

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU  
SYLLABUS - L- SCHEME**

**(Implements from the Academic Year 2011-2012 onwards)**

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

Semester : II-Semester

Subject Title: Engineering Chemistry-II

Subject Code: 2006

Teaching and scheme of Examination:

**No. of Weeks per Semester: 16 Weeks**

Subject	Instruction		Examination			
	Hours/Week	Hours/Semester	Internal Assessments	Board Examination	Total	Duration
<b>Engineering Chemistry-II</b>	4 Hours	64 Hours	25	75	100	3 Hours

**Topics and Allocation of Hours:**

Unit No	Topics	Time Hours
Unit-I	Technology of water, Refractories, and Abrasives	12Hours
Unit-II	Fuels Rocket propellants and combustion	12 Hours
Unit-III	Metallurgy, Extraction of metals, and Alloys	11 Hours
Unit-IV	Photo chemistry, Composite materials, and Ceramics	12 Hours
Unit-V	Polymer, Rubber & Refrigerants	11 Hours
Revision and Examination		6 Hours
<b>Total</b>		<b>64 Hours</b>

**Rationale:** Modern development of industries require more understanding of materials required for Engineering and industrial purposes. This part of chemistry explains various aspects with

regard to water, fuels, metals and alloys, photochemistry and polymers. This subject will develop basic understanding and skill of Engineering Students.

**OBJECTIVES:**

- At the end of this program the Student will be able to state types of hardness of water Reason for hardness purification of Drinking water, standards of Drinking water and Water for industrial uses.
- To acquire knowledge about refractories and abrasives.
- To acquire knowledge about fuels, advantages and combustion of fuels and analysis.
- To know about general principles of metal extraction and about alloys.
- To know about photochemistry and mechanism of light reactions.
- To acquire knowledge about composite Materials, Ceramics, Polymers, Rubber and chemicals used in air coolers.

## Learning Structure

### Application

Apply the knowledge in selecting water for drinking and industrial needs, fuels, propellants, metals and alloys used in Engineering and polymeric materials used in domestic, , industrial ,and medical fields. To select material where requirements are very stringent and specific .

### Procedure

Explaining various source of water hardness, measurement and removal of hardness problems caused by impure water In industries and rectification	Defining fuels types, Propellants, combustion and calculation of volume of air required for combustion	Explaining Ores, methods of separation of ores, Extraction of Titanium and Tungsten Alloys Composition and application.	Explaining Particle nature of materials their effects on light, find applications of composite materials and manufacture of Ceramic materials.	Defining polymerization and study of plastics, Rubber and Chemicals used in air coolers.
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### Concepts

Understanding Importance of Rainwater harvesting source, problems caused by hardness of water in industries and Rectifying methods and essentiality of Abrasive and Refractories.	Knowledge of various types of fuels calorific value and propellants and combustion of fuels.	Understanding the principles of extraction of metals properties of alloys and various fields of Application	Understanding Photochemistry & light involved reactions. Understanding characteristics of Composite materials Manufacture of ceramic materials	Understanding of organic reactions like polymerization and producing polymers like plastics and Rubber. Use of organic compounds as cooling agents.
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### Facts

Water sources, hardness of water softening methods, Engineering materials, Abrasives & Refractories	Fuels Different Types, Quality of propellants and Combustion qualities.	General principles of extraction of metals, Alloys and their composition and uses.	Study of Reactions involving light and knowledge about applications of composite materials. Ceramics as important Engineering Materials.	Plastics types and uses, Rubber types and uses. Refrigerants and its applications.
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## Content: Theory

Unit No.	Name of the Topic	Hours	Marks
01	<p><b>Technology of Water, Refractories , and Abrasives</b></p> <p><b>Technology Of Water:</b> 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.</p> <p style="text-align: right;"><b>- 7 hours</b></p> <p><b>Refractories-</b> Definition-requirements-classification with examples and uses of fireclay bricks, Alumina bricks and silica bricks.</p> <p style="text-align: right;"><b>- 2 hours</b></p> <p><b>Abrasives-</b> Definition -classification-hardness in moh's scale - Natural abrasives-Diamond, Corundum, Emery, and Garnet. - Synthetic abrasives-Carborundum – Boron carbide manufacture- Properties and uses.</p> <p style="text-align: right;"><b>-3 hours</b></p>	12	15
02	<p><b>Fuels ,Rocket propellants and Combustion:</b></p> <p><b>Fuels:</b> Definition-Calorific value- classification, solid fuels- wood-coal -varieties of coal-composition-specific uses-liquid fuels-petroleum-fractional distillation -Fractions and uses, Cracking (concept only) gaseous fuels-preparation and specific uses of producer gas, water gas, biogas-LPG- composition and uses. Advantages of gaseous fuels.</p> <p style="text-align: right;"><b>- 6 Hours</b></p> <p><b>Rocket propellants:</b> Definition- Essential characteristics- classifications of propellants-brief account of solid &amp; liquid propellants with example.</p> <p style="text-align: right;"><b>- 2 Hours</b></p> <p><b>Combustion:</b> Combustion of fuels- Definition- combustion calculation by mass (for solid and liquid fuels)- combustion calculation of gaseous fuels- stoichiometric calculations-Volume of air required-excess air- Flue gas- Flue gas analysis- Orsat Apparatus-simple numerical problems.</p> <p style="text-align: right;"><b>- 4 Hours</b></p>	12	15

03	<p><b>Metallurgy, Extraction of metals , and Alloys</b></p> <p><b>Metallurgy:</b> General principles-Ores, Minerals, gangue, flux-crushing and grinding of ore-Dressing of ore-gravity separation, froth floatation process, and magnetic separation-chemical methods of purifying ore-roasting, calcination, smelting-Refining-Electrolytic refining-copper and Aluminium.</p> <p style="text-align: right;"><b>– 5 Hours</b></p> <p><b>Extraction of metals-</b> Extraction of Tungsten and Titanium - uses.</p> <p style="text-align: right;"><b>– 2 Hours</b></p> <p><b>Alloys-</b> Definition- purpose of Alloying-<b>Ferrous Alloys</b>-Stainless steel, chromium steel, Vanadium steel&amp; Tungsten steel, Composition and uses.</p> <p><b>Non- Ferrous alloys:</b> Definition- Composition and uses of – Nickel alloys- Nichrome, Locanel - Copper alloys- Brass - Dutch metal, Cartridge brass, German silver- Bronze- coinage bronze, Gun metal. Aluminium alloys- Duralumin, Magnalumin.</p> <p style="text-align: right;"><b>– 4 Hours</b></p>	11	15
04	<p><b>Photochemistry, Composite materials and Ceramics:</b></p> <p><b>Photochemistry:</b> 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.</p> <p style="text-align: right;"><b>– 7 Hours</b></p> <p><b>Composite Materials:</b> Definition-advantages over metals and polymers-general applications – types - fibre reinforced composites- particulate composites-layered composites.(basic ideas and specific applications)</p> <p style="text-align: right;"><b>– 3 Hours</b></p> <p><b>Ceramics:</b> White pottery- Definition-manufacture of White pottery-uses-glazing -definition -purpose-method-salt glazing.</p> <p style="text-align: right;"><b>– 2 Hours</b></p>	12	15

05	<p><b>Polymers, Rubber and Refrigerants</b></p> <p><b>Polymers:</b></p> <p><b>Plastics:-</b>  Polymerization-types of polymerization-Addition polymerization-formation of polythene-condensation polymerization-formation of phenol formaldehyde-types of plastics-thermoplastics &amp; thermo set plastics-Differences-Mechanical properties-Advantages over traditional materials, (wood &amp; metal)-specific uses of Bakelite, PVC, Nylon &amp; urea formaldehyde resin-reinforced or filled plastics-definitions- advantages-applications-polymers in surgery-biomaterial-definition-Biomedical uses of polyurethane, PVC, polypropylene, polyethylene.  <p style="text-align: right;">– 5 Hours</p> <p><b>Rubber:</b></p> Natural rubber-preparation from latex –defects of natural rubber compounding-ingredients &amp; their functions-vulcanization-purpose-synthetic rubber-Buna-S. Thiokol, Neoprene (Preparation&amp; specific uses only-no equation) reclaimed rubber-definition-process-properties-uses.  <p style="text-align: right;">– 4 Hours</p> <p><b>Refrigerants:</b>  Anhydrous Ammonia-freon12 (dichlorodifluoromethane)-Methyl Chloride-characteristics of an ideal refrigerant.  <p style="text-align: right;">– 2 Hours</p> </p></p>	11	15
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**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. Engineering Chemistry-Uppal Khanna publishers. - 1986
2. Chemistry of Engineering Materials C.V. Agarwal, C. Parameswara Moorthy, Andra naidu B.S. Publications. - 2006
3. A Textbook of Inorganic Chemistry –P.L. Soni, S.Chand & Company Limited. - 1997
4. Rain Water Harvesting –handbook Chennai metro water.

**SEMESTER-II**  
**Model Question paper I**

**Time: 3 Hrs**

**Total marks: 75**

**PART-A**

**I. Answer any Fifteen Questions:**

**15x1=15**

1. What salts are present in temporary hard water?
2. What is meant by PPM?
3. What is the expansion of EDTA?
4. What are boiler scales?
5. What are the components present in LPG gas?
6. What is flue gas?
7. What are Propellants?
8. What is producer gas?
9. Mention the ore of Tungsten.
10. What is flux?
11. What are alloys?
12. Mention the use of Duralumin.
13. What is Photoemission cell?
14. Define Photosynthesis.
15. What are the types of composite materials?
16. What is glazing?
17. What are the types of polymers?
18. Mention any two uses of PVC.
19. What is Vulcanization?
20. Mention any two ideal refrigerant.

**PART- B**

**II. Answer any TWO Sub-divisions in each of the following Questions:**

**5x12=60**

1. a. How will you estimate the total hardness of a sample of water by EDTA method?  
b. Explain ion change process of softening hard water?  
c. What are the requirements of a good refractory?
2. a. Explain fractional distillation of petroleum?  
b. How is water gas manufactured?  
c. A fuel contains 40% H<sub>2</sub> 45% CO 11% CH<sub>4</sub> and 4% O<sub>2</sub> by volume Determine the volume of air required to burn 1m<sup>3</sup> of the fuel?
3. a. Explain two methods of concentration of ores?  
b. Describe the extraction of Titanium from its ore?  
c. List the advantages of alloying a metal.
4. a. Write notes on mechanism of light and dark reactions?

- b. What are the advantages of composite materials over traditional materials?
  - c. Describe the manufacture of white pottery?
5. a. Distinguish between Addition and condensation polymerization?
- b. What are the Mechanical properties of plastics?
  - c. Write notes on synthetic Rubber.

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**Model Question Paper – II****Time: 3 hours****Maximum Marks: 75****Part – A****I. Answer any 15 questions****(15 x 1 =15)**

1. Define hard water.
2. Mention any two disadvantages of hard water in boilers.
3. Mention two uses of alumina bricks.
4. What are abrasives?
5. Define Calorific value of a fuel.
6. What is meant by cracking?
7. Give two examples of liquid propellants.
8. Give the composition of water gas.
9. What is meant by roasting of ore?
10. Mention the ores of Titanium.
11. Give the composition of German silver.
12. What is bronze? Give an example.
13. What is Fluorescence?
14. What is acid rain?
15. Give two examples for fibre reinforced composites.
16. Define white pottery.
17. Define Addition polymerization.
18. What are reinforced plastics?
19. Mention the uses of Thiokol rubber.
20. What is reclaimed rubber?

**Part – B****II. Answer any two subdivisions in each of the following questions****(5 x 12=60)**

1.
  - a. Explain the reverse osmosis method for softening of hard water.
  - b. What are refractories? Explain its classification and give examples.
  - c. Explain how Carborundum and Boron Carbide are manufactured. Mention their uses.
2.
  - a. Write a note on solid fuels.
  - b. Give a brief account on Solid Propellants.
  - c. A producer gas has the following composition by volume:  
 $\text{CH}_4=3.5\%$ ;  $\text{CO} = 25\%$ ;  $\text{H}_2= 10\%$ ;  $\text{CO}_2=10.8\%$ ;  $\text{N}_2 = 50.7\%$ .  
 Calculate the theoretical quantity of air required for combustion per  $\text{m}^3$  of the gas.
3.
  - a. Explain the electrolytic refining of copper.
  - b. Describe the extraction of Tungsten from its ore. Mention any of its two uses.
  - c. What are Alloys? How are they classified? Give Examples.

4.
  - a. Explain Photosynthesis.
  - b. Write a note on particulate composites and layered composites.
  - c. Define and explain glazing.
5.
  - a. What are the advantages of plastics over traditional materials?
  - b. What are the ingredients added during compounding of rubber? Give their functions.
  - c. Write a note on Ammonium and Freon-12 refrigerants

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