

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

Programme : Diploma in ME
Programme Code : 04/18
Name of Course : Chemistry
Course Code : SC169

Teaching Scheme:

	Hours /Week	Total Hours
Theory	04	64
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two Class Tests , each of 60 Min. duration	03 hrs	03 hrs	---	---
Marks	20	80	25	---	25

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.

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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:

After studying this course, the student will be able to

- 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.	Atomic Structure and Chemical Bonding		
	1.1 Fundamental particles, electronic configuration, atomic orbital, main and sub energy levels, quantum numbers and their significance Definition of valency, types of bonds, formation of electrovalent and covalent compound, definition of metallic bond and examples, nuclear stability, mass defect, nuclear fusion and fission.	06	06
2.	Plastic (Polymer)		
	2.1 Definition, types of polymerization (addition and condensation), classification of plastic (thermoplastic and thermosetting), compounding of plastic, preparation, properties and uses of polyethylene, PVC, polystyrene, Teflon, nylon 66, bakelite, polyester, epoxy resin, silicone resin	08	10

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	2.2	RUBBER (ELASTOMER) Definition, drawbacks of raw rubber, vulcanization of rubber, preparation, properties and uses of synthetic rubber, neoprene rubber, butyl rubber, silicone rubber, polyurethane rubber, compounding and application of rubber		
3.	Metallurgy and Alloys			
	3.1	Occurrence of metals, definitions of mineral, ore, flux, matrix, slag and metallurgy, mechanical properties of metal, flow chart showing different processes in metallurgy, classification, properties and application of carbon steel, heat treatment(definition, purposes and methods), definition of alloy, purposes of making alloys with examples, classification of alloys(ferrous and non-ferrous), effects of alloying elements on the properties of steel(Ni, Co, Si, Mn, V, W), composition, properties and application of duralumin woods metal, brass and monel metal.	10	12
4.	Ceramics, Glass, Adhesives			
	4.1	Introduction to ceramics, clay, white ware, earth ware, stone ware.	08	12
	4.2	Introduction to glass, properties, uses, types of glass.		
	4.3	Introduction to adhesives, definition, characteristics, classification of adhesives, properties and uses of synthetic, natural resins and starch adhesive.		
5.	Water			
	5.1	Causes and types of hardness, analysis of degree of hardness in calcium carbonate equivalent, bad effect of hard water in industries(paper, textile, dye, sugar), removal of hardness by lime soda method, zeolite, ion exchange method, reverse osmosis, PH scale, application of PH in engineering. Numerical based on PH and hardness.	08	14

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6.	Corrosion		
6.1	Definition, types of corrosion(atmospheric and electro chemical), causes of corrosion, Pilling Bedworth Rule, mechanism of wet corrosion, (evolution of hydrogen, absorption of oxygen), Galvanic Series and importance in corrosion, differential aeration, stress corrosion, factors affecting rate of electrochemical corrosion.	12	14
6.2	Protection Methods- Galvanization and tinning processes, sherardizing, metal spraying, electroplating, metal cladding.		
7.	Lubricant and Fuels		
7.1	Definition and functions of lubricant, mechanism of lubrication(fluid film, boundary, extreme pressure lubrication), classification of lubricant, properties of lubricating oils(physical and chemical), selection of lubricant for light machines, I.C.E., gears, cutting tools, high pressure and low speed machines, transformers, spindles in textile industry, for refrigeration system.	12	12
7.2	Definition, classification of fuels, characteristics of good fuel, comparison between solid, liquid and gaseous fuel, types of coal, analysis of coal by proximate and ultimate analysis, refining of crude petroleum, fractions obtained by distillation of crude, gasoline, kerosene, diesel as a fuel, properties and uses of LPG, CNG, bio gas.		
Total		64	80

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of practical/Experiment/Assignment	Hrs
1.	Preparation of phenol formaldehyde resin.	02
2.	To determine acid content in plastic.	02
3.	To draw flow sheet of extraction of metal from its ore.	02
4.	To estimate percentage of pure iron in iron alloy or impure iron by redox titration method	02
5.	Determination of free residual chlorine in given sample of water.	02
6.	Determination of hardness of water by EDTA method.	02
7.	Determination of PH by lovibond comparator and PH meter	02
8.	Write the mechanism of electrochemical corrosion due to evolution of Hydrogen and absorption of oxygen	02
9.	Determination of moisture content from the coal by proximate analysis.	02
10.	Determination of ash content from coal by proximate analysis.	04
11.	Determination of viscosity by using Ostwald viscometer.	04
12.	Write the chart showing uses of lubricant for machines working under different condition.	02
13.	To find acid value of lubricant	02
14.	Formation of compound	02
Total		32

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Atomic structure and Chemical Bonding	Class room Teaching, Demonstration, Models, Charts
2.	Plastic and Rubber	Class room Teaching, Demonstration
3.	Metallurgy and Alloys	Class room Teaching, Demonstration, Models, Charts
4.	Ceramics, Glass, Adhesives	Class room Teaching, Demonstration
5.	Water	Class room Teaching
6.	Corrosion	Class room Teaching, Demonstration, Models
7.	Lubricant and Fuel	Class room Teaching

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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 Delhi

Reference Books:

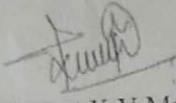
Sr. No	Author	Title	Publication
1.	M.M. Uppal	Engineering Chemistry	Khanna Publisher, Delhi.
2.	J.C. Kurlacose J. Jairam	Chemistry in Engineering and Technology volume I and II.	Tata McGraw hill.
3.	Linus Pauling	The nature of Chemical Bond and the structure of Molecules and crystals	Oxford and IBH Publishing 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

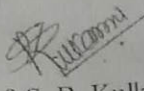
Learning Resources: Models, Charts

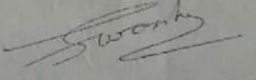
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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Atomic structure and Chemical Bonding	02	02	02	06
2.	Plastic and Rubber	02	04	04	10
3.	Metallurgy and Alloys	06	02	04	12
4.	Ceramics, Glass, Adhesives	04	04	04	12
5.	Water	06	03	05	14
6.	Corrosion	04	04	06	14
7.	Lubricant and Fuel	04	04	04	12
Total		28	23	29	80


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