3ME07: METAL FORMING, JOINING AND FOUNDARY PRACTICES
CREDITS - 4 (LTP: 3,0,1)

Course Objective:
To illustrate technology of welding, casting and forming processes

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** Objectives of a manufacturing process, Classifications of Manufacturing Processes for metals and alloys.	2
2	**Theory of Welding and Welding Processes:** Definition of a weld, a joint, Types & Parameters of weld, Types of joints, Weldment, Welding positions, Mechanisms of formation of weld, Metallurgical aspects of fusion and pressure welding Basic requirements of welding and how these requirements are fulfilled by welding processes, Classifications of welding processes. Comparison between welding, soldering, brazing and riveting. Arc Welding Processes: The welding arc, Nature and Behavior of welding arc and its relevance to the practice, Arc initiation and arc maintenance methods, Arc welding power sources and their characteristics. Principle of operation, characteristics, consumables, equipment, process variables and capabilities of arc welding processes like SMAW, SAW, GMAW, GTAW, Designing arc welding procedures. Principle of operation, characteristics, consumables, equipment, process variables and capabilities of processes like Resistance, LASER, Electron Beam, Friction, Oxy-Acetylene Gas welding. Other Joining Processes like Brazing, Soldering and Adhesive Bonding; Thermal Cutting processes: Oxy-Acetylene gas cutting - mechanism of cutting, effect of process variables, applications; Plasma arc cutting, LASER Beam cutting processes.	16
3	**Fundamentals of Metal casting and Metal casting Processes:** Applications of metal casting, Classification of casting processes. Mechanism and Rate of Solidification of Metals and Alloys: Solidification of pure metals and alloys, Factors influencing solidification of castings, Feeding Resistance, Gas Porosity in castings, Factors causing gas dissolution in liquid metal, Degassing techniques.	12

Unit No.	Topics	Teaching Hours
	Gating Design, gating ratios, Aspiration effects and its prevention, Gating methods, Slag-Trap systems, Metal Fluidity, Factors governing metal fluidity, Measurement of fluidity. Feeder Design and Placement, Directional solidification in castings Expendable Mould Production: 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_2 moulding, Shell Moulding, Investment casting. Permanent Mould processes like Centrifugal casting, Pressure Die casting Defects in castings	
4	**Theory of Metal Forming and Forming Processes:** Application of metal forming, Theory of Plastic deformation, Strain hardening, Recovery, Recrystallization and Grain Growth, Effect of Temperature, Composition and Strain rates on metal forming, Characteristics and applications of Hot working and Cold working, Classification of metal forming processes according to stresses. Working principle, characteristic features, capabilities and application of Bulk Metal Forming Processes like Rolling, Forging, Extrusion, Wire Drawing and Thread Rolling. Working principle, characteristic features, process variables, capabilities and application of Sheet Metal Working like Shearing, Bending, Deep Drawing, Spinning, Coining, Embossing,	12
	Total	**42**

List of References:

1. Parmar, R. S., "*Welding Processes and Technology*", 3rd edition, Khanna Publishers, 1996
2. Kaushish, J. P., *"Manufacturing Processes"*, 2nd Edition, PHI Learning Pvt. Ltd, 2010
3. Rao, P. N., *"Manufacturing Technology: Volume 1 Foundry, Forming and Welding"*, 5th edition, Tata McGrawHill, 2018
4. Ghosh, Amitabh & Mullick, "*Manufacturing Science*", 2nd edition, EWP, 1986.
5. Ravi, B., "*Metal Casting: Computer-Aided Design and Analysis*" PHI,2005
6. Flinn, R. A., "*Fundamentals of Metal Casting*", Addison-Wesley
7. Houldcroft, Peter, "*Welding Process Technology*", Cambridge University Press,1977
8. Cary, Howard B.,Helzer, Scott, "*Modern Welding Technology",* 6th edition, Pearson, 2005
9. Kalpkjian, S, Schmid Stevens, "*Manufacturing Engineering & Technology*" 7th Edition, Pearson, 2013
10. Black, J. T., & Kohser, Ronald A.; "*DeGarmo's Materials and Processes in Manufacturing*", 10th edition, John Wiley & Sons, Inc., 2007
11. Juneja, B. L., "*Fundamentals of Metal Forming*", 1st Edition, New Age International (P) Ltd.,2007

Course Outcomes (COs):

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

1. Identify how the given process achieves the required shape and size along with required properties.
2. Illustrate capabilities of welding processes and select an appropriate welding process for a given application and hence develop a welding procedure for a given job.

3. Illustrate casting problem (melting, refining & pouring and production of a mould) and explain process capabilities and application of casting processes. Design a “mould ready to pour” solution for a given casting.
4. Illustrate capabilities and hence application of bulk metal forming processes and sheet metal work.