FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Mechanical Engineering)**

Semester: **IV**

Course Code: **202090403**

Course Title: **Manufacturing Technology**

Course Group: **Professional Core Course - VI**

Course Objectives: This course is designed to develop the fundamental knowledge and skills to manufacture a product using various processes like Casting, Welding and Forming processes.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Manufacturing principles and processes**: Concept of manufacturing, Production Method; Manufacturing Processes-Classification, selection of process, manufacturing cost; modern concepts of manufacturing	03
2	**Metal-Casting Processes and equipment**: Patterns-types, material, allowances, pattern colours; cores- types, materials, core making, core print, core boxes; moulding materials, moulding sands - properties and sand testing; grain fineness; moisture content, clay content and permeability test; melting, refining, and pouring of liquid metal, types of furnaces, fluidity Gating systems for casting- elements of gating system, gating ratios, aspiration effects and its prevention, risering design – Caine's method, modulus method and NRL method, Chvorinov's rule, numerical on solidification time and riser design. Fettling of casting; defects in casting, its remedies and quality consideration Special Casting Processes: Shell moulding, investment casting, die casting (hot chamber and cold chamber process, vacuum, low-pressure), centrifugal casting and continuous casting.	15

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3	**Metal Joining Processes**: Fabrication Methods, terminology of welding, classification, types of welding joints, welding positions, mechanism of weld formation, Welding arc characteristics, Basic requirements of welding, comparison between welding, soldering and brazing. Gas welding, Electric Arc welding: Arc welding power sources and their characteristics, Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Gas Tungsten Arc Welding (GTAW), Submerged Arc Welding (SAW), Resistance Welding: Spot welding, Seam welding, Projection Welding, Electrode Materials, and Shapes of Electrodes. Other Fabrication Processes: Thermit Welding, Electro slag welding, Electron Beam Welding, Laser Beam Welding, Solid State Welding: Diffusion Welding, Friction Welding, Friction stir welding Causes and Remedies of Defects in Welding Thermal Cutting Process: Oxy-Acetylene gas cutting - mechanism of cutting, effect of process variables, applications; Plasma arc cutting, LASER Beam cutting processes.	**15**
4	**Metal Forming Processes**: Material behavior in metal forming, strain hardening, Bauschinger effect, hot and cold working, rolling process: principle, rolling mills, roll pass sequence, defects in rolled plates and sheets, extrusion: direct, indirect and hydrostatic extrusion, metal forging - methods, forging hammers and presses, principle of forging tool design, defects in forgings, extrusion; wire, tube and strip drawing processes. Sheet metal forming operations: press tool, shearing action, bending, deep drawing, Coining and embossing.	**09**
5	**High energy rate and newer forming processes**: Explosive, Electro-hydraulic, Magnetic pulse forming, forming by laser beam, Die-less forming	**03**

List of Practicals / Tutorials:

1	To appreciate the effect of clay content on the permeability, hardness and (Compression and shear) strength of moulding sand.
2	To appreciate the effect of moisture content on the permeability, hardness and (Compression and shear) strength of moulding sand.
3	To determine the effect of moisture and clay content on flowability.
4	Develop the procedure for producing the mould, ready for pouring, for a given pattern.
5	To understand Oxy-Acetylene Welding, Welding Flames, Welding Techniques and testing for weld quality.
6	To determine the optimal setting for oxy-acetylene flame cutting with a given nozzle and a given plate thickness by trying various combinations of parameters viz. cutting speed, oxygen pressure, nozzle-to-plate distance.
7	To study effect of varying arc welding variables like arc voltage, arc current and welding speed on bead characteristics for a shielded metal arc welding (SMAW) process.
8	To study effect of varying arc welding variables like arc voltage, arc current and welding speed on bead characteristics for a submerged arc welding (SAW) process.
9	To study effect of varying arc welding variables like arc voltage, arc current and welding speed on bead characteristics for a gas tungsten arc welding (GTAW) process.

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10	Spot Welding Heat Balance and Weld Testing.

Reference Books:

1	S. Kalpakjian, Manufacturing Engineering and Technology, Pearson, 2009.
2	Ronald A Kohser, DeGarmo's materials and processes in manufacturing, John Wiley and Sons, 2013.
3	R.W. Heine, C. R. Loper and P.C. Rosenthal, Principles of Metal Casting, Tata McGraw-Hill, 2017.
4	Robert H. Wagoner and Jean-Loup Chenot, Fundamentals of Metal Forming, John Wiley and Sons, 1996.
5	G. K. Lal, P. M. Dixit and N. Venkata Reddy, Modelling Techniques for Metal Forming Processes, Narosa Publishing House, 2011
6	P.N. Rao, Manufacturing Technology Vol – II, Tata Mcgraw Hill, 2013.
7	R. S. Parmar, Welding Processes and Technology, Khanna Publishers, Delhi, 2003.
8	O. P. Khanna, A Text book of Welding Technology, Dhanpat Rai Publications, 2015.

Supplementary learning Material:	
1	NPTEL Resources

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Industrial/ Field visits

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20%	25%	25%	10%	10%	10%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Identify process capabilities, process parameters and design aspects of casting technology.	**30**
CO-2	Illustrate their knowledge to select proper welding conditions, power sources and equipment for performing welding to any part.	**30**

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CO-3	Analyse different metal forming processes along with their characteristics and limitations for wide range of engineering applications.	**30**
CO-4	Understand and evaluate the effect of operating parameters for a given process to avoid defect and improve quality.	**10**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025

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