

**ME307: WELDING AND CASTING TECHNOLOGY**  
**CREDITS = 5 (L=3, T=0, P=2)**

**Course Objective:**

Illustrate technology of welding and casting processes.

**Teaching and Assessment Scheme:**

Teaching Scheme			Credits	Assessment Scheme				
L	T	P		Theory		Practical		Total Marks
			ESE	CE	ESE	CE		
3	0	2	5	70	30	30	20	150

**Course Contents:**

Unit No.	Topics	Teaching Hours
1	<b><u>Introduction to Metal Joining:</u></b> Joint design, permanent and temporary joints, terminology of welding, types of welding joints, welding positions, mechanism of weld formation, Basic requirements of welding and how these requirements are fulfilled by welding processes metallurgy of fusion and pressure welding, comparison between welding, soldering and brazing.	04
2	<b><u>Theory of Welding:</u></b>  <b>Formation of a weld by molten metal bridging:</b> Heat source-Heat sink effects (Thermal effects), Factors dictating formation of a weld, Comparison of weld formation with processes like OFW, Arc Welding, LASER Beam etc, and Performance evaluation of welding processes – Joining rate and Melting efficiency. <b>Physics of Welding Arc:</b> The welding arc, Nature and Behavior of welding arc and its relevance to the practice, Mechanisms of electron emission, zones in arc gap and their relevance, arc initiation and arc maintenance methods, influence of electrode polarity in welding, mechanism of arc blow, mechanism of metal transfer, Welding arc characteristics, Arc welding power sources and their characteristics.	03  06
3	<b><u>Welding Processes:</u></b>  <b>Arc Welding Processes:</b> Principle of operation, characteristics, consumables, equipment, process variables and capabilities of arc welding processes like SMAW, SAW, GMAW, GTAW, Designing arc welding procedures. <b>Resistance Welding Processes:</b> Principle, types of resistance welding processes, heat generation, process parameters in resistance welding, resistance welding electrodes, heat balance. <b>Allied Welding Processes:</b> Principle of operation, characteristics, consumables, equipment, process variables and capabilities of processes like Oxy-Acetylene Gas welding, LBW, EBW, and Friction stir welding. Thermal Cutting processes: Oxy-Acetylene gas cutting - mechanism of cutting, effect of process variables, applications; Plasma arc cutting, LASER Beam cutting processes.	05  02  03  *

Unit No.	Topics	Teaching Hours
4	<p><b><u>Fundamentals of Metal Casting:</u></b></p> <p>Melting, Refining, and Pouring of liquid metal; Gas Porosity in castings, Factors causing gas dissolution in liquid metal, Degassing techniques.</p> <p><b>Feeder Design and Placement:</b> Solidification of pure metals and alloys, Factors influencing solidification of castings, Feeding Resistance, Rationale and methods of riser design, feeding distances; Directional solidification in castings.</p> <p><b>Gating Design:</b> Gating ratios, Aspiration effects and its prevention, Gating methods, Slag-Trap systems, Metal Fluidity, Factors governing metal fluidity, Measurement of fluidity.</p>	08
5	<p><b><u>Defects in Castings, Casting Design Considerations:</u></b></p> <p>Defects in castings, Producibility aspects of castings. Computer-aided-design of castings</p>	04
6	<p><b><u>Metal casting Processes:</u></b></p> <p>Applications of metal casting, Classification of casting processes. Overview of different casting processes, their characteristics and capabilities;</p> <p><b>Expendable Mould Production:</b> Pattern Construction: Types of patterns, Pattern Allowances, Design of pattern, Moulding Material: Types of Sand, Properties, Preparation and Testing, Moulding processes like Green sand, dry sand, CO<sub>2</sub> moulding, Shell Moulding, Investment casting.</p> <p><b>Permanent Mould processes</b> like Centrifugal casting, Pressure Die casting.</p>	10
<b>TOTAL</b>		<b>45</b>

**List of References:**

1. Parmar, R. S., "Welding Processes and Technology", Khanna publishers
2. Kaushish, J. P., "Manufacturing Processes", 2<sup>nd</sup> Edition, PHI Learning Pvt. Ltd, 2010
3. Rao, P. N., "Manufacturing Technology: Foundry, Forming And Welding", Tata McGraw Hill
4. Ghosh, Amitabh & Mullick, "Manufacturing Science", 2<sup>nd</sup> edition, EWP
5. Ravi, B., "Metal Casting Computer-Aided Design and Analyasis" PHI,2005
6. Ramana Rao, "Metal Casting: Principles and Practice", New Age Publishers
7. Flinn, R. A., "Fundamentals of Metal Casting", Addison-Wesley
8. Houldcroft, Peter, "Welding Process Technology", Cambridge university Press
9. Cary, Howard B., "Modern Welding Technology", Prentice Hall
10. Kalpkjian, S, Schmid Stevens, "Manufacturing Engineering & Technology" 7<sup>th</sup> Edition, Pearson, 2013
11. Black, J. T., & Kohser, Ronald A.; "DeGarmo's Materials and Processes in Manufacturing", 10<sup>th</sup> edition, John Wiley & Sons, Inc., 2007

**Course Outcomes (COs):**

At the end of this course students will be able to ...

1. Identify how basic requirements of welding are fulfilled in welding processes and connect with the physical features.
2. Illustrate behavior of welding arc and appraise effect of arc welding process variables on bead parameters and develop arc welding procedure for given job.
3. Choose a suitable welding process for a given welding application.
4. Choose an appropriate method to produce directional solidification in the casting.
5. Illustrate causes of casting defects and its remedies and illustrate casting design considerations.
6. Illustrate capabilities and applications of casting processes.