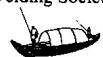


8. Welding Journals (as per syllabus)
9. Welding Hand- book Vol. I – V American Welding Society 550, N. W. Le Jeune Road P. O. Box 351040



4238 - MATERIALS AND PROCESSES										
Teaching Schedule Per Week			Progressive Assessment	Examination Schedule (Marks)						
Lectures	Practical	Credits		Theory			Practical Ex.		Total	
3	-	3	25	3Hrs	100	-	-	-	125	
Pre-requisite		Source	Semester	Theory	Test	Total	TW	PR	Gr Total	W
Nil		FAB		75	25	100	-	-	100	

RATIONALE: A technician in fabrication is involved in the manufacture, repair and maintenance of various types of structures in the industries. This course is designed to enable students to understand the properties and use of engineering materials, applications and implications of heat treatment in design and fabrication, stress relieving processes and metallurgical aspect of welds. The emphasis in this course is on steel. The properties of other materials are also briefly covered.

COURSE CONTENTS		Hrs	Mks
1. STEEL MAKING -INTRODUCTION		1	2
2. PLAIN CARBON STEEL		6	12
Iron- carbon equilibrium diagram (steel portion upto 2% C). Types of solid solutions- Substitutional, interstitial. Types of structures- Ferrite, Austenite, Cementite, Delta (δ) Ferrite, Martensite.			
Types of plain carbon steel (properties, carbon-content and applications). Low carbon steel, medium carbon steel, high carbon steel.			
Influence of constituents on steel- Carbon, silicon, manganese, sulphur, phosphorus.			
Factors affecting mechanical properties- Effect of grain size, effect of heat treatment, effect of atmospheric exposure, effect of low temperature, effect of high temperature.			

3. ALLOY STEELS

Reasons for alloying in steels. Common alloying elements in steel and their effects. Alloy structural steel -Low, medium, high. Stainless steel- Austenitic stainless steel, Martensitic stainless steel, Ferritic stainless steel, Molybdenum leaded stainless steel, low carbon stainless steel, stabilised stainless steel. High speed steel- Effect of alloying elements on high speed steel. Heat resisting steels.

6 12

4. CAST IRON

Grey cast Iron. White cast Iron. Malleable cast Iron- White heart, black heart. Nodular iron or spheroidal graphite iron. Chilled cast iron. Alloy cast Iron.

3 6

5. IDENTIFICATION OF METALS AND ALLOYS

Rapid identification tests of metals and alloys, magnetic properties, weight, colour, spark testing. (Principles, classification of sparks), chemical spot testing (Carbon steels, alloy steels). Physical tests of metals and alloys- Ultimate tensile stress, yield stress, percentage elongation, V-notch impact properties. Chemical analysis of metals and alloys- Methods of identifying the percentage of constituents.

4 8

6. METALLURGY OF WELDING

Introduction. Heat flow in and around weld metal- Temperature distribution, heating and cooling rate of weldment.

11 24

Metallurgical effects of welding.

Weld metal solidification- Concept of Epitaxial growth and competitive growth.

Absorption of gases by welds- Sources of gas, effects of gas absorption-Hydrogen, nitrogen, oxygen, prevention of gaseous contamination.

Thermal effects of welding on parent metal and its mechanical properties- Weld Metal Zone, Heat Affected Zone (HAZ), Unaffected Parent Metal.

Weld cracking- Types of cracks.

Corrosion of welds- Definition, types of corrosion in welded joints, factors influencing corrosion resistance of welded joints, concept and prevention of weld decay.

Stress relief of weldment- Need for stress relief, methods to reduce welding stresses (Peening, vibratory stress relief, thermal treatment, thermo mechanical treatment, over-stressing technique).

8 16

7. HEAT TREATMENT OF STEEL

Definition of heat treatment. Need for heat treatment.

Factors affecting good results-Heating temperature, soaking time, rate of cooling.

Quenching media-water, oil, brine and air.

Hardening processes- Heating methods-Furnaces, salt bath and induction. Effects of carbon, alloying elements and cooling rate on hardenability. Change in properties after hardening.

Tempering- Reasons, effects and methods of tempering.

Normalising-Reasons, effects methods of normalising.

Annealing-Reasons for annealing, changes in properties, full annealing, process annealing (Recovery, re-crystallisation and grain growth).

2 4

8. AGE HARDENING OR PRECIPITATION HARDENING

Brief description using Al-Zn or Al-Cu system. Effect of time and temperature of ageing treatment on the mechanical properties. Practical applications.

1 4

9. WORK HARDENING OR STRAIN HARDENING

Brief description, change in properties, practical applications.

3 6

10. COLD AND HOT WORKING

Re-crystallisation temperature. Difference between cold working and hot working.

Cold working processes (brief description only)- Cold rolling, cold pressing and spinning. Need for process annealing for further cold working. Hot working processes (brief description only)-Hot rolling, forging and extrusion.

11. OTHER MATERIALS

Plastics and polymers. Insulating materials. Thermocole. Glass. Refractory materials and ceramics. Timber. Composite materials (FRP and GRP).	3	6
Total	48	100

Note For Examiners: Due weightage for every topic as mentioned in the syllabus should be given. Minimum two work visits in a term to selected industries/ erection sites and quality testing centres should be arranged by the institution.

REFERENCE BOOKS

Latest editions of recommended reference books are to be made available in the library

1. Engineering Metallurgy Part I, R.A. Higgins ELBS Edward Arnold
2. American Society of Metals Hand Book. Vol. 11-Non -Destructive Inspection and Quality Control
3. Materials and Processes S.K Hajra, Choudhary India Book Distributing Co; Calcutta
4. Welding Technology O.P Khanna, Dhanpat Rai and Sons, Delhi

