SEMESTER S8

METAL ADDITIVE MANUFACTURING

Course Code	PEMET867	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Nil	Course Type	Theory

Course Objectives:

1. To understand IoT and digital manufacturing demands for quicker and modular manufacturing solutions
2. To familiarise the current status of metal AM basics, materials, processes, and major important related aspects.

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Additive Manufacturing (AM)– Process, Materials, Applications- Modular Design and Topology–Customization, Efficiency, Scalability - Design freedom in AM– Complex Geometries, Lightweight Structures, Material Efficiency -Benefits of Topology Design Freedom– Performance Enhancement, Innovation, Sustainability	9
2	CAD for AM, Integration of CAD with Additive Manufacturing, Design for AM, Topology Optimization, Metal AM physics and processes – PBF, DED, Binder Jetting, Sheet Lamination. Laser and Extrusion – SLS, SLM, DMLS, FDM, Robocasting. Metal AM processes, Filament, Powder and Sheet Systems, Metal AM as an Extension of Welding Techniques (GTAW/GMAW).	9
3	Metal AM physics and processes, Directed Energy, Binder and Material Jetting Feedstocks, Metallurgy and properties of materials– Microstructure, Mechanical, Thermal and Chemical Properties, Post processing and testing –	9

	Heat Treatment, Hot Isostatic Pressing, Machining, Surface Treatment and NDT Methods.	
4	Reverse Engineering for metal AM, Data Handling, Simulation and Analysis, Modelling for AM –Support Structures, Functional Integration, Value analysis – Cost, Time, Performance and Sustainability -Future of metal AM	**9**

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 Outcome		Bloom's Knowledge Level (KL)
CO1	To study the basic Metal Additive Manufacturing Techniques	**K2**
CO2	To understand the features and control of various MAM Methods	**K2**
CO3	To familiarize the metallurgy of MAM Processes.	**K3**
CO4	To study the relation between reverse engineering and additive manufacturing.	**K2**

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

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

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

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

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Additive Manufacturing of Metals: The Technology, Materials, Design and Production	Li Yang, Pan Michaleris	Springer	

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Additive Manufacturing of High-Performance Metals and Alloys	Robert Pederson, Matthew S. Sokolov, Chao Ma	IntechOpen	
2	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Ian Gibson, David W. Rosen, Brent Stucker, MahyarKhorasani	Springer	

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://youtu.be/hOkV4Uo_w2Y
2	https://youtu.be/G9T9MkbjB68
3	https://youtu.be/_V_CUDPSzJE
4	https://youtu.be/EyEg57tlS1k

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