

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. (Manufacturing)	Welding Engineering	MEM 511	SM+MT+ET 25+25+50
Semester	Credits	L-T-P	Exam.
I	3	3-0-0	3 Hours

Unit - I

Introduction and Physics of Welding Arc: Evolution of welding; Classification of welding processes; Heat sources and shielding methods.

Welding arc; Voltage distribution along the arc; Thermionic and non-thermionic cathodes; Theories of cathode and anode mechanism; Arc characteristics and its relationship with power source; Arc efficiency; Heat generation; Effect of type of shielding gas on arc; Isotherms of arcs. **(08 Hours)**

Unit - II

Welding Power Sources: Conventional welding power sources; Constructional features; Static and dynamic characteristics; Duty cycle; Influence of inductance on arc and power source characteristics; Internal and external regulation; Specific power source requirements; Special welding power sources. **(07 Hours)**

Unit - III

Weldability of Metals: Solidification of weld metal; Heat affected zone (HAZ); Factors affecting properties of HAZ; Gas-metal, Slag-metal and solid state reactions in welding and their influence on soundness of weld joint; Lamellar tearing and hydrogen damage; Weldability; definition; Factor affecting the weldability of steel Carbon equivalent; Weldability of steel, cast iron and aluminium alloys of commercial importance, failure analysis of welded joints.

(06 Hours)

Unit - IV

Arc Welding Processes: Consumable electrode welding processes; Manual metal arc (MMA) welding; Gas metal arc welding; Pulsed MIG welding; Submerged arc welding, Significance of flux-metal combination; Electroslag welding: heat generation; Principle; Gas tungsten arc welding; Selection of polarity, Plasma arc welding; Transferred and non-transferred plasma arc welding; Selection of gases; Welding parameters; Keyhole technique.

Modern Trends in Welding: Friction welding; Explosive welding; Diffusion bonding; High frequency induction welding; Ultrasonic welding; Electron beam welding; Plasma arc welding; LASER welding. **(12 Hours)**

Unit - V

Heat Flow in Welding: Effect of welding parameter on heat distribution; Calculation of peak temperatures; Thermal cycles; Cooling rate and solidification; Residual stresses and their distribution in welds; Influence of residual stresses in static and dynamic loading, Distortion. **(07 Hours)**

Unit - VI

Inspection and Testing of Welding and Casting: Defects; Destructive tests; Non destructive testing techniques; Surface treatments-safety aspects in welding processes; Specific welding applications and innovations. **(05 Hours)**

Recommended Books:

1. The Metallurgy of Welding, Lancaster, William Andrew Publishing, NY.
2. Principles of Welding (Processes, Physics, Chemistry and Metallurgy), Robert and Messler, Wiley Interscience Publishers.
3. Welding Hand Book Vol. 5; 7th edition, AWS, 1984.
4. Welding Metallurgy, S Kou, John Wiley, USA, 2003.