



**COURSE MODULE**

<b>Faculty Name:</b>				<b>Academic Year: 2024 - 2025</b>			
<b>Department:</b> Mechanical Engineering							
Course Code	Course Title	Core / Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BME302	Manufacturing Process	Core	Designing the Product	3	0	2	40T+8-10 Lab slots
<b>Course Objectives</b>	<ol style="list-style-type: none"> <li>To provide knowledge of various casting process in manufacturing.</li> <li>To provide in-depth knowledge on metallurgical aspects during solidification of metal and alloys, also to provide detailed information about the moulding processes.</li> <li>To acquaint with the basic knowledge on fundamentals of metal forming processes and also to study various metal forming processes.</li> <li>To impart knowledge of various joining process used in manufacturing.</li> <li>To impart knowledge about behaviour of materials during welding, and the effect of process and parameters in welding</li> </ol>						
<b>Topics Covered as per Syllabus</b>							
<p><b>Module-1</b>  <b>Introduction &amp; basic materials used in foundry:</b> Introduction: Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy. Introduction to casting process &amp; steps involved–(Brief Introduction)-<b>Not for SEE</b>  <b>Patterns:</b> Definition, classification, materials used for pattern, various pattern allowances and their importance.  <b>Sand moulding:</b> Types of base sand, requirement of base sand. Binder, Additive’s definition, need and types; preparation of sand moulds. Molding machines- Jolt type, squeeze type and Sand slinger.  <b>Study of important moulding process:</b> Green sand, core sand, dry sand, sweep mould, CO<sub>2</sub>mould, shell mould, investment mould, plaster mould, cement bonded mould.  <b>Cores:</b> Definition, need, types. Method of making cores, Concept of gating (top, bottom, parting line, horn gate) and risers (open, blind) Functions and types <b>8 Hours</b></p> <p><b>Module-2</b>  <b>Melting furnaces:</b> Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features &amp; working principle of cupola furnace.  <b>Casting using metal moulds:</b> Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes. Casting defects, their causes and remedies. <b>8 Hours</b></p> <p><b>Module-3</b>  <b>METAL FORMING PROCESSES</b> Introduction of metal forming process: Mechanical behavior of metals in elastic and plastic deformation, stress-strain relationships, Yield criteria, Application to tensile testing, strain rate and temperature in metal working; Hot deformation, Cold working and annealing.  <b>Metal Working Processes:</b> Fundamentals of metal working, Analysis of bulk forming</p>							

processes like forging, rolling, extrusion, wire drawing by slab method,  
**Other sheet metal processes:** Sheet metal forming processes (Die and punch assembly, Blanking, piercing, bending etc., Compound and Progressive die), High Energy rate forming processes. **8 Hours**

**Module-4**

**JOINING PROCESSES** Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding

**8 Hours**

**Module-5**

**Weldability and thermal aspects:** Concept of weldability of materials; Thermal Effects in Welding (Distortion, shrinkage and residual stresses in welded structures); Welding defects and remedies. Allied processes: Soldering, Brazing and adhesive bonding Advance welding processes: Resistance welding processes, friction stir welding (FSW). **8 Hours**

**Laboratory Component:**

1. To determine permeability number of green sand, core sand and raw sand..
2. To determine AFS fineness no. and distribution coefficient of given sand sample.
3. Studying the effect of the clay and moisture content on sand mould properties
4. Use of Arc welding tools and welding equipment Preparation of welded joints using Arc Welding equipment L-Joint, T-Joint, Butt joint, V-Joint, Lap joints on M.S. flats
5. Foundry Practice: 1. Using two molding boxes (hand cut molds). 2. Using patterns (Single piece pattern and Split pattern).
6. Preparation of green sand molds kept ready for pouring in the following cases: Incorporating core in the mold
7. Forging Operations: Use of forging tools and other forging equipment. Preparing minimum three forged models involving upsetting, drawing and bending operations

**List of Textbooks**

1. Ghosh, A. and Mallik, A. K., (2017), Manufacturing Science, East-West Press.
2. Parmar R. S., (2007), Welding Processes and Technology, Khanna Publishers.
3. Little R. L. – ‘Welding and Welding Technology’ – Tata McGraw Hill Publishing Company Limited, New Delhi – 1989
4. Grong O. – ‘Metallurgical Modelling of Welding’ – The Institute of Materials – 1997 – 2nd Edition
5. Kou S. – ‘Welding Metallurgy’ – John Wiley Publications, New York – 2003 – 2nd Edition.

**Web links and Video Lectures (e-Resources):**

1. (Link:<http://www.springer.com/us/book/9781447151784><http://nptel.ac.in/courses/112105127/>)
2. [http://www.astm.org/DIGITAL\\_LIBRARY/MNL/SOURCE\\_PAGES/MNL11.htm](http://www.astm.org/DIGITAL_LIBRARY/MNL/SOURCE_PAGES/MNL11.htm)
3. [http://www.astm.org/DIGITAL\\_LIBRARY/JOURNALS/COMPTECH/PAGES/CTR10654J.htm](http://www.astm.org/DIGITAL_LIBRARY/JOURNALS/COMPTECH/PAGES/CTR10654J.htm)
4. MOOCs: <http://nptel.ac.in/courses/112105126/>

<b>Course Outcomes</b>	<p><b>CO1:</b> Describe the casting process and prepare different types of cast products. Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, and Sand Slinger Moulding machines.</p> <p><b>CO2:</b> Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces. Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.</p> <p><b>CO3:</b> Understand the Solidification process and Casting of Non-Ferrous Metals.</p> <p><b>CO4:</b> Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing.</p> <p><b>CO5:</b> Describe the methods of different joining processes and thermal effects in joining process</p>
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**Internal Assessment Marks:** 50 (CIE for theory component-25 Marks: 2 Tests, each of 15 marks and other assessments for 10 marks and CIE for Practical component-25 Marks: conduction of the

experiment along with laboratory record for 15 Marks and test for 10 Marks).

### The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

List of Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO-1	2	-	2	-	-	-	-	-	-	-	-	2
CO-2	2	-	2	-	-	-	-	-	-	-	-	2
CO-3	2	-	2	-	-	-	-	-	-	-	-	2
CO-4	2	-	2	-	-	-	-	-	-	-	-	2
CO-5	2	-	2	-	-	-	-	-	-	-	-	2

Note: 3 = Strong Contribution, 2 = Average Contribution, 1 = Weak Contribution, - = No Contribution

### The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

List of Course Outcomes	Program Specific Outcomes	
	PSO-1	PSO-2
CO-1	-	-
CO-2	-	-
CO-3	-	-
CO-4	-	-
CO-5	-	-