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GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme : Diploma in ET/CM/IT
Programme Code : 03 / 06 /07 /17
Name of Course : Applied Chemistry
Course Code : SC165

Teaching Scheme:

	Hours /Week	Total Hours
Theory	02	32
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Three class tests, each of 60 Min. duration	03	03	---	---
Marks	20	80	50	---	---

Course Rationale:

Material Science is the science that investigates the composition and structure of matter the changes that matter undergoes, the amount and kind of energy necessary for these changes, and the law that govern the changes.

Applications of Material Science and Chemical Principles have resulted into the Development of new materials used in modern medicines and automobiles, synthetic fibers polymers, alloys, new energy sources and many other important products and processes.

Hence, Material Science is an important and expanding branch in scientific engineering and economic field of our society.

Thus the principles of Material Science have a wide application in all the branches of engineering and technologies.

In this syllabus, the coverage of various topics will orient the students to appreciate the principles Material Science in the fields of engineering and Technology. The topic microstructure includes the basic structure of matter, which governs the Mechanical, Electrical and Magnetic properties of the matter. Steels, alloys, plastic resins and Elastomers are included in the syllabus considering their present extensive use in automobiles, chemicals and heavy engineering industries.

Course Objectives:

- Develop interest in the fundamental structure of matter, which governs the properties of matter.
- Apply principles of chemistry, to Engineering situations.
- Understand applications of basic concepts in chemistry.
- Appreciate effect of chemical changes.
- Understand various Chemical Technology processes.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	Introduction to Material Science		
	1.1 Atomic Structure and Chemical bonding – Fundamental particles, Electronic configuration, Atomic Orbital, Main and sub energy levels, Quantum Numbers and their significance, formation of molecules, electrovalent and ionic Bonds, Covalent Bonds, Nuclear stability, mass defect Nuclear fusion, fission.	04	10
	1.2 Introduction to crystal structure- Unit cell, , seven systems, closed packed structures, hexagonal closed packed structure, cubic close packed structure, body-centered cubic structure and explanation of metallic properties based on these structure. Inter Atomic Distances and Ionic Radii Correlation between Crystal structure and properties.		

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2.	Electrochemistry			
	2.1	Introduction Definition of electrolyte ,metallic and electrolytic conduction degree of ionization ,factors affecting degree of ionization, conductivity of electrolytes Mechanism of electrolysis Activity series Electrolysis of H ₂ SO ₄ , KCl with platinum electrodes. NaCl fused and NaCl (aq) CuSO ₄ solution with Pt electrodes and Cu electrodes.		
	2.2	Faraday's law of electrolysis. Statements, Numerical examples based on Faraday's laws of electrolysis.		
	2.3	Some electrochemical cells and cell reaction such as i) Voltaic cells, chemical cell, concentration cell, reversible and irreversible cells. ii) Daniel cell with porous vessel and salt bridge. Concept of electrode potential, standard electrode potential (E ⁰), significance of oxidation –reduction potential, type of electrodes, active electrodes. EMF series and its application, constructions, working and reaction of lead accumulators, Nickel Cadmium cell. Applications of Electrolysis Electroplating and Electrefining.	06	15
3.	Corrosion			
	3.1	Definition Types of corrosion Atmospheric Corrosion, Factors affecting atmospheric corrosion, Corrosion by oxidation Mechanism of Oxidation corrosion Types of oxide films formed	06	15

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	3.2	<p>Electrochemical Corrosion, its mechanism, electrochemical series, Galvanic corrosion, concentration cell corrosion- Metal ion concentration, oxidation concentration.</p> <p>Factors affecting Electro-chemical corrosion</p> <p>Protection of metal from corrosion-</p> <ul style="list-style-type: none"> i) Purification of metal and alloy formation. ii) Cathodic Protection. iii) Inorganic coating. iv) Metallic coating- Anodic and Cathodic coating, Electroplating, Hot dipping galvanizing and tinning, Cementation-Sherardizing, Metal cladding, Spraying 		
4.	Polymer			
	4.1	<p>Plastic</p> <p>i) Introduction ii) Definition of polymerization iii)</p>		
	4.2	<p>Types of polymerization – Addition and Condensation iv) Structure of polymer v) Types of plastic – Thermosoft and thermoset, vi) Their structure and properties vii) Study of polymers such as cellulose, acetate, PVC, polythene, polystyrene Nylon, Teflon(Thermosoft) Bakelite, silicon (Thermoset plastic) Compounding of plastic, Properties and related applications in industries.</p>	04	10
	4.3	<p>B- Elastometers-</p> <p>Natural Rubber drawback of natural rubber, polymerization and. Vulcanization of rubber, properties (tack rebound, elasticity, abrasion resistance) and application of rubber.</p>		
5.	Metal and Alloy			
	5.1	<p>Definition of metal, mineral, ore , properties and applications of different metals (Fe, Cu ,Al ,Cr ,Ni,Sn,Pb,Zn,Co,W,Ag)</p>	05	10

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	5.2	Definition of alloy ,formation of alloy, purposes of making alloy, classification (ferrous and nonferrous alloy) composition, properties and uses of heat resisting steel, magnetic steel ,shock resistance steel, stainless steel ,high speed steel spring steel, tool steel, and bronze brass monel metal babbitt metal duralumin.		
6.	Engineering Materials			
	6.1	Definition, properties ,application of Composite material	04	10
	6.2	Insulating materials		
	6.3	Ceramics and Asbestos, Paint ,Adhesives,		
7.	Environmental Effects (Awareness Level)			
	7.1	Definition, types of pollution, air, water, soil, sound, nuclear pollution. (Causes, control method, effect), E-waste (origin effect control) deforestation, ozone depletion, green house effect, preventative environmental management activities.	03	10
Total			32	80

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
1	Drawing of Electronic configuration of items from Z = 1 to Z = 20 Drawing of Molecular structures of electrovalent and covalent compounds and + ve and -ve ions	02
2	Qualitative Analysis of salts of metals such as Hg, Pb, Cu, Sn, Fe, Al, Cr, Ni, Zn, Mn, Ca, Ba, Mg, NH ₄ , K, Na (Any two)	04
3	Draw the crystal structure of cu and graphite.	04
4	To find the electrochemical equivalent of copper by electrolysis and to verify Faraday's 1 st law of Electrolysis.	04
5	Determine conductivity of different electrolytes by using conductometer.	04

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6	Study of Mechanism of electrochemical Corrosion due to evolution of H ₂ And absorption of O ₂	04
7	Formation of phenol formaldehyde resin.	02
8	To estimate percentage of pure iron in iron alloy or impure iron by redox titration method.	02
9	Preparation of chart of composition, properties, uses of metal and alloys.	04
10	To determine co content in emission from petrol vehicle	02
Total		32

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction to material science	Models of Hydrogen atom, Electrovalent and covalent molecules and crystal structure.
2.	Electrochemistry	Different Galvanic cells, and the working of dry cells and storage batteries, group discussion on laboratory experiment, based on this theory
3.	Corrosion	Comparison of the rate of corrosion in different environments such as water, moisture, acid, alkali, industrial area.
4.	Polymers	Collection the required data, from nearly polymer industry, to study the manufacturing conditions, and advantages of using polymer industry, to study the manufacturing conditions and advantages of using polymer over metallic material.
5.	Metal and alloy	Samples of different materials, chart
6.	Engg. Materials	Introduction to Engineering Materials – demonstration of material, samples and group discussion
7.	Environmental effects	Measure the level of pollutant and control method by using data group discussion

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Text Books:

Sr. No	Author	Title	Publication
1.	S.N.Narkhede	Chemistry of Engineering Materials	Nirali Publication
2.	V. P. Mehta	Polytechnic Chemistry	Jain Brothers, New Delhi.
3.	P.C. Jain and Monica Jain	Applied Chemistry	Dhanpat Rai and sons, New Del hi

Reference Books:

Sr. No	Author	Title	Publication
1.	M.M. Uppal	Engineering Chemistry	Khanna Publisher, Delhi.
2.	J.C. Kurlacose J. Jairam	Chemistry in Engineering and Technology volume I and II.	Tata McGraw hill.
3.	Linus Pauling	The nature of Chemical Bond and the structure of Molecules and crystals	Oxford and IBH Publishing Co.
4.	C.M. Shrivastav C. Shrinivasam	Science of Engineering Materials.	Wiley Eastern Ltd.
5.	Lawrence H Van Vlack	Elements of Material science and Engineering (6 th Edition)	Wesley Publishing Co.
6.	Z bigniew D Jastrebski	The nature and properties of engineering material third edition.	John Eiley and Sons.
7.	T.T.T.I. Chandigarah	Civil Engineering Materials	Tata McGraw hill .
8.	P.N. Balguni and p.Shah	Fiber Reinforced Cement composites	Tata McGraw hill

Learning Resources:

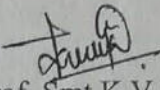
Chalk, Board, Books, Video cassette no 51,55,56,60,61,63 of GPP Library

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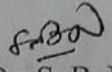
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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction to Material Science	05	02	03	10
2.	Electrochemistry	05	04	06	15
3.	Corrosion	07	04	04	15
4.	Polymers	04	04	02	10
5.	Metal and alloy	04	04	02	10
6.	Engg. Materials.	04	02	04	10
7.	Environmental effects	06	02	02	10
Total		35	22	23	80


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