

**LOK JAGRUTI UNIVERSITY (LJU)**  
**INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**Department of Mechanical Engineering**  
**Bachelor of Engineering (B.E.) – Semester – IV**

<b>Course Code:</b>	<b>017103401</b>
<b>Course Name:</b>	<b>Manufacturing Technology</b>
<b>Category of Course:</b>	Professional Core Course (PCC)
<b>Prerequisite Course:</b>	Mathematics 1 (017101191), Physics(017101192), Electrical and Electronics Engineering (017102292), Engineering Mechanics (017102291), Strength of Materials (017103391), Material Science and Metallurgy (017103404)

Teaching Scheme				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
4	0	2	5	40

Syllabus				
Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	<b>Introduction to Manufacturing Technology</b>			1 (2.5%)
	1.1 Classification of manufacturing Processes-Primary Shaping, Deformation, Machining, Joining, Surface Finishing, Material modification processes	---	---	
	1.2 Selection of manufacturing Processes	---	---	
02	<b>Pattern, Mould and Mould Making</b>			5 (12.5%)
	2.1 Types of pattern like single piece, two piece, loose piece, cope and drag, gatted, match plate, sweep, skeleton, segmental, follow board and lagged up pattern.	---	---	
	2.2 Pattern material like wood, metal, plastic, plaster and wax	---	---	
	2.3 Pattern allowances like shrinkage, machining, draft, distortion and rapping	---	---	
	2.4 Color coding for patterns according to American color scheme	---	---	
	2.5 Moulding sand types like natural, synthetic and special sands	---	---	
	2.6 Moulding sand characteristics	---	---	
	2.7 Moulding sand testing like moisture content test, clay content test, permeability test, grain fineness test and compression strength test.	---	---	
	2.8 Moulding tools	---	---	
	2.9 Core, core print and chaplets	---	---	
	2.10 Core types like horizontal, vertical, hanging, balanced, ramm up, kiss and drop core.	---	---	
2.11 Types of moulding processes	---	---		
03	<b>Gating Systems</b>			4 (10%)
	3.1 Elements of gating system	---	---	
	3.2 Types of gating system	---	---	
	3.3 Types of gates like pating line, top, bottom and side, pouring time calculation	---	---	
	3.4 Types of riser like top, side, open and blind	---	---	
	3.4 Chvorinov's rule, chills and sleeve	Solidification of metals (017103404 – Unit-3.3)	---	
3.5 Design and location of riser	---	---		
04	<b>Casting Processes and Defects</b>			5 (12.5%)
	4.1 Sand casting	---	Advantages, limitations and applications of powder metallurgy (017103404 – Unit-9.4)	
	4.2 Investment casting	---	---	
	4.3 Die casting like gravity, hot chamber pressure die casting and cold chamber die casting	---	---	
	4.4 Shell mould casting, Slush casting	---	---	
	4.5 Centrifugal casting like true centrifugal, semi centrifugal and centrifuging	---	---	
	4.6 Types of furnaces like Cupola, Electric arc furnace, Induction furnace	Hard and soft magnetic materials (017101192-Unit-9.6)	---	
	4.7 Casting Defects	Pattern allowances (017103401 – Unit-2.2) Moulding sand: types and properties (017103401 – Unit-2.3) Core, core types and core print (017103401 – Unit-2.5) Types of moulding processes (017103401 – Unit-2.6) Types of gating system (017103401 –	---	

		Unit-3.2) Types of gates and riser, pouring time calculation (017103401 – Unit-3.3) Chvorinov’s rule, chills and sleeves, solidification of metals (017103401 – Unit-3.4)		
	<b>Joining Processes</b>			
05	5.1 Types of joining processes like welding, soldering, brazing and adhesive bonding.	---	---	1 (2.5%)
	5.2 Working principle, advantage, limitation and application of Soldering and Brazing			
	5.3 Types of welded joints like lap, butt, corner, edge and t joint.			
	5.4 Types of welding positions like horizontal, vertical, flat, overhead and inclined.	---	---	
	<b>Gas and Arc Welding Processes and Welding Defects</b>			
06	6.1 Introduction to gas welding and Oxy-acetylene welding process - principle, types of flame and welding techniques	---	---	4 (10%)
	6.2 Introduction to arc welding and types of electrode like bare, coated, consumable and non consumable and its importance	---	---	
	6.3 Arc welding equipments	Three Phase Induction Motor (017102292-Unit-7.1), Single Phase Induction Motor (017102292-Unit-7.2), DC Motors (017102292-Unit-7.3), Earthing – Types of Earthing and its Importance (017102292 - Unit-9.3)	---	
	6.4 Carbon arc welding		---	
	6.5 Shielded metal arc welding (SMAW)		---	
	6.6 Tungsten inert gas welding (TIG)		---	
	6.7 Metal inert gas welding (MIG)		---	
	6.8 Submerged arc welding (SAW)		---	
	6.9 IS coding for electrodes		---	
	<b>Resistance, Solid State and Thermochemical Welding processes</b>			
07	7.1 Types of Resistance welding processes like spot, seam and projection welding	Three Phase Induction Motor (017102292-Unit-7.1), Single Phase Induction Motor (017102292-Unit-7.2), DC Motors (017102292-Unit-7.3), Earthing – Types of Earthing and its Importance (017102292 - Unit-9.3), Friction and its applications, Types of friction (017102291 - Unit-7.1)	---	5 (12.5%)
	7.2 Merit, demerits and applications of resistance welding processes	Three Phase Induction Motor (017102292-Unit-7.1), Single Phase Induction Motor (017102292-Unit-7.2), DC Motors (017102292-Unit-7.3), Earthing – Types of Earthing and its Importance (017102292 - Unit-9.3)	---	
	7.3 Numerical related to Spot welding		---	
	7.4 Types of Solid State welding processes like friction, diffusion, ultrasonic and explosive welding.		---	
	7.5 Types of Thermochemical welding processes like thermit and atomic hydrogen welding		---	
	7.6 Types of Radiant welding processes like Laser Beam welding and Electron Beam welding	Applications (Material processing, heat treatment, drilling/cutting, welding) (017101192-Unit-6.5)	LASER beam machining, LASER cutting (017103503 Unit -2.2) Electron beam machining, ion beam machining (017103503 Unit -2.3)	
	7.7 Defects in welding			
	<b>Jigs and Fixtures</b>			
08	8.1 Concept of Jigs and Fixtures and difference between them,	---	---	1 (2.5%)
	8.2 Design, principles, 3-2-1 Location principle (To be Covered in Lab)	---	---	
	8.3 Types of Locators and Clamps,	---	---	
	8.4 Jig bushes, Jigs and Fixtures for various machining operations	Classification of Material (017103404 Unit-1.2)	---	
	<b>Plastic Technology</b>			
09	9.1 Define Plastic processes and classification of polymers	Classification of Material (017103404 Unit-1.2)	---	4 (10%)
	9.2 Compression moulding and Transfer moulding process	Extrusion process, types, applications and defects (017103401-Unit-8.6)	---	
	9.3 Injection moulding, Extrusion moulding, Blow moulding Processes		---	
	9.4 Concepts of Calendaring, Thermoforming, Laminating, Packaging	---	---	
	<b>Metal Shaping and Forming Process</b>			
10	10.1 Classification of metal Shaping and Forming process	Hook’s law, Stress strain Characteristics(017103391 – Unit-1.3)	---	10 (25%)
	10.2 Concept of Elastic and Plastic deformation, Strain Hardening, Hot working and Cold working process	Stress and types of stress, Strain and types of strain(017103391 – Unit-1.2)	---	
	10.3 Forging process: Classification of forging, forging	Stress and types of stress, Strain and	---	

operations, types of hammer, types of press and forging defects	types of strain(017103391– Unit- 1.2)		
10.4 Rolling process: Basic definitions, classification of rolling processes, types of rolling mills, applications like roll piercing, ring rolling and thread rolling and defects in rolling processes.	Law of sines and cosines (017101191 - Unit- 2.5), Stress and types of stress, Strain and types of strain(017103391– Unit- 1.2)	---	
10.5 Calculation of roll bite angle and height reduction	Trigonometry and Geometry (017101191 - Unit-2.5)	---	
10.6 Extrusion process: Classification of extrusion processes, types of extrusion process and defects in extrusion process.	Stress and types of stress, Strain and types of strain(017103391– Unit- 1.2)	---	
10.7 Drawing Processes: Tube drawing and wire drawing			
10.8 Sheet metal process	Stress and types of stress, Strain and types of strain(017103391– Unit- 1.2)	---	
10.9 Types of die like simple, compound, combination, progressive, transfer and multiple die	---	---	

Major Components/ Equipment	
Sr. No.	Component/Equipment
1	Welding Kit (Helmet, Goggles, Gloves, Chipping hammer, scraper, apron)
2	Shield metal arc welding kit
3	Tungsten inert gas welding kit
4	Metal inert gas welding kit
5	Spot welding machine
6	Gas welding kit
7	Punching machine
8	Gases (acetylene, oxygen, helium & carbon dioxide)
9	Melting Furnace
10	Sand mixing machine (Sand Muller)
11	Mould Preparation Material (Sand, Bentonite, Pattern, Mould Box)

Sr No.	Practical Title	Link to Theory Syllabus
1	To prepare sand for sand casting process	Unit-2,3,4
2	To prepare mould for sand casting process	Unit-2,3,4
3	To melt the metal for the casting process	Unit-2,3,4
4	To prepare gating process for proper casting process	Unit-3
5	To perform shield metal arc welding	Unit-6
6	To perform metal inert gas welding	Unit-6
7	To perform tungsten inert gas welding	Unit-6
8	To perform gas welding	Unit-6
9	To perform spot welding	Unit-7
10	To perform punching operation on sheet metal	Unit-10

Proposed Theory + Practical Evaluation Scheme by Academicians (% Weightage Category Wise and it's Marks Distribution)					
<b>L :</b>	<b>4</b>	<b>T:</b>	<b>0</b>	<b>P:</b>	<b>2</b>
<b>Note : In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject. Each Test will be of 25 Marks. Each Test Syllabus Weightage: Range should be 20% - 30%</b>					
Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory	4	5	MCQ	54%	68
Theory			Theory Descriptive	22%	27
Theory			Formulas and Derivation	0%	0
Theory			Numerical	4%	5
<b>Expected Theory %</b>	<b>80%</b>		<b>Calculated Theory %</b>	<b>80%</b>	<b>100</b>

Practical	1		Individual Project	0%	0
Practical			Group Project	8%	40
Practical			Internal Practical Evaluation (IPE)	12%	60
Practical			Viva	0%	0
Practical			Seminar	0%	0
<b>Expected Practical %</b>			<b>20%</b>		<b>Calculated Practical %</b>
<b>Overall %</b>	<b>100%</b>			<b>100%</b>	<b>200</b>

### Course Outcome

	<i>Upon completion of the course students will be able to</i>
1	Apply the manufacturing process suitable for making products and knowledge regarding casting processes along with gating system.
2	Understand different casting processes and furnaces along with Joining Processes using Gas and Arc Welding.
3	Explain the various process in making of plastic components for engineering and domestic applications, various methods of jigs and fixtures and solid state, radiant energy and thermochemical welding processes.
4	Understand the various forming processes.

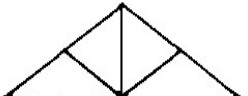


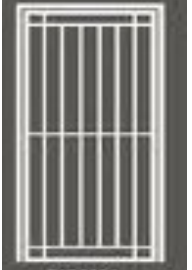

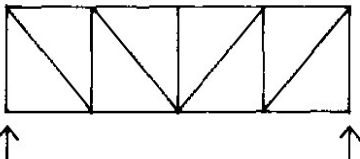
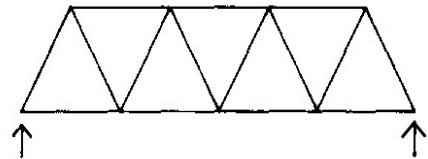
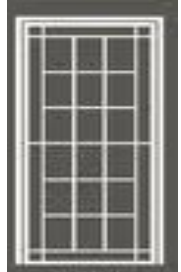
### Suggested Reference Books

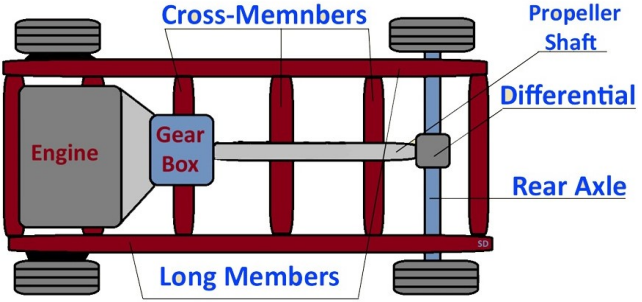

1	Textbook of Production Engineering by P. C. Sharma, S Chand
2	Production Technology Vol-II by O. P. Khanna and Lal, Dhanpat Rai
3	Elements of Production Technology –Vol. II, Hajra Choudhary et al, Asia Publishing House, 2000.
4	Plastics materials and Processes, Seymour S. Schwartz and Sidney H. Goodman, Van Nostrand Reinhold Company, New York, 1982.
5	Manufacturing Engg. And Technology By S. Kalpakajain, PHI/Pearson.
6	Production technology, by R.K. Jain, Khanna publishers.

### List of Open Source Software/Learning website

1	<a href="http://nptel.ac.in/">http://nptel.ac.in/</a>
2	<a href="http://E_foundry.iitb.ac.in">E foundry.iitb.ac.in</a>
3	<a href="http://www.twi-global.com">www.twi-global.com</a>

### Practical Project/Hands on Project

Sr. No.	Project List	Linked with Unit
1	Make 1 to 10 numbers from sheet metal.	Unit 07
2	Make L, V, T, X and C using SMAW welding	Unit 06
3	Make any type of statue using sand casting.	Unit 02, 03, 04
4	   Design truss using suitable welding technique.	Unit 06
5	 Prepare a door structure using welding technique.	Unit 06
6	 Prepare handles of door using sand casting process.	Unit 02, 03, 04
7	  Design truss using suitable welding technique.	Unit 06
8	 Prepare a door structure using welding technique.	Unit 06

<p>9</p>	<p>Automobile chassis frame using gas welding</p>	 <p>Unit 06</p>
<p>10</p>	<p>Make cloth hanging stand using suitable welding technique.</p>	 <p>Unit 06</p>