Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. in Manufacturing Engg.	Design and Metallurgy of Welded Joints	MEM 510	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
II	3	3-0-0	3 Hours

Unit - I

Introduction: Welded joints, symbols, welded defects; Design considerations; Joint efficiency; Factor of safety, Types of loading; Permissible stress; Computation of stresses in welds; Weld size calculation; Code requirement for statically loaded structures. **(07 Hours)**

Unit - II

Dynamic Behaviour of Welded Joints and Failure Theories: Design for fluctuating and impact loading; Dynamic behavior of welded joints; Stress Concentrations; Fatigue analysis; Fatigue improvement techniques; Permissible stress- life prediction; Concept of stress intensity factors - LEFM and EPFM concepts; Brittle fracture; Transition temperature approach; Fracture toughness testing; Application of fracture mechanics to fatigue. **(08 Hours)**

Unit - III

Welding Residual Stresses : Causes; Occurrence; Effects and measurements; Thermal and mechanical relieving; Types of distortion - factors affecting distortion - distortion control methods - prediction - correction; Jigs; fixtures and petitioners. **(07 Hours)**

Unit - IV

Welding Metallurgy: Thermal effect of welding on parent metal; Structure of fusion welds; Effect of cooling rate; Weld metal solidification and heat affected zone; Heat flow - temperature distribution-cooling rates; Influence of heat input; Joint geometry; Plate thickness; Preheat; Significance of thermal severity

number; Epitaxial growth - weld metal solidification - columnar structures and growth morphology effect of welding parameters; Absorption of gases - gas/metal and slag/metal reactions. **(08 Hours)**

Unit - V

Phase Transformations: weld CCT diagrams - carbon equivalent-preheating and post heating weldability of low alloy steels; Welding of stainless steels use of Schaffler and Delong diagrams; welding of cast irons. Welding of Cu; Al; Ti and Ni alloys – processes- difficulties; Microstructures; defects and remedial measures. **(08 Hours)**

Unit - VI

Testing of Weld Joints: Destructive and non-destructive tests; Equipments required of tests; Tensile test; Bend test; Impact test; Hardness test; Brittle and fatigue failure tests; Dye penetrate inspection; Magnetic particle inspection etc. **(07 Hours)**

Recommended Books:

1. Design of Weldments; W. B. Omer; James. F. Lincoln; Arc Welding Foundation; 1991.
2. Rational Welding Design; T. G. E. Gray; Butterworths; 1982.
3. Deformation and Fracture of Mechanics of Engineering Materials; R. W. Hertzberg; John Wiley; 1996.
4. Mechanical Metallurgy; G. Dieter; Tata McGraw Hill; 1988.
5. Weldment Design; M. Bhattacharya; Association of Engineers;1991.
6. Welding Metallurgy; Volume I and II; 4th Edition; G. E. Linnert; AWS; 1994.
7. Fundamentals of Welding Metallurgy; H. Granjon; Jaico Publishing House; 1994.
8. Introduction to Physical Metallurgy of Welding; 2nd Edition; Easterling Kenneth; Butterworth Heinmann; 1992.
9. The Metallurgy of Welding; D. Saferian; Chapman and Hall; 1985.
10. Welding Methods and Metallurgy; M. D. Jackson; Grffin; London; 1967.
11. Friction Stir Welding and Processing; R. S. Mishra and M. W. Mahoney; ASM; 2007.