SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM NAGAR, KATTANKULATHUR – 603 203

DEPARTMENT OF CHEMISTRY

QUESTION BANK

II SEMESTER

CH3221-Chemistry of Construction Materials

Regulations 2023

Academic Year 2024-25

UNIT I - ELECTROCHEMISTRY AND CORROSION

Electrode - electrode reaction - redox reaction - origin of electrode potential, oxidation potential - reduction potential - measurement and applications, electrochemical series and its significance - electrochemical cell - Nernst equation (derivation). Corrosion - causes - factors - types - chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electroplating of Au - electroless plating of Ni - paints - constituents and function.

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	What is Electrochemical cell?	1	Remembering	CO1
2.	Define Standard Electrode Potential.	1	Remembering	CO1
3.	What is electrode potential?	1	Remembering	CO1
4.	Describe electrochemical series.	2	Understanding	CO1
5.	Mention the significance of electrochemical series.	1	Remembering	CO1
6.	Define corrosion. Give an example.	1	Remembering	CO1
7.	List out the factors affecting the corrosion.	2	Understanding	CO1
8.	Calculate the reduction potential of Cu^{2+} (0.3M) / Cu at 25ºC. $E^{o}_{(Cu2+/Cu)}$ = 0.34 V.	3	Applying	CO1
9.	State Pilling-Bedworth ratio.	2	Understanding	CO1
10.	Differentiate dry corrosion and wet corrosion.	2	Understanding	CO1
11.	Explain water line corrosion with example.	1	Remembering	CO1
12.	Bolt and nut made of same metal is preferred in practice. Why?	4	Analyzing	CO1
13.	List out the metals which could be used as sacrificial anodes.	1	Remembering	CO1
14.	Explain cathodic protection. Mention its two applications.	2	Understanding	CO1
15.	How is galvanic corrosion prevented?	2	Understanding	CO1
16.	What is a paint? Mention its constituents.	1	Remembering	CO1
17.	What is the role of pigments in paints?	1	Remembering	CO1
18.	Define electroless plating.	1	Remembering	CO1
19.	Describe electroplating.	2	Understanding	CO1
20.	Compare electroplating and electroless plating.	2	Understanding	CO1
21.	Compose the Nernst equation for the cell, $Zn_{(s)}/Zn_{(aq)}\| Mg_{(aq)}/Mg_{(s)}$	3	Applying	CO1
22.	Classify the advantages of electroless plating over electroplating.	2	Understanding	CO1

S.No		PART-B (16 Marks)	BTL	Competence	CO
1.		Derive Nernst equation for single electrode potential and give its significance.	3	Applying	CO1
2.	(i)	Compare electrolytic cell and electrochemical cell.	4	Analyzing	CO1
	(ii)	Calculate the standard electrode potential of zinc electrode dipped in 0.1 M $ZnSO_4$ at 25ºC ($E^º$ Zn/Zn^{2+} = 0.76 V)	3	Applying	CO1
3.		What is single electrode potential? How electrode potential can be obtained by deriving Nernst equation?	3	Applying	CO1
4.		Summarize the following in detail (i) Corrosion by oxygen (ii) Corrosion by Hydrogen.	3	Applying	CO1
5.	(i)	Define EMF Series. Explain its significance.	2	Understanding	CO1
	(ii)	Investigate the measurement of single electrode potential and its applications.	6	Creating	CO1
6.	(i)	Explain the terms, cell potential and single electrode potential and describe the method of determination of electrode potential.	3	Applying	CO1
	(ii)	Examine electrochemical series. Give its applications.	4	Analyzing	CO1
7.		Discuss wet (or) electrochemical corrosion with suitable diagram.	3	Applying	CO1
8.		Analyse dry (or) chemical corrosion with suitable diagram.	4	Analyzing	CO1
9.		What is meant by electroplating? With a neat sketch explain the electroplating of gold.	3	Applying	CO1
10.		Examine the constituents and functions of paint in detail.	4	Analyzing	CO1
11.		Define electroless plating. Discuss electroless plating of Nickel with detailed chemical reactions.	3	Applying	CO1
12.	(i)	State the differences between electrochemical corrosion and chemical corrosion.	2	Understanding	CO1
	(ii)	How will you control corrosion by material selection and design aspects?	2	Understanding	CO1
13.		What are paints? Analyse its constituents and function with examples.	4	Analyzing	CO1
14.		Evaluate the electroless plating of nickel with detailed reactions.	5	Evaluating	CO1
15.	(i)	What are the factors which influences the rate of corrosion? Explain.	3	Applying	CO1
	(ii)	Analyse the sacrificial anode and impressed current cathodic techniques for the prevention of corrosion.	4	Analyzing	CO1

UNIT II - PHASE RULE AND ALLOYS

Phase rule: introduction, the definition of terms with examples, one component system (water system) - reduced phase rule - construction of phase diagram by thermal analysis - simple eutectic systems, two-component systems (Zn-Mg system). Alloys: introduction - definition- properties of alloys - significance of alloying, functions and effect of alloying elements- ferrous alloys - Nichrome and stainless steel - types (18/8) - heat treatment of steel, non-ferrous alloys - brass and bronze.

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	Define phase.	1	Remembering	CO2
2.	What is component?	1	Remembering	CO2
3.	Describe degree of freedom.	2	Understanding	CO2
4.	Solve the no. of phases of the following equation. i) Sulphur(monoclinic)⇋Sulphur(rhombic)⇋Sulphur(*l*) ii) Water+Alcohol ⇋ Vapour	3	Applying	CO2
5.	Write the degree of freedom of the following equation. i) Ice(s) ⇋ Water(l) ⇋ Vapour(g) ii) $MgCO_3(s) \leftrightharpoons MgO(s) + CO_2(g)$	3	Applying	CO2
6.	Illustrate the no. of components i) $CaCO_3(s) \leftrightharpoons CaO(s) + CO_2(g)$ ii) $PCl_5(s) \leftrightharpoons PCl_3(v) + Cl_2(v)$	3	Applying	CO2
7.	What is phase rule? Explain.	1	Remembering	CO2
8.	State the merits and demerits of phase rule.	1	Remembering	CO2
9.	Describe condensed phase rule.	2	Understanding	CO2
10.	What is meant by triple point?	1	Remembering	CO2
11.	Discuss eutectic point. Mention its characteristics.	2	Understanding	CO2
12.	List out the different heat treatment.	1	Remembering	CO2
13.	Mention the differences between triple point and eutectic point.	2	Understanding	CO2
14.	Distinguish melting point, boiling point and triple point.	4	Analysing	CO2
15.	Explain alloy. Give example for ferrous and nonferrous alloy.	2	Understanding	CO2
16.	What is Nichrome? Mention its constituents.	2	Understanding	CO2
17.	Describe Nitriding.	2	Understanding	CO2
18.	What are stainless steel? How do they resist corrosion?	1	Remembering	CO2
19.	What do you understand about annealing?	2	Understanding	CO2
20.	Formulate the composition and uses of brass and bronze.	2	Understanding	CO2
21.	Write the significance of increasing the carbon content in steel.	2	Understanding	CO2

22.	What is the purpose of making alloy?	1	Remembering	CO2

S.No		PART-B (16 Marks)	BTL	Competence	CO
1.		State Phase rule and discuss the terms involved in it.	3	Applying	CO2
2.		Draw a neat one component water system and explain in detail.	3	Applying	CO2
3.		Explain the following in detail with examples (i) Phase rule, (ii) components, (iii) Phases (iv) Degree of freedom	3	Applying	CO2
4.		Examine the reduced phase rule with help of Zn-Mg phase diagram.	4	Applying	CO2
5.	(i)	What is the one component system?	2	Understanding	CO2
	(ii)	Explain the one component system in detail with phase diagram.	3	Applying	CO2
6.	(i)	Evaluate the heat treatment processes, (a) Nitriding (b) Normalizing (c) Carburizing.	5	Evaluating	CO2
	(ii)	What are the types of alloys? Analyse the purpose of making alloys.	4	Analysing	CO2
7.		Examine the heat treatment of steel with its significance.	4	Analysing	CO2
8.		Illustrate a neat Zn-Mg system and explain in detail	3	Applying	CO2
9.		Explain the construction of phase diagram by thermal analysis in detail.	3	Applying	CO2
10.	(i)	Explain the heat treatment processes, (a) Annealing (b) Tempering (c) Hardening.	3	Applying	CO2
	(ii)	Mention the limitations of Phase rule.	2	Understanding	CO2
11.	(i)	What is stainless steel? Describe the different types of stainless steel.	2	Understanding	CO2
	(ii)	What are Non-ferrous alloys? What are its applications? Write about any two Non-ferrous alloys.	2	Understanding	CO2
12.	(i)	Evaluate the effect of Ni, Cr and Mn in the alloying of steel.	5	Evaluating	CO2
	(ii)	Write the composition, properties and uses of any two ferrous alloys.	3	Applying	CO2
13.		Analyse the composition, properties and uses of various types of Brass and Bronze.	4	Analysing	CO2
14.	(i)	Discuss the various types of plots in Phase rule.	3	Applying	CO2
	(ii)	What is condensed phase rule? Criticize the number of degrees of freedom at the Eutectic point?	4	Analysing	CO2
15.	(i)	Criticize Nichrome with its composition and applications.	4	Analysing	CO2
	(ii)	What are ferrous alloys? Give their properties.	2	Understanding	CO2

UNIT III - ENGINEERING MATERIALS

Abrasives - natural abrasives, artificial abrasives. Refractories - properties - manufacture, common refractory bricks, insulating refractories, cermets, inorganic cermeting materials. Engineering plastics- thermoplastic - thermosetting plastics, Composite materials: Reinforced or filled plastics, polymer blends and alloys.

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	What is abrasives? Mention its types.	1	Remembering	CO3
2.	How abrasives are prepared?	2	Understanding	CO3
3.	List out the applications of abrasives.	1	Remembering	CO3
4.	Define refractories. How can they be classified?	1	Remembering	CO3
5.	Mention the acidic and basic refractories.	1	Remembering	CO3
6.	What do you mean insulating refractories?	2	Understanding	CO3
7.	Describe refractoriness.	2	Understanding	CO3
8.	List the stages in manufacture of a refractory.	1	Remembering	CO3
9.	Illustrate RUL test.	3	Applying	CO3
10.	What is porosity of refractories?	1	Remembering	CO3
11.	Explain thermal spalling? How will it be controlled?	4	Analyzing	CO3
12.	What is cerment?	1	Remembering	CO3
13.	Why cerment is called so?	3	Applying	CO3
14.	Mention the uses of cerments.	1	Remembering	CO3
15.	Cerments are inorganic materials. Justify?	4	Analyzing	CO3
16.	Define plastics.	1	Remembering	CO3
17.	Illustrate the advantages and disadvantages of Plastics?	3	Applying	CO3
18.	Compare thermo and thermosetting plastics? Give examples.	4	Analysing	CO3
19.	What is composite?	1	Remembering	CO3
20.	Describe reinforcement in plastic.	2	Understanding	CO3
21.	How do you prepare polymer blends?	2	Understanding	CO3
22.	What is polymer alloys?	1	Remembering	CO3

S.No		PART-B (16 Marks)	BTL	Competence	CO
1.		What are the abrasives? Give a detailed account on types and preparation of abrasives.	1	Remembering	CO3
2.	(i)	How are abrasives classified? Explain the properties of any two in each category.	2	Understanding	CO3
	(ii)	Describe about (a) abrasive paper (b) abrasive cloth (c) grinding wheel.	2	Understanding	CO3
3.	(i)	What is refractory? Discuss the types of refractory in	3	Applying	CO3

		detail.			
	(ii)	Mention the characteristics (or) requisites of a good refractory.	2	Understanding	CO3
4.		Discuss in detail about properties of refractory.	3	Applying	CO3
5.		Write the manufacturing process, properties and uses of basic and neutral refractory.	3	Applying	CO3
6.		Analyze the manufacturing, properties and uses of acid and neutral refractory.	4	Analyzing	CO3
7.		How alumina, zirconia and magnesite bricks are prepared and write its properties and uses.	4	Analyzing	CO3
8.		Explain the following in detail with respect to refractory (a) thermal spalling, (b) porosity (c) dimensional stability (d) RUL.	3	Applying	CO3
9.		Summarize the manufacturing process, properties and uses of acid and neutral refractory.	5	Evaluating	CO3
10.	(i)	What is cerment? Why it is called so?	3	Applying	CO3
	(ii)	Categorize various applications of cerments.	4	Analyzing	CO3
11.		Appraise the types and applications of cerments in detail.	5	Evaluating	CO3
12.		Analyze the types, merites and demerits of plastics in detail.	4	Analyzing	CO3
13.	(i)	Differentiate thermoplastics and thermosetting plastics.	4	Analyzing	CO3
	(ii)	What are plastics? Explain its advantages and disadvantages.	3	Applying	CO3
14.		Evaluate the following (a). Reinforced or filled plastics (b) Polymer blends (c) Polymer alloys	5	Evaluating	CO3
15.		Summarize the preparation, properties and uses of reinforced plastics and polymer blends.	5	Evaluating	CO3

UNIT IV - BUILDING MATERIALS

Lime - classification - manufacture and properties of lime - cement - classification - portland cement - chemical composition - manufacture of portland cement by wet method - setting and hardening - analysis of cement - concretes - hot and cold weathering of concrete cement and its prevention methods - special cement - plaster of paris. Glass - manufacture, types, properties and uses - recent trends in construction materials.

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	What is lime? Mention its chemical formula?	1	Remembering	CO4
2.	List out the different types of lime.	1	Remembering	CO4
3.	How lime is prepared?	2	Understanding	CO4
4.	Outline the application of lime	2	Understanding	CO4
5.	What is portland cement?	1	Remembering	CO4
6.	Discuss the chemical composition of cement.	3	Applying	CO4
7.	How does white cement differ from portland cement?	2	Understanding	CO4
8.	Discuss about portland cement? Give its properties.	2	Understanding	CO4
9.	What is white cement?	1	Remembering	CO4
10.	Write a note on hydrophobic cement?	1	Remembering	CO4
11.	Construct wet process in the preparation of cement.	3	Applying	CO4
12.	Comment on hardening and setting of cement.	3	Applying	CO4
13.	Describe the plaster of paris.	2	Understanding	CO4
14.	Categorize the types of plaster of paris.	4	Analyzing	CO4
15.	What is the chemical composition of plaster of paris? Mention its another name.	1	Remembering	CO4
16.	Why is cement analysis important?	2	Understanding	CO4
17.	Which cements are used in hot and cold weather concreting?	2	Understanding	CO4
18.	What is glass? Mention the types of it.	1	Remembering	CO4
19.	Explain the composition borosilicate glass.	3	Applying	CO4
20.	Mention the applications of laminated glass.	2	Understanding	CO4
21.	Analyse the composition of flint glass.	4	Analyzing	CO4
22.	What are the main ingredients for manufacturing of gass?	1	Remembering	CO4

S.No		PART-B (16 Marks)	BTL	Competence	CO
1.		Investigate the types, manufacturing and properties of lime.	4	Analyzing	CO4
2.	(i)	Mention different types of lime and its properties.	1	Remembering	CO4
	(ii)	State the various applications of lime.	2	Understanding	CO4
3.	(i)	Discuss about various zones of kiln in cement manufacturing.	3	Applying	CO4
	(ii)	What is portland cement? Illustrate the various types chemicals used in manufacturing of cements.	3	Applying	CO4
4.		Construct the manufacturing of cement by wet process and explain its working.	4	Analyzing	CO4
5.		Examine the mechanism of setting and hardening of cement with help of reactions.	3	Applying	CO4
6.		Illustrate the manufacture of cement by any one process.	3	Applying	CO4
7.	(i)	Discuss the analysis of cement and its important.	3	Applying	CO4
	(ii)	Outline the hot and cold weathering of concrete cement and its prevention methods.	2	Understanding	CO4
8.		Compose the setting and hardening of cement with reactions.	5	Evaluating	CO4
9.	(i)	What is special cement? List out the various special cements?	1	Remembering	CO4
	(ii)	Compare the special cements with portland cements.	4	Analyzing	CO4
10.		Evaluate elaborately on the types, composition, properties and uses of glasses.	5	Evaluating	CO4
11.		Describe the manufacturing process of glass with chemical reactions.	4	Analyzing	CO4
12.	(i)	What is glass? Examine the properties of glass.	3	Applying	CO4
	(ii)	Explain the reactions involving in the manufacturing of glass.	3	Applying	CO4
13.	(i)	Differentiate lead glass, bullet proof glass and tempered glass.	4	Analyzing	CO4
	(ii)	Discuss the composition, properties and uses of Borosilicate glass.	3	Applying	CO4
14.		Analyze the applications of lead glass, bullet proof glass and tempered glass.	4	Analyzing	CO4
15.		Demonstrate the manufacturing of glass with neat diagram.	3	Applying	CO4

UNIT V - ANALYTICAL TECHNIQUES

Introduction, absorption of radiation, types of spectra, UV-Visible and IR Spectrophotometer: Instrumentation and applications. Thermal methods of analysis TGA, DTA, DSC. Scanning electron microscopy and Mercury intrusion porosimetry (working principle and applications).

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	What is absorption of radiation?	1	Remembering	CO5
2.	Describe the types of spectra.	2	Understanding	CO5
3.	Define electromagnetic radiation.	1	Remembering	CO5
4.	Discuss the range of UV visible energy and wavelength?	2	Understanding	CO5
5.	List out the applications of UV-Visible Spectroscopy.	1	Remembering	CO5
6.	Explain the principle of UV-Visible Spectroscopy.	2	Understanding	CO5
7.	Differentiate chromophores and auxochromes with examples.	4	Analyzing	CO5
8.	Define Beer-Lambertz law.	1	Remembering	CO5
9.	Evaluate the term Bathochromic Shift.	5	Evaluating	CO5
10.	Find the energy per mole of light having wavelength of 85 nm.	1	Remembering	CO5
11.	Illustrate finger print region. Mention its important uses.	3	Applying	CO5
12.	Which is important region in IR spectroscopy?	2	Understanding	CO5
13.	Outline the application of IR spectroscopy.	1	Remembering	CO5
14.	Expand the following TGA, DTA and DSC.	1	Remembering	CO5
15.	Examine TGA. Mention its uses.	2	Understanding	CO5
16.	Differences between TGA, DTA and DSC.	4	Analysing	CO5
17.	What do you understand about thermal analysis?	2	Understanding	CO5
18.	What is the general principle of electron microscopy?	1	Remembering	CO5
19.	Discuss the applications of scanning electron microscopy.	2	Understanding	CO5
20.	Report basic principle of SEM.	2	Understanding	CO5
21.	Mention the applications of TGA.	1	Remembering	CO5
22.	What is mercury intrusion porosimetry?	1	Remembering	CO5

S.No		PART-B (16 Marks)	BTL	Competence	CO
1.		State the following (a) Hypsochromic shift, (b) Hyper chromic shift, (c) Hypochromic shift and (d) Bathochromic shift	2	Understanding	CO5
2.	(i)	What are electromagnetic spectrum? Explain the characteristics of it.	3	Applying	CO5
	(ii)	Explain the various changes occurring during absorption of radiation.	3	Applying	CO5
3.	(i)	Discuss working principle of scanning electron microscopy.	3	Applying	CO5
	(ii)	Explain working principle of mercury intrusion porosimetry.	3	Applying	CO5
4.		Formulate the principle, instrumentation and working mechanism of UV-Visible spectroscopy.	6	Creating	CO5
5.		Discuss the applications of UV-Visible spectroscopy.	3	Applying	CO5

6.	(i)	Differentiate Chromophore from Auxochrome.	4	Analyzing	CO5
	(ii)	Illustrate in detail about the Rotational, Vibrational and Electronic transitions.	3	Applying	CO5
7.		Examine the principle, components, instrumentation and working of UV-Visible spectroscopy.	4	Analyzing	CO5
8.	(i)	Compare atomic spectra with molecular spectra.	4	Analyzing	CO5
	(ii)	Differentiate emission spectra from absorption spectra?	4	Analyzing	CO5
9.		Evaluate the principle of IR spectroscopy and discuss the functions of various components in IR spectrophotometer.	5	Evaluating	CO5
10.	(i)	Discuss the applications of IR spectroscopy.	3	Applying	CO5
	(ii)	How do rotational vibrations differ from electronic vibrations. Give Example.	4	Analyzing	CO5
11.		Summarize the principle, instrumentation and working mechanism of IR spectroscopy.	5	Evaluating	CO5
12.		Discuss the thermal analysis methods (TGA, DTA, DSC) in detail.	3	Applying	CO5
13.		Analyze the working principle and applications of mercury intrusion porosimetry.	4	Analyzing	CO5
14.		Evaluate the working principle and applications of scanning electron microscopy.	5	Evaluating	CO5
15.	(i)	Write a note on Finger print region.	3	Applying	CO5
	(ii)	Explain the types of stretching and bending vibrations with suitable examples.	3	Applying	CO5