SEMESTER S4

MANUFACTURING PROCESSES

Course Code	PCPET402	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To provide students with a comprehensive understanding of various manufacturing processes, including casting, forming, machining, joining, and additive manufacturing.
2. To enhance students' problem-solving skills by applying engineering principles to address real-world manufacturing challenges.

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Overview of casting processes, Advantages and limitations of casting, Classification of casting processes, solidification. Mold Design and Gating Systems ,Principles of mould design considerations for moulds and cores ,Gating systems: types and design, Riser design and solidification time calculation, Use of chills and chaplets. Types of sand moulds and their properties ,Properties of moulding sands, Pattern making and types of patterns, Core making and core materials, Steps in the sand casting process, Advantages and disadvantages of sand casting	11

	Special Casting Processes : Investment casting (lost wax process),Die casting, Centrifugal casting, Shell moulding, Continuous casting, Squeeze casting Casting defects: Porosity, Shrinkage ,Inclusions Cold shuts ,Misruns, Hot tears, Surface cracks ,Blowholes, Sand inclusions, Runout	
2	Metal joining: classification; welding heat sources; fusion and non-fusion welding processes; gas welding; electric arc welding; arc welding machines; physics of welding arc, polarity; arc production; arc characteristics; metal transfer; arc blow; welding electrode; consumable and non-consumable arc welding, SMAW; GTAW; GMAW; SAW; AHW; PAW; resistance welding; electro slag welding; thermit welding; solid state welding; Welding metallurgy: Heat Affected Zone; weldability of ferrous and non-ferrous metals; design of weldments; joint design; residual stresses and distortion; defects in welding; testing of welded joints; brazing and soldering, beam welding; solid state welding; welding metallurgy: Heat Affected Zone; weldability of ferrous and non-ferrous metals; residual stresses and distortion; defects in welding; testing of welded joints; brazing ,soldering and braze welding.	**11**
3	Powder metallurgy: Introduction to powder metallurgy, Applications, powder fabrication methods, metallic and ceramic powders, microstructural control, powder characterization, powder treatment: mixing granulation, degassing, coating; Powder compaction and sintering. Principles of sintering: solid state sintering, liquid phase sintering mechanisms: diffusion, vapor phase transport, viscous flow Sintering atmospheres and their effects Secondary operations: machining, heat treatment, surface finishing Hot isostatic pressing (HIP) Infiltration and impregnation Joining techniques for powder metallurgy components	**11**
4	Advanced manufacturing process: Abrasive jet machining (AJM),Water jet machining (WJM),Abrasive water jet machining(AWJM),Electrochemical	**11**

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	machining (ECM),Electro discharge machining (EDM), Electron beam machining (EBM)and electron beam welding(EBW),Laser beam machining (LBM)and processes, laser beam welding (LBW),ultrasonic welding (USW)	

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcomes		Bloom's Knowledge Level (KL)
CO1	Demonstrate a fundamental understanding of various manufacturing processes such as casting, forming, machining, joining, and additive manufacturing.	**K3**
CO2	Evaluate and select appropriate manufacturing processes for different materials and product designs.	**K3**
CO3	Analyze and solve manufacturing-related problems by applying engineering principles and techniques.	**K3**
CO4	Operate and handle manufacturing equipment and tools safely and effectively.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

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CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**
CO3	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Modern Manufacturing: Materials, Processes, and Systems	Mikell P. Groover	Wiley	5th Ed. 2012
2	Manufacturing Engineering and Technology	Serope Kalpakjian and Steven Schmid	Pearson	7th Ed. 2017
3	Manufacturing Science	Ghosh and Mallik	East West Press.	2nd Ed. 2010
4	Manufacturing Technology: Foundry, Forming and Welding	P.N. Rao	McGraw Hill Education	4th Ed. 2017

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Materials and Processes in Manufacturing,	DeGarmo, Black, and Kohser	Wiley	3rd Ed. 2017
2	Product Design for Manufacture and Assembly	G. Boothroyd, P. Dewhurst, and W. Knight	CRC Press	3rd Ed. 2010
3	Welding Engineering and Technology	Dr. R.S. Parmar	McGraw Hill Education	4th Ed. 2017