SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM NAGAR, KATTANKULATHUR – 603 203

DEPARTMENT OF CHEMISTRY

QUESTION BANK

I SEMESTER

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Prepared by

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1	I	WATER AND ITS TREATMENT	Dr. L. Devaraj Stephen Mr. V. Arivalagan
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3	III	ELECTROCHEMISTRY, CORROSION AND PROTECTIVE COATINGS	Ms. M. Meera Dr. M. Soundarrajan
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5	V	NANOCHEMISTRY	Dr. S. G. Gunasekaran Dr. P. Maheswari

UNIT I – WATER AND ITS TREATMENT

Hardness of water – types – expression of hardness – units - Boiler feed water-boiler troubles - scale and sludge, priming and foaming, caustic embrittlement, boiler corrosion. Treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning). External treatment – Ion exchange process – domestic water treatment (break point chlorination) – Desalination of brackish water – Reverse Osmosis.

Q. No	PART-A (2 Marks)	BTL	Competence
1.	What is hardness? How is it classified?	1	Remembering
2.	What are the units of hardness of water?	2	Understanding
3.	Distinguish hard water and soft water.	2	Understanding
4.	What is priming and foaming? How can they be prevented?	3	Applying
5.	Name the salts responsible for scale and sludge.	1	Remembering
6.	Define conditioning of water.	1	Remembering
7.	How is calgon conditioning better than phosphate conditioning?	4	Analyzing
8.	Explain the term scales and sludges.	2	Understanding
9.	Mention the requisites of potable water.	5	Evaluating
10.	Investigate the reason for boiler corrosion.	6	Creating
11.	Explain the term boiler feed water.	3	Applying
12.	Define desalination.	1	Remembering
13.	Compare internal conditioning with external conditioning.	4	Analyzing
14.	Name any two salts that cause temporary hardness.	1	Remembering
15.	What is reverse osmosis (RO)?	1	Remembering
16.	Define the term break point chlorination.	2	Understanding
17.	How is blow down operation applied to remove hard water?	3	Applying
18.	Defend caustic embrittlement. How is it prevented?	4	Analyzing
19.	Critique carbonate and non-carbonate hardness. Give examples.	5	Evaluating
20.	Formulate is it necessary to chlorinate drinking water supply beyond break point.	6	Creating
21.	What are responsible for formation of the scale and sludge?	1	Remembering
22.	Sketch the requirement of boiler feed water.	3	Applying
23.	Interpret break point chlorination.	2	Understanding
24	Inspect the causes of caustic embrittlement of boiler water.	4	Analyzing
25.	State the term softening of water.	1	Remembering

Q. No		PART-B (13 Marks)	BTL	Competence
1.	(i)	How do you identify the hard and soft water? Explain the types of hard water.	2	Understanding
	(ii)	What are boiler troubles of using hard water in the boiler? Suggest steps to minimize the boiler troubles.	1	Remembering
2.	(i)	Differentiate scales and sludges.	2	Understanding
	(ii)	Discuss how the water is disinfected by chlorine?	4	Analyzing
3.	(i)	Criticize how caustic embrittlement can be prevented and define the same.	5	Evaluating

	(ii)	Outline the various stages of domestic water treatment in sequence.	5	Evaluating
4.	(i)	What is boiler feed water? What are its requirements and explain its drawbacks?	1	Remembering
	(ii)	Explain with chemical reaction of the demineralization process.	1	Remembering
5.	(i)	How is hard water converted into soft water using ion exchange process?	3	Applying
	(ii)	Explain carbonate and non-carbonate hardness of water with examples?	2	Understanding
6.	(i)	What is calgon? Explain calgon conditioning briefly.	4	Analyzing
	(ii)	How is internal treatment of boiler water carried out using colloidal, phosphate and sodium aluminate conditioning method?	4	Analyzing
7.	(i)	Compare the external and internal treatment of boilers.	2	Understanding
	(ii)	Write the merits and demerits of external treatment of water.	2	Understanding
8.	(i)	What is desalination? With a neat diagram describe the Reverse Osmosis method for the desalination of brackish water.	1	Remembering
	(ii)	How will you regenerate the exhausted ion exchange resins?	3	Applying
9.	(i)	Explain the principle and process of break-point chlorination.	4	Analyzing
	(ii)	Describe sodium aluminate and calgon conditioning.	1	Remembering
10.	(i)	How is calgon conditioning is superior to phosphate conditioning?	4	Analyzing
	(ii)	Explain the disadvantages of scale formation?	1	Remembering
11.	(i)	What are the essential requirements of boiler feed water?	4	Analyzing
	(ii)	What are the factors which causes boiler corrosion? How can it be minimized?	1	Remembering
12.	(i)	Give an account of Internal treatment of boiler water.	2	Understanding
	(ii)	Draw a suitable diagram and describe the ion exchange process for the softening of boiler water.	1	Remembering
13.	(i)	Define the term desalination with a neat diagram and describe desalination by reverse osmosis method.	3	Applying
	(ii)	Illustrate how you will protect boiler from corrosion.	3	Applying
14.	(i)	Discuss the causes and prevention of priming and foaming.	2	Understanding
	(ii)	Explain how sterilization of water carried out using chlorine? Write the mechanism.	3	Applying
15.	(i)	Execute the process to regenerate the exhausted cationic and anionic resins.	3	Applying
	(ii)	Outline the various disadvantages of scale formation.	1	Remembering
16.	(i)	Formulate the causes and prevention of priming and foaming.	6	Creating
	(ii)	Categorize the various factors which cause boiler corrosion	4	Analyzing

		and how it can be minimized.		
17.	(i)	Assess the causes and prevention of caustic embrittlement.	5	Evaluating
	(ii)	Correlate the different internal treatment of boiler water.	4	Analyzing

Q. No	PART-C	BTL	Competence
1.	Evaluate with a suitable diagram and describe the ion exchange method for the softening of boiler water.	5	Evaluating
2.	What is break point chlorination? State its significance.	1	Remembering
3.	What are the problems one would face when hard water is used in boiler industries?	4	Analyzing
4.	Define desalination. Explain any one method in detail.	2	Understanding
5.	With a suitable schematic diagram, design the softening method of boiler water using ion exchange resins.	6	Creating

UNIT II - SURFACE CHEMISTRY AND CATALYSIS

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms. Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – Contact theory. Kinetics of surface reactions, unimolecular reactions, Langmuir – applications of adsorption on pollution abatement. Catalysis: Catalyst – types of catalysis – Criteria – Autocatalysis – Catalytic poison and catalytic promoters – Acid base catalysis – Applications (3 way catalytic convertor) – Enzyme catalysis– Michaelis – Menten equation.

Q. No	PART-A (2 Marks)	BTL	Competence
1.	Define adsorption.	1	Remembering
2.	Mention a few important characteristics of adsorption.	3	Applying
3.	What is physical adsorption? Give an example.	1	Remembering
4.	What is chemisorption?	2	Understanding
5.	Differentiate catalytic promoters and catalytic poisoner.	4	Analyzing
6.	What is meant by negative adsorption?	2	Understanding
7.	Define adsorption isotherm.	1	Remembering
8.	Give the conditions in which Freundlich's adsorption isotherm fails.	2	Understanding
9.	Define the terms adsorbent and adsorbate with suitable example.	1	Remembering
10.	Mention the types of catalysis with an example.	3	Applying
11.	Define catalyst.	1	Remembering
12.	What are catalytic promoters?	2	Understanding
13.	What is meant by catalytic poisoning?	2	Understanding
14.	How is acid-base catalysis carried out?	3	Applying
15.	State the reason why the temperature of human body has to be maintained at 37˚C.	5	Evaluating
16.	Explain the term negative adsorption.	2	Understanding
17.	With an example illustrate homogeneous catalysis.	3	Applying
18.	What is auto catalysis? Give an example.	1	Remembering
19.	Why is a reaction speeded up in the presence of a catalyst?	5	Evaluating
20.	List any four characteristics of enzyme catalysis.	4	Analyzing
21.	What is chemical adsorption? Give an example.	1	Remembering
22.	Demonstrate auto catalysis with an example.	3	Applying
23.	Examine the limitations of Langmuir adsorption isotherm.	4	Analyzing
24.	Compose the different factors of adsorption of gases on solids.	6	Creating
25.	Criticize the negative adsorption with example.	5	Evaluating

Q. No	PART-B (13 Marks)		BTL	Competence
1.	(i)	Differentiate physisorption and chemisorption.	4	Analyzing
	(ii)	Discuss various factors which affect the adsorption of a gas on a solid adsorbent.	1	Remembering
2.	(i)	Examine catalytic promoters and catalytic poisoning.	4	Analyzing

	(ii)	Derive Freundlich's adsorption isotherm and state its limitations.	3	Applying
3.	(i)	State the postulates and derive Langmuir adsorption isotherm and discuss its pressure conditions and limitations.	3	Applying
	(ii)	Discuss the adsorption of solutes from solutions.	2	Understanding
4.	(i)	Explain the applications of adsorption in pollution abatement of air and waste water.	2	Understanding
	(ii)	List out the characteristics of catalysis and give four applications of absorption.	1	Remembering
5.	(i)	Explain contact theory of catalysis.	2	Understanding
	(ii)	Explain about positive and negative adsorption.	2	Understanding
6.	(i)	Derive the rate of a unimolecular reaction in a heterogeneous catalysis.	3	Applying
	(ii)	Explain auto catalysis with suitable examples.	2	Understanding
7.	(i)	Derive Michaelis-Menten equation for enzyme catalysis.	3	Applying
	(ii)	Evaluate on catalytic converters.	5	Evaluating
8.	(i)	Explain physical adsorption and chemical adsorption with suitable examples.	2	Understanding
	(ii)	What are unimolecular reactions? Explain its kinetics.	1	Remembering
9.	(i)	Explain by deriving, when Langmuir adsorption isotherm becomes identical with Freundlich's adsorption isotherm.	3	Applying
	(ii)	Outline the role of activated carbon in pollution abatement of water.	4	Analyzing
10.	(i)	Illustrate the role of adsorbents in ion exchange adsorption. Bring out the applications of activated carbon.	3	Applying
	(ii)	Discuss the factors that influence adsorption of solutes from solution.	1	Remembering
11.	(i)	Describe the heterogeneous catalytic reaction with a suitable example.	1	Remembering
	(ii)	Explain the Freundlich's adsorption isotherm at various pressures.	3	Applying
12.	(i)	With suitable examples explain homogeneous and heterogeneous catalysis.	2	Understanding
	(ii)	Investigate the criteria on auto catalysis.	5	Evaluating
13.	(i)	Explain the following (i) Acid base catalysis (ii) Enzyme catalysis.	2	Understanding
	(ii)	Explain the factors affecting the adsorption of a gas on a solid.	2	Understanding
14.	(i)	Discuss the kinetics of enzyme catalyzed reaction.	3	Applying
	(ii)	How does a three way catalytic converter work?	3	Applying
15.	(i)	Derive Langmuir adsorption isotherm under different pressure conditions and mention limitations.	3	Applying

	(ii)	Categorize the factors influence the adsorption of solutes from solutions.	4	Analyzing
16.	(i)	Illustrate about the contact theory of catalysis.	2	Understanding
	(ii)	Criticize the catalytic converters.	5	Evaluating
17.	(i)	Justify the auto catalysis with suitable example.	5	Evaluating
	(ii)	Analyze the difference between the physisorption and chemisorption.	4	Analyzing

Q. No	PART-C	BTL	Competence
1.	Categorize the different factors of adsorption of gases on solids.	5	Evaluating
2.	Compose Langmuir adsorption isotherm at various pressures.	6	Creating
3.	Investigate the kinetics of enzyme catalyzed reaction by deriving Michaelis-Menten equation.	5	Evaluating
4.	Compose the categories of catalysis.	6	Creating
5.	Compute the Freundlich's adsorption isotherm and list out limitations.	3	Applying

UNIT III – ELECTROCHEMISTRY, CORROSION AND PROTECTIVE COATING

Electrochemical cell - redox reaction, electrode potential - origin of electrode potential - oxidation potential - reduction potential, measurement and applications - Electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion – causes – factors – types - chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects – Electrochemical protection – sacrificial anode method and impressed current cathodic method. Protective coatings: Metallic coatings – Electroplating of Cu - electroless plating of Ni. Organic coatings: Paints - constituents and function.

Q. No	PART-A (2 Marks)	BTL	Competence
1.	Define electrochemical cell.	1	Remembering
2.	Describe standard electrode potential?	2	Understanding
3.	What are the factors affecting the emf of the cell?	3	Applying
4.	Can we use nickel spatula to stir a solution of copper sulphate?	4	Analyzing
5.	Calculate the reduction potential of lead electrode in solution of 0.018M Pb^{2+} ions (standard reduction potential = - 0.13V).	1	Remembering
6.	What is the significance of electrochemical series?	3	Applying
7.	Illustrate the terms anode and cathode.	3	Applying
8.	What is corrosion? Give an example.	1	Remembering
9.	What is Pilling-Bedworth rule? Discuss its importance.	1	Remembering
10.	Blunt edges are preferred over sharp edges. Interpret.	2	Understanding
11.	Differentiate dry corrosion and wet corrosion.	4	Analyzing
12.	Bolt and nut made of same metal is preferred in practice. Why?	4	Analyzing
13.	What is water line corrosion? Give example.	1	Remembering
14.	Explain pitting corrosion.	2	Understanding
15.	Discuss cathodic protection. Mention its two applications.	1	Remembering
16.	How is galvanic corrosion prevented?	2	Understanding
17.	What is paint? Mention its constituents.	1	Remembering
18.	Describe electroplating (or) Give the principle of electro deposition.	1	Remembering
19.	Compose the Nernst equation for the cell, $Zn_{(s)}/Zn_{(aq)}$ Mg(aq)/Mg(s)	6	Creating
20.	Classify the advantages of electro less plating over electroplating.	4	Analyzing
21.	Outline the applications of Nernst equation.	2	Understanding
22.	Define the term cell potential.	1	Remembering
23.	Identify the various types of oxide layer.	1	Remembering
24.	Investigate the factors which influence the rate of corrosion.	4	Analyzing
25.	Compose the basic constituents of paint.	6	Creating

Q. No	PART-B (13 Marks)		BTL	Competence
1.	(i)	Derive Nernst equation and give its significance.	3	Applying
	(ii)	Calculate the standard electrode potential of zinc electrode dipped in a solution of 0.1 M $ZnSO_4$ at 25°C (Zn/Zn^{2+}=0.76 V).	3	Applying
2.	(i)	Compare electrolytic cell and electrochemical cell.	4	Analyzing
	(ii)	Discuss the measurement of single electrode potential.	2	Understanding
3.	(i)	Consider the cell reaction $Zn+Fe^{2+}$ (0.005**)** $\rightarrow$ Zn^{2+} (0.01) + Fe. Given that the standard emf of the cell is 0.323V at 298K. Construct the cell and calculate emf of cell.	3	Applying
	(ii)	Calculate the reduction potential of Cu^{2+} (0.5M)/Cu at 25^0C. $E^o(Cu^{2+}/Cu)$ = 0.337 V	6	Creating
4.	(i)	Compose the measurement of single electrode potential and its application.	6	Creating
	(ii)	What is electrochemical series? Give its applications.	4	Analyzing
5.	(i)	Analyze dry (or) chemical corrosion with suitable examples and diagrams.	2	Understanding
	(ii)	State the differences between electrochemical corrosion and chemical corrosion.	2	Understanding
6.	(i)	Discuss wet (or) electrochemical corrosion with suitable examples and diagrams.	3	Applying
	(ii)	Explain differential aeration corrosion and galvanic corrosion with suitable illustrations.	1	Remembering
7.	(i)	What are the factors which influence the rate of corrosion?	1	Remembering
	(ii)	Explain the sacrificial anode and impressed current cathodic techniques for the prevention of corrosion.	2	Understanding
8.	(i)	How will you control corrosion by material selection and design aspects?	2	Understanding
	(ii)	What is chemical corrosion? Explain the mechanism.	5	Evaluating
9.	(i)	What are paints? Give its constituents and functions with examples.	1	Remembering
	(ii)	How is electroplating of copper carried out?	3	Applying
10.	(i)	How is galvanic corrosion occurred?	2	Understanding
	(ii)	Differentiate electroplating and electroless plating.	2	Understanding
11.	(i)	Explain the terms, cell potential and single electrode potential and describe the method of determination of electrode potential.	1	Remembering
	(ii)	How electrode potential can be obtained from Nernst equation.	3	Applying
12.	(i)	Define EMF Series. Explain its significance.	2	Understanding
	(ii)	Discuss the importance of design and material selection in controlling corrosion.	2	Understanding
13.	(i)	Illustrate Electroless plating and explain the plating of Ni by this process.	4	Analyzing

	(ii)	Explain how corrosion is controlled by sacrificial anode.	3	Applying
14.	(i)	Describe the mechanism of differential aeration corrosion taking pitting as example.	4	Analyzing
	(ii)	Discuss the factors which influence electrochemical corrosion.	3	Applying
15.	(i)	Construct the Nernst equation and mention its applications.	6	Creating
	(i)	What is paint? Investigate the various constituents and functions with examples.	1	Analyzing
16.	(i)	Tabulate the factors which influence the rate of corrosion.	1	Remembering
	(ii)	Discuss the sacrificial anode and impressed current cathodic techniques for the prevention of corrosion.	2	Understanding
17.	(i)	Report the significance of electrochemical series.	2	Understanding
	(i)	Analyze and explain the plating of Nickel by this process.	4	Analyzing

Q. No	PART-C	BTL	Competence
1.	Derive the Nernst equation and Measure the emf of the cell at 25° C. The standard emf of the following cell is 1.54 V. $Zn(s)/Zn^{2+}$ (0.2M)//Ag+(0.002M)/Ag(s)	5	Evaluating
2.	Formulate the mechanism of wet corrosion for i) Hydrogen evolution type corrosion ii) Hydroxide formation type corrosion	6	Creating
3.	Execute the basic constituents and the functions of paint.	3	Applying
4.	i) Construct a plating bath for coating nickel on an object by electroless plating method. ii) Construct a electroplating of Cu	6	Creating
5.	Examine the corrosion control methods by sacrificial anode and impressed current cathode.	5	Evaluating

UNIT IV – ENGINEERING MATERIALS

Cement: Definition – classification of cement – Portland cement - manufacture and properties - setting and hardening of cement - special cement, water proof, white and sorel cement – properties and uses – Glass: Manufacture, types, properties and uses (laminated, safety and flint glass) - Polymers: Classification - types of polymerization - mechanism - methods of polymerization - Engineering polymers: Nylon-6, Nylon-6,6, Teflon, Kevlar and PEEK - preparation, properties and uses - Plastic and its types - Conducting polymers: Types and applications - Polymers in medicine and surgery (applications).

Q. No	PART-A (2 Marks)	BTL	Competence
1.	Indicate the raw materials used for preparing Portland cement.	1	Remembering
2.	Using excess amount of lime during cement manufacturing is not good. Discuss.	4	Analyzing
3.	Evaluate the steps involved in the manufacturing of Portland cement.	5	Evaluating
4.	Analyze the main components of water proof cement.	4	Analyzing
5.	What are the advantages of sorel cement flooring?	1	Remembering
6.	Mention the uses of white cement.	1	Remembering
7.	What is a glass and give its general formula	3	Applying
8.	List the raw materials used for manufacturing of glass.	2	Understanding
9.	What is a laminated glass?	1	Remembering
10.	Give the chemical composition of flint glass.	3	Applying
11.	Outline the manufacturing of safety glass with two uses.	5	Evaluating
12.	Formulate the methods involved in preparing polymers.	6	Creating
13.	Why are plastics indispensible in everyday life?	4	Analyzing
14.	Find and write the monomers used in Kevlar and PEEK.	3	Applying
15.	Differentiate between addition and condensation polymer.	4	Analyzing
16.	Teflon is an addition polymer but it behaves like a thermosetting polymer. Give reasons.	5	Evaluating
17.	Enumerate the disproportionation reaction in free radical mechanism.	6	Creating
18.	Give any four applications of polymer in medicine and surgery.	2	Understanding
19.	Define polymer with an example.	1	Remembering
20.	How thermo plastics differ from thermosetting plastics?	2	Understanding
21.	Inspect how Nylon-6 is prepared	4	Analyzing
22.	Identify the benefits of water proof cement.	1	Remembering
23.	Discuss about condensation polymerization with an example.	2	Understanding
24.	Investigate the various techniques of polymerization.	4	Analyzing
25.	Arrange the applications of biopolymers.	1	Remembering

Q. No		PART-B (13 Marks)	BTL	Competence
1.	(i)	What is cement? Give the various classification of cement.	2	Understanding
	(ii)	Organize a neat flow diagram to show various steps involved in the dry process of Portland cement manufacture by rotary kiln technology. Also write the chemical reactions involved in it.	4	Analyzing
2.	(i)	Sketch the various steps involved in manufacture of cement by wet process with sequential reactions.	3	Applying
	(ii)	Write the chemistry of setting and hardening of cement.	2	Understanding
3.	(i)	Formulate various reactions of water with cement constituents which take place during setting and hardening.	6	Creating
	(ii)	Prepare a detailed account on special cements with its various applications.	3	Applying
4.	(i)	Write notes on (i) water proof cement (ii) white cement (iii) sorel cement	3	Applying
	(ii)	What is a glass? Discuss the manufacture of glass.	1	Remembering
5.	(i)	How is glass prepared by pot-furnace method?	1	Remembering
	(ii)	Write a brief account of types of glass with its composition and uses.	2	Understanding
6.	(i)	Analyze in detail about laminated, safety and flint glass.	4	Analyzing
	(ii)	Discuss in detail about different types of polymerization.	1	Remembering
7.	(i)	Elaborately explain addition, condensation and copolymerization.	2	Understanding
	(ii)	How are polymers prepared by high temperature and low temperature method?	2	Understanding
8.	(i)	Illustrate free radical mechanism of polymer.	4	Analyzing
	(ii)	Give the applications of polymers in medicine and surgery.	2	Understanding
9.	(i)	Outline the cationic and anionic mechanism for polymer preparation.	4	Analyzing
	(ii)	Analyze the methods by which condensation polymerization is conducted.	4	Analyzing
10.	(i)	Write elaborately on Bulk, Solution, Emulsion and Suspension polymerization?	1	Understanding
	(ii)	Develop the methods by which addition polymerization can be carried out?	6	Creating
11.	(i)	Formulate the mechanism of preparing polymers using both positive and negative ions.	5	Evaluating
12.	(i)	Write in detail about the preparation, properties and uses of Kevlar, Teflon and PEEK.	3	Applying
	(ii)	Summarize elaborately on conducting polymers.	6	Creating
13.	(i)	Evaluate any four engineering polymers.	5	Evaluating
	(ii)	What are plastics? Discuss in detail about different types of plastics.	1	Understanding

14.	(i)	What are biopolymers? Find the various applications of biopolymers in the field of medicine and surgery.	2	Remembering
	(ii)	Evaluate the following: (i). Intrinsically conducting polymer (ii). Extrinsically conducting polymer (iii). Doped conducting polymer (iv). Coordination conducting polymer	5	Evaluating
15.	(i)	Compose the mechanism of cationic and anionic polymerization.	6	Creating
	(ii)	Interpret of setting and hardening of cement.	2	Understanding
16.	(i)	Formulate the different types of conducting polymers.	6	Creating
	(ii)	Expose the following (i) sorel cement (ii) water proof cement	3	Applying
17.	(i)	Summarize in detail preparation, properties and uses of laminated, safety and flint glass.	4	Analyzing
	(ii)	Enumerate the applications of biopolymers in various fields.	2	Understanding

Q. No	PART-C	BTL	Competence
1.	Evaluate the processes involving the manufacturing of cement.	5	Evaluating
2.	Compile the manufacturing of glass with various types and its uses.	6	Creating
3.	Explore various conducting polymers which act as engineering materials with respect to its functional properties.	5	Evaluating
4.	Examine about the preparation, properties and applications of Nylon-6, Kevlar, Teflon and PEEK	3	Applying
5.	Evaluate the free radical mechanism for preparation of a polymer.	4	Analyzing

UNIT V – NANOCHEMISTRY

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties (surface to volume ratio, melting point, optical and electrical). Nanoparticles, Nanocluster, Nanorods, Nanotube (CNT: SWNT and MWNT) and Nanowire, Synthesis - precipitation, thermolysis, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process and applications.

Q. No	PART-A (2 Marks)	BTL	Competence
1.	What are nanomaterials?	1	Remembering
2.	Illustrate the size dependent property of nanoparticles?	3	Applying
3.	Explore the important differences between nanoparticles and bulk materials?	4	Analyzing
4.	Discuss any four nanomaterials.	2	Understanding
5.	Demonstrate the some characteristic properties of nanomaterials?	3	Applying
6.	Criticize the different methods of preparing nanomaterials?	4	Analyzing
7.	State nanoclusters?	1	Remembering
8.	Explain nanorods? Mention their specific applications.	1	Remembering
9.	Define nanowires.	1	Remembering
10.	Summarize few applications of nanomaterials.	2	Understanding
11.	Defend the applications of nanotechnology in engineering.	1	Remembering
12.	What are carbon nanotubes?	1	Remembering
13.	Analyze the different types of CNTs.	4	Analyzing
14.	Clarify laser ablation method.	2	Understanding
15.	Evaluate chemical vapor deposition (CVD) method.	5	Evaluating
16.	Formulate electro-deposition method.	6	Creating
17.	Investigate the applications of nanorods and nanowires.	6	Creating
18.	Support how nanoparticles are prepared by precipitation method.	5	Evaluating
19.	Report the applications of nanomaterials in pollution control.	2	Understanding
20.	Enumerate hydrothermal and solvothermal synthesis of nanoparticles.	3	Applying
21.	Tell the various methods of preparing nanomaterials	1	Remembering
22.	Describe nanocluster.	2	Understanding
23.	Assess the different methods of top-down synthesis.	5	Evaluating
24.	Criticize nanorods with suitable example.	4	Analyzing
25.	Discuss the medicinal applications of nanomaterials	2	Understanding

Q. No	PART-B (13 Marks)		BTL	Competence
1.	(i)	Distinguish molecules, nanoparticles and bulk materials.	2	Understanding
	(ii)	Discuss the size dependent properties of nanomaterials.	2	Understanding
2.	(i)	Classify the various properties of nanomaterials.	1	Remembering
	(ii)	Write a note on top–down and bottom–up approach for nanomaterial preparation with examples.	2	Understanding
3.	(i)	Briefly explain carbon nanotubes and its properties?	1	Remembering

	(ii)	Sketch chemical vapour deposition (CVD) method for the synthesis of nanomaterials.	3	Applying
4.	(i)	Discuss the vibration properties of CNTs with suitable diagram.	2	Understanding
	(ii)	Examine the hydrothermal synthesis of nanoparticles.	1	Remembering
5.	(i)	Compare hydrothermal and solvothermal synthesis of nanomaterials with suitable examples.	4	Analyzing
	(ii)	Interpret the synthesis of nanoparticles by any three methods.	3	Applying
6.	(i)	Discuss precipitation process with example in preparing nanoparticles.	2	Understanding
	(ii)	Enumerate solvothermal process for the preparation of nanoparticles.	4	Analyzing
7.	(i)	Formulate the synthesis of carbon nanotubes.	6	Creating
	(ii)	Report various applications of carbon nanotubes.	2	Understanding
8.	(i)	Elucidate the electrodeposition method for the synthesis of nanomaterial.	4	Analyzing
	(ii)	Tell about the laser ablation method of preparing nanoparticles.	1	Remembering
9.	(i)	State the synthesis, properties and applications of carbon nanorods.	1	Remembering
	(ii)	Analyze nanoclusters and nanowires? Explain their properties and applications.	4	Analyzing
10.	(i)	Discuss the various types of synthesis involved in the preparation of nanomaterials.	1	Remembering
	(ii)	Describe the solvothermal and laser ablation methods of synthesis of nanomaterials.	1	Remembering
11.	(i)	Explore in detail about bottom-up approach in nanomaterial synthesis.	4	Analyzing
	(ii)	Quote the electrical properties of CNTs.	1	Remembering
12.	(i)	Relate nanorods, nanotubes, nanowires.	5	Evaluating
	(ii)	Compare molecules and nanomaterials with bulk materials.	4	Analyzing
13.	(i)	Demonstrate medicinal and industrial application of nanomaterials.	3	Applying
	(ii)	Select the applications of nanomaterials in electronics and biomaterials.	5	Evaluating
14.	(i)	Explain nanoparticles and nanorods in detail.	3	Applying
	(ii)	Investigate the various applications of nanomaterials with suitable examples.	6	Creating
15.	(i)	Assess the hydrothermal, solvothermal and precipitation methods of synthesis of nanomaterials.	5	Evaluating
	(ii)	Examine in detail about top-down approach in nanomaterial synthesis.	4	Analyzing
16.	(i)	Explore the sol-gel process of synthesizing nanomaterials.	3	Applying

	(ii)	Formulate the laser ablation and chemical vapour deposition method of synthesizing nanomaterials.	6	Creating
17.	(i)	Relate the nanoparticles with molecules and bulk materials.	2	Understanding
	(ii)	Discuss in detail about the size dependent properties of nanomaterials.	2	Understanding

Q. No	PART-C	BTL	Competence
1.	Formulate the various applications of nanomaterials with suitable examples.	6	Creating
2.	Clarify the top-down and bottom-up synthesis in the preparation of nanomaterials.	5	Evaluating
3.	Design the laser ablation and chemical vapour deposition (CVD) method of preparing nanomaterials.	6	Creating
4.	Evaluate the applications of nanotechnology in various industries.	5	Evaluating
5.	Categorize the properties and applications nanotubes, nanocluster, nanorods, nanoparticles and nanowires.	4	Analyzing