polymer when doped with HCl forms

(A) Oxidative doping (B) Productive (C) Protonic acid (D) None of these

iv) A polymer containing alternate substituents / groups in the polymer chain will have the geometry called

(A) Isotoetic (B) Syndiotoeitic (C) Atactic (D) None of these

- b. Define the following terms : i) Monomer ii) Polymer iii) Functionality (05 Marks)
- iv) Degree of polymerization and v) Co - polymer

c. Describe the production and uses of i) Teflon ii) polyurethane iii) Neoprene (06 Marks)

d. What are conducting polymers? Write the structure and applications of conducting polyaniline. (05 Marks)

8 a. Choose the correct answer : (04 Marks)

i) Which of the following is potable water?

(A) Spring (B) River (C) Reservoir (D) None of these

ii) A treatment involving the removal of phosphate is

(A) Primary (B) Secondary (C) Tertiary (D) All of these

iii) Reverse osmosis means flow of solvent molecules from a region of concentration

(A) Higher to lower (B) Lower to higher

(C) Both A & B (D) None of these

iv) The function of $HgCl_2$ in the estimation of COD is to act as a

(A) Catalyst (B) Oxidizing agent
(C) Producing agent (D) Suppressing agent for chlorides

- b. Explain the following :
 - i) Determination of fluoride content in water using SPADANS reagent.
 - ii) BOD determination in effluent sample by Winkler's method.
 - iii) Purification of water by electro dialysis. (12 Marks)

c. $20cm^3$ of sewage sample for COD is reacted with $25cm^3$ of $K_2Cr_2O_7$ solution and the unreacted $K_2Cr_2O_7$ requires $9.0cm^3$ of N/4 FAS solution. Under similar conditions in blank titration $15.0cm^3$ of FAS is used up. Calculate the COD of the sample. (04 Marks)

CBCS SCHEME

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BCHEM102

First Semester B.E./B.Tech. Degree Examination, Jan./Feb. 2023 Chemistry for Mechanical Engineering Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Define calorific value. Explain principle, construction and working of bomb calorimeter to determine GCV and NCV of a solid fuel.	7	L2	CO1
	b.	Describe the construction and working of methanol-oxygen fuel cell.	6	L3	CO1
	c.	Explain the construction and working of photovoltaic cells and mention any two applications.	7	L3	CO1
OR					
Q.2	a.	What are green fuels? Explain the synthesis of bio diesel by transesterification. Write any four applications.	7	L2	CO1
	b.	Describe the construction and working of Lithium-ion battery and mention any two applications.	7	L3	CO1
	c.	Define a fuel. Determine calorific value of fuels with a bomb calorimeter.	6	L2	CO1
Module – 2					
Q.3	a.	What do you mean by metal finishing? Mention any five technological importance.	6	L1	CO2
	b.	What is corrosion? Explain the electrochemical theory of corrosion by taking iron as an example.	7	L2	CO2
	c.	What is CPR? Calculate the CPR in both mpy and mmpy for a thick steel sheet of area 100inch ² which experiences a weight loss of 485g after one year. (Density of steel = 7.9g/cm ³).	7	L2	CO2
OR					
Q.4	a.	What is electroplating? Explain electroplating of chromium as hard and decorative coatings.	7	L2	CO2
	b.	Explain the process of Galvanization.	6	L2	CO2
	c.	Define electroless plating. Explain electroless plating of Nickel.	7	L2	CO2

Module – 3					
Q.5	a.	In a polymer sample, 20% of the molecules have molecular weight of 15,000g/mol, 35% of the molecules have molecular weight of 25,000g/mol and remaining molecules have molecular weight of 20,000g/mol. Calculate the number average and weight average molecular mass of the polymer.	7	L3	CO3
	b.	Explain the synthesis, properties and applications of Kevlar.	7	L3	CO3
	c.	What are lubricants? Explain any four properties and applications of lubricants.	6	L2	CO3
OR					
Q.6	a.	Explain the synthesis, properties and applications of PMMA.	7	L3	CO3
	b.	What are fibres? Explain any four properties and applications of polystyrene.	6	L2	CO3
	c.	Explain metal matrix composite with an example. Explain any four properties and applications of metal matrix composites.	7	L2	CO3
Module – 4					
Q.7	a.	Explain the principle and instrumentation of optical sensor for the estimation of copper.	6	L2	CO4
	b.	Explain the determination of pH of beverages using glass electrode.	6	L2	CO4
	c.	Define phase rule. Explain the following terms with an example phase, components and degree of freedom.	8	L3	CO4
OR					
Q.8	a.	Explain the estimation of FAS potentiometrically using calomel and platinum electrode as potentiometric sensors.	6	L2	CO4
	b.	Explain the procedure for the estimation of copper present in a solution using optical sensor.	6	L2	CO4
	c.	Discuss the lead-silver two component system along with phase diagram.	8	L3	CO4
Module – 5					
Q.9	a.	What are alloys? Explain composition, properties and applications of Alnico.	7	L2	CO5
	b.	What are perovskites? Mention any four properties and applications of perovskites.	6	L2	CO5
	c.	What are nanomaterials? Explain any three size dependent properties of nanomaterials.	7	L2	CO5
OR					
Q.10	a.	Explain the synthesis of nanomaterial by sol-gel method.	7	L2	CO5
	b.	Explain composition, properties and applications of stainless steel.	6	L2	CO5
	c.	Write a note on carbon nano tubes. Mention any four properties and applications of carbon nano tubes.	7	L2	CO5

CBCS SCHEME

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2	V	D	2	2	C	2	4	0	1
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BCHE102

First Semester B.E./B.Tech. Degree Examination, Jan./Feb. 2023 Applied Chemistry for CSE Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	What are batteries? Explain the working principle, properties and applications of quantum Dot sensitized solar cells.	7	L2	CO1
	b.	Explain the working principle of electrochemical sensors, and mention its applications.	6	L2	CO1
	c.	What are sensors? Explain the detection of ascorbic Acid and Glyphosate using sensors.	7	L2	CO1
OR					
Q.2	a.	What are electro chemical sensors? Explain its applications in the measurement of dissolved oxygen (DO).	7	L2	CO1
	b.	Describe the construction working and applications of Lithium – ion batteries and mention any four applications.	6	L2	CO1
	c.	Explain about detection of Diclofenac and hydro carbons (PAH's) with electro chemical oxidation sensors.	7	L2	CO1
Module – 2					
Q.3	a.	What are photoactive and electro active materials and explain their working principle in display system.	6	L2	CO1
	b.	Explain any four properties and applications of light emitting materials – poly [9 – Vinyl Carbazole] (PVK) suitable for opto electronic devices.	6	L2	CO1
	c.	Discuss the working and liquid crystal display.	8	L2	CO1
OR					
Q.4	a.	Explain the types of organic memory devices by taking P-type and n-type semi conducting materials.	6	L2	CO1
	b.	What are nano materials? Explain any four properties and applications of polythiophenes (P3HT) suitable for optoelectronic devices.	7	L2	CO1
	c.	What is QLED? Mention any four properties and applications of QLED.	6	L2	CO1
Module – 3					
Q.5	a.	Define metallic corrosion. Describe the electrochemical theory of corrosion taking iron as an example.	6	L2	CO2
	b.	What are Ion-selective electrodes? Explain the determination of pH of a solution using glass electrode.	7	L2	CO2
	c.	Define concentration cell. The EMF of the cell Ag/AgNO ₃ (C ₁ M)//AgNO ₃ (0.2M)/Ag is 0.8V at 25°C. Find the value of C ₁ .	7	L3	CO2

OR					
Q.6	a.	Briefly explain the principle, instrumentation and working of potentiometry taking estimation of Iron as example.	6	L2	CO1
	b.	What are reference electrode? Explain the construction, working and application of Calomel electrode.	7	L2	CO1
	c.	What is CPR? A piece of corroded steel plate was found in a submerged ocean vessel. It was estimated that the original area of the plate was 10 inch ² and that approx 2.6kg had corroded away during the submersion. Assuming a corrosion penetration rate of 200 mpy for this alloy in sea water, estimate the time of submersion in years. The density of steel is 7.9g/cm ³ .	7	L3	CO2
Module – 4					
Q.7	a.	In sample of a polymer, 20% molecules have molecular mass 15000 g/mol, 45% molecules have molecular mass 25000 g/mol, and remaining molecules have molecular mass 27000g/mol, calculate the number average and weight average molecular mass of the polymer.	6	L3	CO3
	b.	Explain the preparation, properties and commercial application of Kevlar.	7	L2	CO3
	c.	What are green fuels? Explain the generation of hydrogen by Alkaline water electrolysis with its advantages.	7	L2	CO3
OR					
Q.8	a.	Explain the construction and working of photovoltaic cells. Mention the advantages and disadvantages.	6	L2	CO4
	b.	Explain the preparation, properties, and commercial applications of graphene oxide.	7	L2	CO4
	c.	What are conducting polymer? Discuss the conduction mechanism in polyacetylene through oxidative doping technique and its uses.	7	L2	CO4
Module – 5					
Q.9	a.	Explain the ill effects of toxic materials used in manufacturing electrical and electronic products.	7	L2	CO5
	b.	Write a brief note on role of stake-holders for example, producers, consumers, recyclers and statutory bodies.	6	L2	CO5
	c.	Briefly discuss the various chemical methods involved in hydrometallurgy process of recovery of E-waste.	7	L2	CO5
OR					
Q.10	a.	Explain the pyro metallurgical recycling methods.	7	L2	CO5
	b.	Explain the steps involved in extraction of gold from e-waste.	7	L2	CO5
	c.	Mention the sources of e-waste and explain the need for e-waste management.	6	L2	CO5

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BCHEC102/202

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Applied Chemistry for Civil Engineering Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. VTU Formula Hand Book is permitted.
 3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	What is Glass? Describe the preparation of Soda Lime Glass.	07	L2	CO1
	b.	Explain the various steps involved in the manufacture of cement by wet process with a flow chart.	06	L2	CO1
	c.	Define Refractories. Write the properties and applications of refractory materials.	07	L3	CO1
OR					
Q.2	a.	What is Cement? Illustrate the process of setting and hardening of cement with chemical reactions.	07	L3	CO1
	b.	Define alloys. Write the properties and applications of Iron and its alloys.	07	L3	CO1
	c.	Write a note on additives used in the manufacture of cement.	06	L3	CO1
Module – 2					
Q.3	a.	Illustrate the construction and working of Methanol – Oxygen fuel cell.	06	L4	CO2
	b.	Define corrosion. Describe the electrochemical corrosion of steel in concrete.	07	L2	CO2
	c.	What is anodizing? Explain anodizing of aluminium. Mention its applications.	07	L2	CO2
OR					
Q.4	a.	Define PV cell. Illustrate the construction and working of Photovoltaic Cell.	07	L3	CO2
	b.	Explain differential metal and aeration corrosion with suitable examples.	07	L2	CO2
	c.	Explain how material selection and design can prevent corrosion.	06	L2	CO2
Module – 3					
Q.5	a.	100 ml of a water sample required 20ml of 0.01 M EDTA for the titration with Erichrome Black-T indicator, 100 ml of the same water sample after boiling and filtering required 10 ml of 0.01 M EDTA. Calculate (i) Total hardness (ii) Permanent Hardness (iii) Temporary Hardness of the sample.	07	L3	CO3
	b.	With a neat labeled diagram illustrate the softening of hard water by ion exchange method.	07	L3	CO3
	c.	Explain the following size dependent properties of nanomaterials: (i) Catalytic property (ii) Surface area	06	L2	CO3
OR					
Q.6	a.	What is desalination? Explain desalination of brackish water by forward osmosis.	07	L2	CO3
	b.	Define Nanomaterials. Demonstrate the synthesis of Nanomaterials by Sol-gel method.	07	L3	CO3
	c.	Write a note on use of metal-oxide nano particles in the treatment of water.	06	L3	CO3

Module – 4					
Q.7	a.	Calculate the number average molecular mass (M_n) and weight average molecular mass (M_w) of a polymer in which 30% molecules have a molecular mass 20,000 ; 40% have 30,000 and the rest have 60,000.	06	L3	CO4
	b.	Define Fibers. Explain the synthesis, properties and applications of Nylon Fibers.	07	L2	CO4
	c.	Define Polymer Composites. Write the properties and applications of Fiber Reinforced Polymer (FRP) and Geo-Polymer Concrete (GPC).	07	L3	CO4
OR					
Q.8	a.	Explain the synthesis, properties and applications of Chloropolyvinyl chloride.	06	L2	CO4
	b.	Define Biodegradable Polymer. Explain the steps involved in the preparation of polylactic acid and mention the applications.	07	L2	CO4
	c.	What are adhesives? Explain the synthesis, properties and applications of epoxy resin.	07	L2	CO4
Module – 5					
Q.9	a.	State Phase Rule. Explain the terms involved in the phase rule with examples.	07	L2	CO5
	b.	With the help of a neat phase diagram, explain the Lead-Silver system.	07	L2	CO5
	c.	Describe the determination of pH of soil sample using pH sensors.	06	L2	CO5
OR					
Q.10	a.	State and explain phase rule for two component system. Mention the use of phase diagram.	06	L2	CO5
	b.	Illustrate the principle and instrumentation of conductometric sensors.	07	L2	CO5
	c.	Explain the applications of potentiometric sensors in the estimation of iron.	07	L2	CO5

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BCHEM102/202

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Applied Chemistry for ME Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. VTU Formula Hand Book is permitted.
 3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Define GCV. Explain the determination of calorific value of a fuel using Bomb calorimeter.	07	L1	CO1
	b.	Explain the construction, working and applications of Photovoltaic cells.	07	L1	CO1
	c.	Explain the construction, working and applications of Lithium-ion battery.	06	L2	CO1
OR					
Q.2	a.	A coal sample with 93% C, 5% H ₂ and 2% ash is subjected to combustion in a Bomb calorimeter. Calculate the gross and net calorific values, given that mass of coal sample taken is 0.95g, mass of water in the calorimeter is 2000g, water equivalent of calorimeter is 700g, rise in temperature of water is 2.8°C, latent heat of steam is 2457 J/g and specific heat of water is 4.2 J/g°C.	07	L2	CO1
	b.	What are fuel cells? Explain the construction, working and applications of methanol-oxygen fuel cell.	07	L2	CO1
	c.	Justify biodiesel is a great fuel. Explain the synthesis of biodiesel by transesterification method.	06	L2	CO1
Module – 2					
Q.3	a.	Define metallic corrosion. Explain electrochemical theory of corrosion taking iron as an example.	07	L2	CO2
	b.	Describe electroplating of hard and decorative chromium.	07	L2	CO2
	c.	What is cathodic protection? Explain the principle, process and applications of sacrificial anode method.	06	L2	CO2
OR					
Q.4	a.	What is CPR? A steel sheet of area 100 inch ² is exposed to air near the ocean. After 1 year period it was found to experience a weight loss of 485g due to corrosion. If the density of steel is 7.9 g/cm ³ , calculate the CPR in mpy and mmpy.	07	L2	CO2
	b.	What is stress corrosion? Explain the process of stress corrosion taking caustic embrittlement as an example.	07	L2	CO2
	c.	Explain the process of Galvanization and its applications.	06	L2	CO2
Module – 3					
Q.5	a.	In a polymer sample, 20% of molecules have molecular mass 15000 g/mol, 35% molecules have molecular mass 25000 g/mol, remaining molecules have molecular mass 20000 g/mol, calculate the number average, weight average molecular mass of the polymer.	07	L2	CO3
	b.	Explain the synthesis, properties and applications of chlorinated poly vinyl chloride	07	L2	CO3
	c.	Explain the synthesis of Teflon. Mention its applications.	06	L2	CO3

OR					
Q.6	a.	Explain the synthesis, properties and applications of Kevlar fiber.	07	L2	CO3
	b.	Explain the properties and industrial applications of lubricants.	07	L2	CO3
	c.	Explain the properties and industrial applications of metal matrix polymer composites.	06	L2	CO3
Module – 4					
Q.7	a.	Define Phase, Components and degree of freedom with example.	07	L2	CO4
	b.	Explain the principle, instrumentation and applications of potentiometric titration.	07	L2	CO4
	c.	Describe the estimation of total hardness of water by using EDTA method.	06	L2	CO4
OR					
Q.8	a.	With the help of phase diagram, describe Lead-Silver system.	07	L2	CO4
	b.	Explain the application of colorimetric sensors in the estimation of copper.	06	L2	CO4
	c.	Explain the principle, instrumentation and applications of glass electrode in the determination of pH of beverages.	07	L2	CO4
Module – 5					
Q.9	a.	Define an Alloy. Explain the composition, properties and applications of stainless steel.	07	L1	CO5
	b.	Explain size dependent properties of nanomaterials with respect to i) Catalytic property ii) Thermal property.	07	L2	CO5
	c.	Explain the properties and applications of carbon nanotubes.	06	L3	CO5
OR					
Q.10	a.	Explain the composition, properties and applications of Alnico.	07	L2	CO5
	b.	Explain the chemical composition, properties and applications of Perovskites.	07	L2	CO5
	c.	Explain the synthesis of nanomaterials by Sol-Gel method.	06	L2	CO3

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BCHES102/202

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Applied Chemistry for CSE Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. VTU Formula Hand Book is permitted.
 3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Explain the working principle of conductometric sensors and mention any two applications.	06	L2	CO2
	b.	Discuss the construction and working of Li-ion batteries. Mention its applications.	07	L2	CO4
	c.	Describe the application of Electrochemical gas sensors for the detection of SO _x and NO _x .	07	L3	CO3
OR					
Q.2	a.	Explain the working principle of an Electrochemical sensor in the detection of Dissolved Oxygen (DO).	06	L2	CO2
	b.	Discuss the construction and working of Quantum Dot Sensitized Solar Cells (QDSSCs). Mention its applications.	07	L2	CO4
	c.	Describe the use of disposable sensor in the detection of herbicide Glyphosate.	07	L3	CO3
Module – 2					
Q.3	a.	What are memory devices? Explain the classification of Electronic memory devices with examples.	07	L1 L2	CO1
	b.	What are nanomaterials? Explain any four properties of polythiophenes (P ₃ HT) suitable for optoelectronic devices.	07	L1 L2	CO1 CO4
	c.	Mention any three properties and applications of QLED.	06	L1	CO4
OR					
Q.4	a.	Explain the types of organic memory. Devices by taking p-type and n-type semiconductor materials.	07	L2	CO2
	b.	What are photoactive and electroactive materials and explain their working principle in the display system.	07	L2	CO1 CO2
	c.	Mention any 3 properties and applications of LC-displays.	06	L1	CO4
Module – 3					
Q.5	a.	Define metallic corrosion. Describe the electrochemical theory of corrosion taking.	07	L1 L2	CO1 CO2
	b.	Describe galvanizing and mention its applications.	06	L2	CO4
	c.	What is CPR? A thick brass sheet of area 400 inches exposed to moist air. After 2 years of period. It was found to experience a weight loss of 375 g due to corrosion. If the density of brass is 8.73 g/cms, calculate CPR in mpy and mmpy.	07	L2	CO1 CO3
OR					
Q.6	a.	Explain the construction and working of the Calomel electrode.	07	L2	CO2
	b.	Explain the application of conductometric electrodes in the estimation of a weak acid.	06	L2	CO4
	c.	Define concentration cell. Derive an expression for emf of the cell.	07	L1 L2	CO1 CO3

Module – 4					
Q.7	a.	A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions. 1 g of 10000 molecular weight. 2 g of 50000 mol. wt and 2 g of 100000 mol.wt. Determine the number and weight average mol. wt.	07	L2	CO3
	b.	What is Green fuel (hydrogen fuel)? Mention the advantages of Green fuel.	06	L1	CO1
	c.	Explain the construction and working of Photovoltaic cells.	07	L2	CO2
OR					
Q.8	a.	Discuss the conduction mechanism in polyacetylene through oxidative or reductive doping techniques (Any one).	07	L3	CO2
	b.	Explain the generation of hydrogen by alkaline water electrolysis.	07	L2	CO4
	c.	Explain the preparation, properties and applications of Kevlar.	06	L2	CO4
Module – 5					
Q.9	a.	What is e-waste? Explain the need for e-waste management.	07	L2	CO1
	b.	Explain the process of recycling e-waste.	06	L2	CO5
	c.	Discuss the following : (i) Pyrometallurgy (ii) Hydrometallurgy	07	L3	CO5
OR					
Q.10	a.	Explain the extraction of gold from e-waste.	07	L2	CO2
	b.	Write a brief note on the role of stakeholders for example: Producers, Consumers, Statutory bodies.	07	L3	CO5
	c.	Explain the health hazards due to exposure to e-waste.	06	L2	CO3

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CBCS SCHEME

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BCHEE102/202

First/Second Semester B.E./B.Tech. Degree Examination, June/July 2023 Chemistry for EEE Stream

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks , L: Bloom's level , C: Course outcomes.

3. VTU formula handbook is permitted.

Module – 1			M	L	C
Q.1	a.	Explain the terms conductors , semiconductors and insulators on the basis of Band theory.	6	L2	CO1
	b.	Explain the production of electronic grade silicon by Czochrolski (CZ) method.	7	L2	CO1
	c.	A polymer sample contains 1, 2, 3 and 4 molecular having molecular weight 1×10^5 , 2×10^5 , 3×10^5 and 4×10^5 respectively. Calculate number average and weight average molecular weight.	7	L3	CO1
OR					
Q.2	a.	What are Conducting Polymers? Explain Conducting mechanism of poly acetylene.	7	L2	CO1
	b.	Explain the preparation , properties and applications of Graphene oxide (Hummers method).	7	L2	CO1
	c.	Define Electroless Plating. Describe the electroless plating of copper in the manufacture of double sided PCB. [Printed Circuit Board].	6	L2	CO1
Module – 2					
Q.3	a.	Define the term Battery. Explain the classification of batteries with an example.	7	L1, L2	CO2
	b.	Define Fuel cells. Explain the construction , working and applications of Methanol – oxygen ($\text{CH}_3\text{OH} - \text{O}_2$) fuel cell.	7	L1, L2	CO2
	c.	What are Photovoltaic Cells? Explain the construction and working of Photovoltaic cell.	6	L1, L2	CO2
OR					
Q.4	a.	Explain the Construction , working and applications of Vanadium Redox flow battery.	7	L2	CO2
	b.	Explain the Construction , working and applications of Polymer Electrolyte Membrane fuel cell (PEM).	7	L2	CO2
	c.	Explain the Construction , working and applications of Na – ion battery.	6	L2	CO2
Module – 3					
Q.5	a.	Explain Electrochemical theory of corrosion by taking iron as an example.	7	L2	CO3

BCHEE102					
	b.	Explain the process of Galvanisation, with a neat diagram.	6	L2	CO3
	c.	Explain the methods of disposal of e – waste.	7	L2	CO3
OR					
Q.6	a.	A thick steel sheet of area 300cm ² is exposed to air near the ocean. After one year period it was found to experience a weight loss of 250 gm due to corrosion. Calculate the rate of corrosion in both mpy and mmpy. (density of steel is 7.9 g/cm ³).	7	L3	CO3
	b.	Explain differential Aeration corrosion with an example.	6	L2	CO3
	c.	What are the effects of e – waste on Environment and Human health?	7	L2	CO3
Module – 4					
Q.7	a.	What are the Nanomaterials? Explain the size dependent properties of nanomaterials.	7	L2	CO4
	b.	Explain the properties and applications of nano fibres and nanosensor.	6	L2	CO4
	c.	Explain the properties and applications of Organic Light Emitting Diodes.	7	L2	CO4
OR					
Q.8	a.	Explain the preparation of nano – material by Sol – gel method.	7	L2	CO4
	b.	Explain the properties and applications of Quantum Light Emitting Diodes (QLED's).	7	L2	CO4
	c.	Explain the properties and applications of Perovskite materials.	6	L2	CO4
Module – 5					
Q.9	a.	What are Reference Electrodes? Explain construction , working and applications of Calomel electrode.	7	L1, L2	CO5
	b.	Explain the principle and instrumentation of colorimetric sensor and application in the estimation of copper.	7	L3	CO5
	c.	A concentration cell was constructed by immersing two copper electrodes in 0.1M and 1.0M CuSO ₄ solution , write the cell representation and cell reactions and calculate the EMF of the cell.	6	L3	CO5
OR					
Q.10	a.	Explain the method of determination of pH by using glass electrode.	7	L2	CO5
	b.	Explain the working principle and applications of electrochemical sensors.	6	L2	CO5
	c.	Explain the principle and instrumentation of conductometric sensors and its applications in the estimation of weak acid.	7	L3	CO5

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BCHEE102/202

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024 Chemistry for EEE Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module - 1			M	L	C
Q.1	a.	Explain the band diagrams for conductors and insulators.	7	L2	CO1
	b.	Describe the production of electronic grade silicon from quartz by Czochralski method.	7	L2	CO1
	c.	Explain the preparation, properties and commercial applications of graphene oxide.	6	L2	CO1
OR					
Q.2	a.	What are conducting polymers? Explain the mechanism of polyacetylene.	7	L2	CO1
	b.	What is electroless plating? Describe electroless plating of copper in the manufacture of double-sided PCB.	7	L2	CO1
	c.	In a polymer sample 20% of molecules have molecular mass 15000 g/mol. 45% molecules have molecular mass 25000 g/mol remaining molecules have molecular mass 27,000 g/mol. Calculate number average and weight average molecular weight of the polymer.	6	L3	CO1
Module - 2					
Q.3	a.	What are batteries? Explain the classification of batteries with suitable examples.	7	L2	CO2
	b.	What are photovoltaic cells? Describe the construction and working of a photovoltaic cell.	7	L2	CO2
	c.	Explain the construction and working of li-polymer battery. Mention its applications.	6	L2	CO2
OR					
Q.4	a.	Explain the construction and working of vanadium redox flow battery. Mention its applications.	7	L2	CO2
	b.	What are fuel cells? Explain the construction and working of methanol-oxygen fuel cell. Mention its applications.	7	L2	CO2
	c.	Explain the construction and working of Na-ion battery.	6	L2	CO2
Module - 3					
Q.5	a.	What is metallic corrosion? Explain the electrochemical theory of corrosion, taking iron as an example.	7	L2	CO3
	b.	What is corrosion penetration rate? Calculate the CRR in both MPY and MMPY for a thick steel sheet of area 100 inch ² , which experience a weight loss of 485 g after one year (density of steel 7.9 g/cm ³).	7	L3	CO3
	c.	Describe the extraction of copper and gold from E-waste.	6	L2	CO3
OR					
Q.6	a.	Write notes on: (i) Differential metal corrosion (ii) Differential aeration corrosion	7	L2	CO3
	b.	Explain the sacrificial anode method for the corrosion control.	6	L2	CO3
	c.	What is e-waste? Describe the effects of e-waste on environment and human health.	7	L2	CO3

Module – 4					
Q.7	a.	What are nanomaterials? Explain the any two size dependent properties of nanomaterials.	7	L2	CO4
	b.	What are pervoskite materials? Mention the properties and applications of perovskite materials in opto electronic devices.	7	L2	CO4
	c.	Describe the synthesis of nanomaterials by co-precipitation method.	6	L2	CO4
OR					
Q.8	a.	Explain the synthesis of nanomaterials by sol-gel method.	7	L2	CO4
	b.	What are QLED's? Mention its properties and applications.	6	L2	CO4
	c.	Write notes on: (i) Nanophotonics (ii) Nanosensors	7	L2	CO4
Module – 5					
Q.9	a.	What are reference electrode? Explain the construction and working of calomel electrode.	7	L2	CO5
	b.	Explain the principle, instrumentation and applications of potentiometric sensor in the estimation of iron.	7	L3	CO5
	c.	The emf a cell $\text{Ag}/\text{AgNO}_3(0.001\text{m})//\text{AgNO}_3(X\text{m})/\text{Ag}$ is 0.059 V at 25°C, find the value of 'X'.	6	L3	CO5
OR					
Q.10	a.	What are ion selective electrodes? Explain the construction and working principle of glass electrode.	7	L2	CO5
	b.	Explain the principle and instrumentation colorimetric sensor, mention its applications.	7	L3	CO5
	c.	Explain how the strength of a weak acid determined using a conductometric sensor.	6	L2	CO5
