



C.U.SHAH UNIVERSITY – Wadhwan City

FACULTY OF: - Technology and Engineering (Diploma Engineering)

DEPARTMENT OF: - Mechanical Engineering

SEMESTER: - III **CODE:** - 2TE03MSC1

NAME OF SUBJECT: - Material Science

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme					Evaluation Scheme								
		Th	Tu	Pr	Total	Credit	Theory				Practical (Marks)				Total
							Sessional Exam		University Exam		Internal		University		
							Marks	Hours	Marks	Hours	Pr/Viva	TW	Pr		
<u>2TE03MSC1</u>	Material Science	03	00	02	05	04	30	1.5	70	03	30	20	----	150	

Objective: -

- Solving the problems of material selection and application in the construction and manufacturing of equipment/machines, devices, attachments, tools, etc.
- Right selection of materials adds to the economy, working, quality and life of all mechanical related devices and elements.
- Reading phase Diagrams.
- Operate Metallurgical microscope.
- The study of basic concepts of material science will help the students understanding engineering subjects where the emphasis is laid on the application of these materials.

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	Engineering Materials: Types of bonds, Construction and characteristics of electrovalent, Covalent, Coordinate hydrogen and metallic, Intermolecular force of attraction, Molecular arrangement in solids, liquid and gases, Structure of solids, Physical, Chemical, Electrical, Electromagnetic and Thermal properties of material, Solidification of metals.	05
2	Phase Diagrams: Equilibrium diagrams (Concept, definition and need, Solid solution-definition, properties and examples, Alloys-major elements, Reasons to add and important effect on material properties, Cooling curve-concept and method to plot, Cooling curve for pure metals and alloys.), Time Temperature Transformation curve- (TTT curve), Iron carbon equilibrium diagram, Heat treatment processes.	10
3	Metallurgical Microscope: Metallographic examination and microstructures need and importance, Principle & working of metallurgical microscope, Preparation of specimen for microscopic examinations.	03
4	Metals and Its alloys: Classification of metals, Flow diagram for the production of iron and steel, Ferrous metals (Classification, Steels-types, composition, properties, applications, Designation and coding methods according to BIS for plain & alloy steel and cast iron, Designation and coding), Non ferrous metals (Classification, Types, composition, properties and applications, Designation and coding methods according to BIS, Designation and coding)	10
5	Non metallic materials: Introduction and classification of non metallic materials, Classification of Polymers on basis of Thermal behavior (Thermoplastics &Thermosetting), Properties and applications of polymers (like Polyethylene, Polypropylene, Polyvinyl chloride, Teflon, Polystyrene,	06

	Phenol formaldehyde, Acrylonitrile, Epoxy resin.), Surface coating methods, setup, working parameters and applications using polymers, Composites, Other non metallic materials-types, properties and applications.(like rubber, ceramics, refractories , insulators, abrasives, adhesives, etc),Surface coating methods, setup, working parameters and applications using polymers, Composites-Introduction of composite, Characteristics of composites, Constituents of composite, Types and applications of composites. Other non metallic materials-types, properties and applications.(like rubber,ceramics, refractories , insulators, abrasives, adhesives, etc), Designation and coding of important non metallic materials as per BIS.	
6	Electrolysis: Introduction, Electrolytes And Non-Electrolytes,-Types Of Electrolytes, Construction And Working Of Electrochemical Cell, Standard Conditions, Standard Hydrogen Electrodes, Electrochemical Series, Galvanic Series, Faraday's Laws Of Electrolysis Industrial Applications Of Electrolysis, Surface Coating Through Electrolysis Setup And Working, Corrosion-Types and Reasons.	04
7	Fluid And powder materials: Classification Of Fluid And Powder Materials, Oils-Types And Properties, Designation Methods As Per BIS, Applications In Mechanical Engineering. Paints and Varnishes-Definition and Classifications, Surface Preparation And Coating Methods Using Paints And Varnishes, Powder Metallurgy-Basic Concept Of Powder Metallurgy And Its Applications, Merits And Demerits, Manufacturing Process Of Powder Coating-Setup, Equipment Used and Working.	04

List of Experiments:-

- Based on any five material (3 metallic and 2 non metallic) selected by student, identify materials of them. Also state the criteria to identify the material. List properties of each material. Also judge main alloying elements and reasons to add them.
- Study of various heat treatment furnaces, and Perform hardening process on ferrous material. Measure the hardness before and after hardening.
- Demonstration and study of Microscope.
- Prepare ferrous micro specimens and examine them. Also prepare report on this. –Four specimens.(One of plain carbon steel, second of alloy steel, third of heat treated steel and fourth of cast iron).
- Prepare non-ferrous micro specimens and examine them. Also prepare report on this. – Three specimens (One of copper, second of brass and third of aluminum).
- Demonstrate corrosion of metals.
- **Problem Based Learning:**
Group of 4-5 students will identify and collect five machine / product components which are made from different engineering materials and which are also failed in their applications. Students will measure and sketch the components (free hand-orthographic views) with dimensions. Students in group will also discuss the reasons of failure and will note down the discussion and outcome.
- **School Within School:**
 - a. Each student will explain at least one diagram (assigned by teacher-may be part of iron-carbon diagram, TTT curve for specific material, etc) to all batch colleagues.
 - b. Each student will share his/her student's activities outcome. He/she will also share the experience for the student activities he/she has carried out.

Learning Outcomes:-

- Select Engineering materials based on properties, behavior and environmental effect for given engineering application.
- Examine microstructure and alloying elements of given engineering material.

Books Recommended:-

- Materials science, GBS Narang Khanna, Publishers, New Delhi.
- Materials science, R.K.Rajpoot, Laxmi Publication, Dariya ganj, New Delhi.
- Materials science, R.S.Khurmi, R.S.Sedha S.Chand.
- Materials science and Engineering, V.Raghavan EEE Edition, Prentice Hill,New Delhi.
- Physical Metallurgy Sidney Avner Tata McGraw-Hill Educationv