GOVERNMENT OF TAMILNADU

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN ENGINEERING
I YEAR

SEMESTER SYSTEM

L - SCHEME

2011 - 2012

I SEMESTER

ENGINEERING CHEMISTRY - I

CURRICULUM DEVELOPMENT CENTER

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN ENGINEERING - SYLLABUS
L-SCHEME
(Implements from the Academic Year 2011-2012 on wards)

Course Name : All Branches of Diploma in Engineering and Technology and Special Programmes except DMOP, HMCT and Film & TV

Subject Code : **21005**

Semester : I Semester

Subject Title : **ENGINEERING CHEMISTRY - I**

TEACHING AND SCHEME OF EXAMINATION:

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
			Marks			
	Hours/ Week	Hours/ Semester	Internal assessment	Board Examination	Total	Duration
ENGINEERING CHEMISTRY-I	5 Hours	80 Hours	25	75	100	3 Hours

Topics and Allocation of Hours:

Sl. No	Topics	Time (Hours)
Unit-I	Molecular Mass and Equivalent Mass, Acids and Bases, Chemical Bonding	14 Hours
Unit-II	Solution, Technology of water and Solid state	14 Hours
Unit-III	Colloids and Nano particles, Photochemistry	14 Hours
Unit-IV	Electrochemistry, cell and Batteries	14 Hours
Unit-V	Corrosion Engineering	14 Hours
Revision and Examinations		10 Hours
Total		**80 Hours**

Rationale:

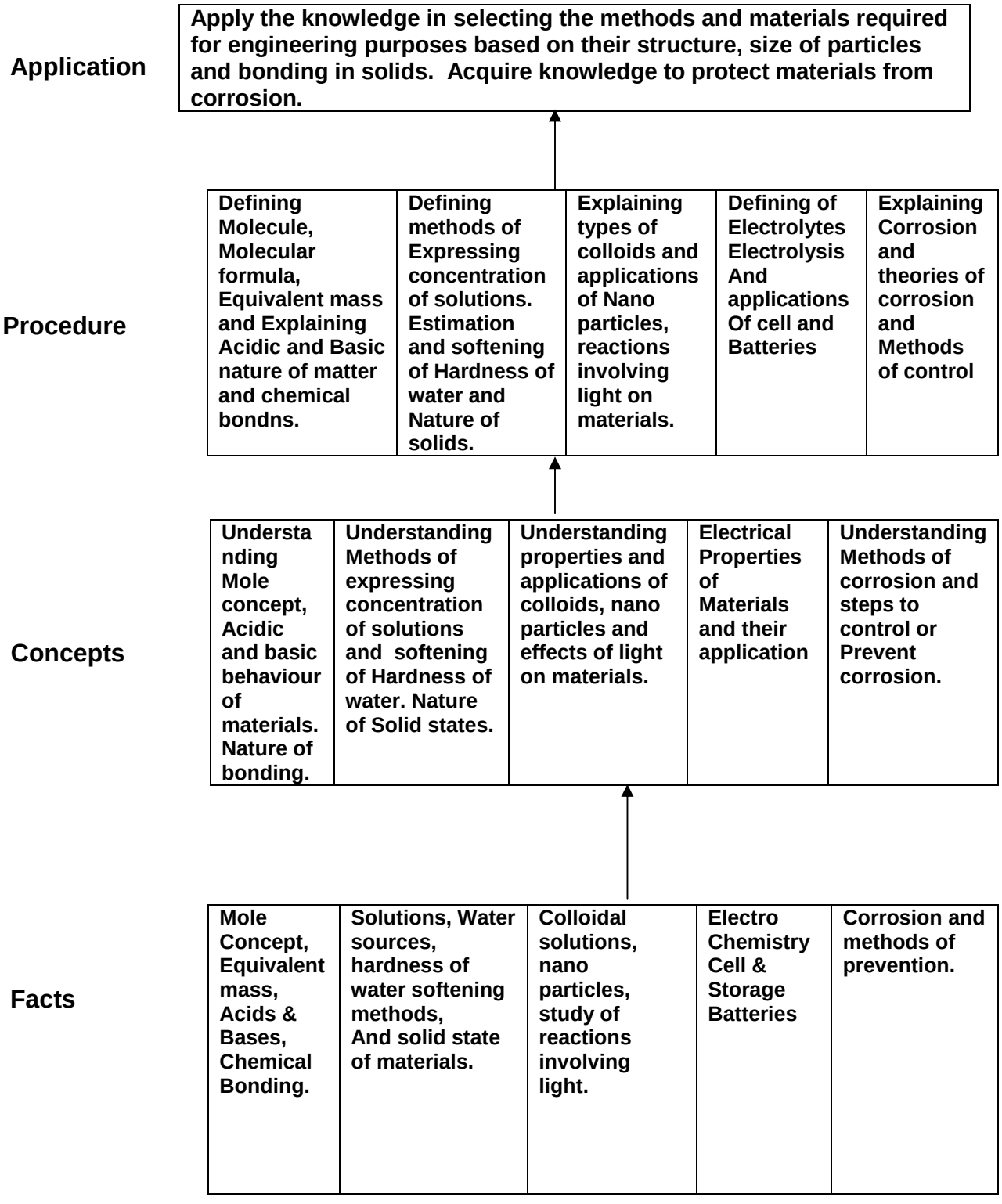
The Subject Engineering Chemistry creates foundation for understanding basic concepts of chemistry and its effects on Engineering Materials. Engineering Chemistry also impart knowledge of properties of materials and protecting them from corrosion and selecting right types of Materials used in various fields of Engineering and Industry.

Objectives:

The objective of this Course is to make the student:

1. Study about the importance of Engineering Chemistry in industry.
2. Know about Mole concepts and equivalence, Acids and bases and chemical bonds.
3. Learn about solutions, hardness of water, and solid states.
4. Know about Colloidal particles, Nano particles, Photochemistry and light reactions.
5. Explain the details of electrochemistry and batteries.
6. Understand Corrosion and preventive methods.

Learning Structure



DETAILED SYLLABUS

CONTENT

Unit No.	Name of the Topic	Hours	Marks
I	**1.1. Molecular Mass -4 Hours** Molecule- Molecular formula- Molecular Mass- Mole- Definition-Simple calculations- Avogadro's Hypothesis- Application- Relationship between Molecular Mass and Vapour Density. Gram Molecular Volume- Definition- Avogadro's Number-Definition- Simple Problems. **1.2. Equivalent Mass -2 Hours** Equivalent Mass & Gram Equivalent Mass- Definition- Determination of Equivalent Mass by Oxide Method (Direct Method)- Simple Problems. **1.3. Acids and Bases: -5 Hours** Theories of Acids and bases-Arrhenius Theory - Lowry-Bronsted Theory - Lewis theory - Advantages of Lewis theory. Definition of pH & pOH. Numerical problems – Indicators - Definition –Acid-Base concept of Indicators (Basic ideas) - Buffer solution- definition-types and examples. Application of pH in industries- Electronic Concept of Oxidation and Reduction- Definition- Example. **1.4. Chemical bonding: -3 Hours** Definition-Ionic bonding-Formation of NaCl - Covalent bonding- formation of NH_3 – Coordinate bonding- formation of NH_4^+ ion - Metallic bonding - Electron sea model.	**14**	**15**
II	**TECHNOLOGY OF WATER, CHEMICAL BONDING AND SOLID STATE** **2.1. Solution -4 Hours** Definition- Methods of Expressing Concentration of a Solution: Molarity, Molality, Normality, Mole fraction, Percentage, Mass- Simple Problems. **2.2. Technology of Water – 7 hours** Sources-depletion of underground water-reasons-rainwater harvesting. (Basic ideas)-advantages-hard and soft water-carbonate, non -carbonate hardness-methods of expressing hardness-mg/lit, ppm-simple problems-Estimation of total hardness by EDTA method-problems involving total, carbonate, non-carbonate hardness in ppm-softening of hard water ion- Exchange method, Reverse Osmosis method - standards of drinking water-Municipal water supply-purification (sedimentation, filtration and sterilization)-Disadvantages of hard water in boilers -Scale formation, Corrosion of boiler metal, Caustic Embrittlement - Priming and Foaming	**14**	**15**

Unit No.	Name of the Topic	Hours	Marks
II	**2.3. Solid state: – 3 Hours** Structure of Solids- Definition and examples for ionic, Molecular, Covalent and Metallic solids- Unit cell- bcc, fcc and hcp packing of metals –examples and properties reflected by the packing of atoms. (no numerical problems		
III	**3.1. Colloids – 5 Hours** Definition- sols-True solution and Colloidal solution-differences-Types- Lyophilic & Lyophobic sols- Differences.- Properties- Tyndall effect, Brownian movement, Electrophoresis, Coagulation – Industrial applications- Smoke Precipitation - Cottrell's method, Purification of water, Cleaning action of soap, tanning of leather and sewage disposal. **3.2. Nano-Particles – 2 Hours** Definition- Area of application - Medicine, Electronics and biomaterials. **3.3. Photochemistry – 7 Hours** Introduction-Important terms- charge transfer, electronic energy migration, emission, Excited state, Frequency, Ground state, Fluorescence, Phosphorescence, Chemiluminescence - photo electric cell- photo emission cell- photo synthesis-general chemical reactions-chlorophyll and accessory pigments-Mechanism of light reactions-Dark reaction-photosynthesis and acid rain.	**14**	**15**
IV	**ELECTRO CHEMISTRY, CELL AND BATTERIES** **4.1. Electro Chemistry: – 5 Hours** Electrolytes- Strong and weak electrolytes-Definition-examples. Electrolysis- Definition- Mechanism- Industrial applications of electrolysis –electro-plating -Preparation of surface- factors affecting the stability of the coating - Chrome plating - electro less plating.- Definition- advantages over electroplating- applications **4.2. Cell: – 4 Hours** Electro chemical cell- Single electrode potential- Galvanic cell-Formation - Daniel cell. Electrochemical series-Concentration Cell. **4.3. Storage Batteries: – 5 Hours** Primary, Secondary and fuel batteries. Primary battery - definition and example - Dry cell- construction and working. Secondary battery–definition- example- Lead acid storage cell -construction and working. Nickel/Cadmium battery – construction and working. Fuel cell- definition example H_2/O_2 fuel cell [green fuel cell] - solar cells	**14**	**15**

Unit No.	Name of the Topic	Hours	Marks
V	**Corrosion Engineering** **5.1. Corrosion – 4 Hours** Definition- types - Theories of corrosion- Galvanic cell Formation theory- Differential aeration theory. - Factors influencing rate of corrosion. **5.2. Methods of prevention of Corrosion – 5 Hours** Control of Environment, Alloying, Surface coating- Metal coating- Electroplating, Galvanization and Tinning- Inorganic coating- Anodizing and Phosphating- Cathodic protection Sacrificial anode and Impressed voltage methods. **5.3. Organic coating**: **– 5 Hours** Paints-definition- components of paints and their functions-Varnish-Definition-types-Preparation of oil varnish-Difference between paint & varnish-Special paints- Luminescent, heat resistant, fire retardant, Anti-fouling paints - cement paint, aluminium paint & distemper. Dyes-Acid dyes-basic dyes - Mordant dyes -Definition only (No equations).	**14**	**15**

Text Books:

1. Engineering Chemistry- Jain & Jain Dhanpat rai & Sons - 2005
2. A Textbook of Engineering Chemistry- S. S. Dara, S. Chand & Company Ltd. - 1996

Reference Books:

1. A Text book of Environmental Chemistry and Pollution Control S.S.Dara, S. Chand & Company Ltd. - 2007
2. Engineering Chemistry – Uppal- Khanna Publishers. - 1986
3. Higher Secondary +2 Chemistry Vol. I & II Tamil Nadu Textbook Corporation, Chennai. - 2005
4. Environmental chemistry VP KUDESIA-PRAGATI PRAKASHAN

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ENGINEERING CHEMISTRY - I

MODEL QUESTION PAPER -1

Time: 3 Hrs **Max. Marks: 75**

PART A

I. Answer Any Fifteen Questions: - **[15x1=15]**

All Questions carry equal marks

1. What is Mole.
2. Define pOH.
3. Define Lewis acid.
4. Define ionic bond.
5. Define Normality.
6. What salts are present in temporary hard water?
7. What is the expansion of EDTA?
8. Given an example for Covalent solid.
9. What is the dispersion medium is starch solution?
10. What are the types of Colloids?
11. Define Photosynthesis.
12. Define Phosphorescence.
13. What type of reaction takes place at anode during corrosion of iron?
14. Mention the factors affecting stability of Coating.
15. Give an example for fuel cell.
16. What is the anode and electrolyte used in chrome plating?
17. What is dry Corrosion?
18. Mention any two factors connected with metal surface influencing rate of corrosion.
19. Give two examples for Sacrificial anodes.
20. What are dyes?

PART-B

II. Answer any Two Sub divisions in each of the following questions:- [5x12=60]

All Questions carry equal marks

1. a) Derive the relation between Molecular Mass and vapour density.
   b) Describe determination of Equivalent Mass of a metal by Oxide method.
   c) Define and Explain the Lewis Concept of Acid and base.

2. a) How will you estimate the total hardness of a sample of water by EDTA method?.
   b) Explain bcc and fcc packing with suitable example.
   c) Explain ion change process of softening hard water?

3. a) Explain mechanical and optical properties of Colloids.
   b) Distinguish between Lyophobic and Lyophilic colloids.
   c) Write notes on Mechanism of Light and Dark reactions.

4. a) Explain electrolysis with a suitable example.
   b) What is electro less plating? Explain with a suitable example.
   c) Describe a Lead-acid storage cell with a neat diagram.

5. a) Explain the formation of concentration cell.
   b) Explain Galvanic cell formation of theory of Corrosion.
   c) What is galvanization? How is it carried out?

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ENGINEERING CHEMISTRY - I

MODEL QUESTION PAPER – 2

Time: 3 hours **Max. Marks:75**

Part – A

I. **Answer any 15 questions** **(15 x 1 =15)**

All Questions carry equal marks

1. What is the value of Avogadro's Number.
2. What is the mass of 1 mole of Sulphuric Acid.
3. Define pH.
4. What is an acidic buffer?
5. What is one normal Solution?
6. Define hard water.
7. Mention any two disadvantages of hard water in boilers.
8. Mention the names of different types of solids.
9. What are the types of colloids?
10. What are called nano particles?
11. What is Tyndall Effect?
12. What is Fluorescence?
13. Define Electrolysis.
14. Define electroless plating.
15. What are the types of batteries?
16. What is meant by electrochemical series?
17. Define corrosion.
18. Mention the names of methods used for prevention of corrosion.
19. Define Galvanization.
20. Give two examples of acid dyes.

Part – B

II. Answer any two subdivisions in each of the following questions:(5 x 12=60)

All Questions carry equal marks

1. a) Explain Lowry-Bronsted theory of acids and bases.
   b) Calculate the [H+] ion concentration of a solution whose pH is 4.3.
   c) Explain Electron-Sea model of metallic bonding

2. a) Define Molality. Calculate the molality of a solution containing 2 gms of NaOH dissolved in 500gms of water.
   b) Explain the reverse osmosis method for softening of hard water.
   c) Write a note on covalent solids with suitable examples.

3. a) Define colloids. What are the differences between a colloidal solution and a true solution?
   b) Write notes on Electrophoresis and Brownian movement.
   c) Explain Photosynthesis.

4. a) Explain chromeplating.
   b) Explain the construction and working of a Daniel cell.
   c) What is a Fuel cell? Write a note on H_2/O_2 Fuel cell.

5. a) What are the factors influencing the rate of corrosion? Explain any two factors.
   b) Explain Cathodic protection method of preventing corrosion.
   c) What are varnishes? Explain the preparation of oil varnish.

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