



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	MANUFACTURING PROCESSES				
Course Code	AMEB05				
Programme	B.Tech				
Semester	III	ME			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	1	4	2	1
Chief Coordinator	Mr. G. Aravind Reddy, Assistant Professor,				
Course Faculty	Mr. G. Aravind Reddy, Assistant Professor, Mr. V. Mahidhar Reddy, Assistant Professor				

I. COURSE OVERVIEW:

The primary objective of this course is to introduce the concept of manufacturing technology with the help of various processes widely employed in industries. The course consists of casting, welding, sheet metal forming, extrusion and forging processes with the related details of equipment and applications. Introduces the different manufacturing processes and breakeven analysis. Engineering materials, laying emphasis on ferrous and non-ferrous materials along with the heat treatment of metals. Discusses the special casting processes and metal-forming processes respectively.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AMEB01	II	Workshop Manufacturing Practices Laboratory	1.5

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Manufacturing Processes	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✗	Chalk & Talk	✓	Quiz	✓	Assignments	✗	MOOCs
✓	LCD / PPT	✓	Seminars	✗	Mini Project	✓	Videos
✗	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with “either” or “choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory			Total Marks
	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Presentation on real-world problems
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Seminar
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Term Paper

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	Professional Skills: To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	1	Seminar
PSO 2	Software Engineering Practices: An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	-	-
PSO 3	Successful Career and Entrepreneurship: To build the nation, by imparting technological inputs and managerial skills to become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES:

The course should enable the students to:	
I	Understand and develop an appreciation of the manufacturing processes in correlation with material properties.
II	Learn the material properties which change the shape, size and form of the raw materials into the desirable product.
III	Understand the processes for creating products by conventional or unconventional manufacturing methods.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Describe the concept of manufacturing and material, design and properties of casting.	CLO 1	Understand and various manufacturing processes used in various industries
		CLO 2	Explain the steps involved in casting processes.
		CLO 3	Use design principles to in cooperate sprue, runner, gates, and risers in foundary practice
		CLO 4	Evaluate properties of sand for use in sand casting.
		CLO 5	Solve problems and find methods to rectify casting defects.
CO 2	Understand the functions of casting defects, welding and industrial concepts.	CLO 6	Demonstrate the preparation of moulds for various casting processes.
		CLO 7	Describe applications of various casting processes
		CLO 8	Explain principles of welding, brazing and soldering processes.
		CLO 9	Demonstrate use of welding equipment for various industrial applications.

COs	Course Outcome	CLOs	Course Learning Outcome
CO 3	Understand the working of design related and causes and NDT techniques systems.	CLO 10	Demonstrate use of Brazing and soldering equipment for various industrial applications.
		CLO 11	Explain design of welded joints, residual stresses, distortion and control
		CLO 12	Explain causes and remedies of welding defects
		CLO 13	Compare destructive and non-destructive testing techniques.
CO 4	Explore the concept of heat inputs and rapid prototyping, sheet metal and forging	CLO 14	Understand the effect of heat input in welds
		CLO 15	Understand the concepts to Additive manufacturing.
		CLO 16	Understand the importance of sheet metal forming, bending, and deep drawing.
		CLO 17	Compare extrusion and forging processes to identify advantages and limitations.
CO 5	Classification of various manufacturing processes for industrial applications and their use in real world competition	CLO 18	Enable students to understand various manufacturing processes for industrial applications.
		CLO 19	Enable students to understand importance of manufacturing for lifelong learning, Higher Education and competitive exams.

X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AMEB05.01	CLO 1	Understand and various manufacturing processes used in various industries	PO 1	3
AMEB05.02	CLO 2	Explain the steps involved in casting processes	PO 2	2
AMEB05.03	CLO 3	Use design principles to in cooperate sprue, runner,gates,and risers in foundary practice.	PO 1	3
AMEB05.04	CLO 4	Evaluate properties of sand for use in sand casting	PO 1	3
AMEB05.05	CLO 5	Solve problems and find methods to rectify casting defects.	PO 2	2
AMEB05.06	CLO 6	Demonstrate the preparation of moulds for various casting processes.	PO 2	2
AMEB05.07	CLO 7	Describe applications of various casting processes	PO 2	2
AMEB05.08	CLO 8	Explain principles of welding, brazing and soldering processes	PO 2	2
AMEB05.09	CLO 9	Demonstrate use of welding equipment for various industrial applications.	PO 4	1
AMEB05.10	CLO 10	Demonstrate use of Brazing and soldering equipment for various industrial applications.	PO 4	1
AMEB05.11	CLO 11	Explain design of welded joints, residual stresses, distortion and control	PO 2	2
AMEB05.12	CLO 12	Explain causes and remedies of welding defects.	PO 2	2
AMEB05.13	CLO 13	Compare destructive and non-destructive testing techniques.	PO 1	3
AMEB05.14	CLO 14	Understand the effect of heat input in welds	PO 1	3
AMEB05.15	CLO 15	Understand the concepts to Additive manufacturing.	PO 1	3
AMEB05.16	CLO 16	Understand the importance of sheet metal forming, bending, and deep drawing.	PO 1, PO 2	3
AMEB05.17	CLO 17	Compare extrusion and forging processes to identify advantages and limitations.	PO 1, PO 2	3
AMEB05.18	CLO 18	Enable students to understand various manufacturing processes for industrial applications.	PO 1, PO 2	3
AMEB05.19	CLO 19	Enable students to understand importance of	PO 1,	3

		manufacturing for lifelong learning, Higher Education and competitive exams.	PO 2	
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XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)			
	PO 1	PO 2	PO 4	PSO1
CO 1	3	2		1
CO 2		2	1	
CO 3	3	2	1	
CO 4	3	2		1
CO 5	3	2		1

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XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												1		
CLO 2		2													
CLO 3	3												1		
CLO 4	3												1		
CLO 5		2													
CLO 6		2													
CLO 7		2													
CLO 8		2													
CLO 9				1											
CLO 10				1											
CLO 11		2													
CLO 12		2													
CLO 13	3														
CLO 14	3												1		

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 15	3														
CLO 16	3	2											1		
CLO 17	3	2											1		
CLO 18	3	2											1		
CLO 19	3	2											1		

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XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO4, PSO1	SEE Exams	PO1, PO2, PO4, PSO1	Assignments	-	Seminars	PO1, PO2, PO4, PSO1
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO1, PO2, PO4, PSO1						

XIV. ASSESSMENT METHODOLOGIES - INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

XV. SYLLABUS

Module-I	CASTING
Casting: Steps involved in making a casting, its applications, patterns and types of patterns, pattern allowances and their construction, types of casting processes, solidification of casting..	
Module-II	WELDING
Welding: Welding types, Oxy-fuel gas welding, cutting, standard time and cost calculations, arc welding Process, forge welding, resistance welding, thermit welding. Inert gas welding, TIG welding, MIG welding, friction welding, induction pressure welding, explosive welding, electron beam welding, laser welding, soldering and brazing. Heat affected zone in welding, welding defects, causes and remedies, destructive and non-destructive testing of welds.	
Module-III	METAL FORMING
Forming: Hot working, cold working, strain hardening, recovery, re-crystallization and grain growth, comparison of properties of cold and hot worked parts, rolling fundamentals, theory of rolling, types of rolling mills and products; Forces in rolling and power requirements, stamping, forming and other cold.	
Working processes: Blanking and piercing, bending and forming, drawing and its types, wire drawing and tube drawing; coining; hot and cold spinning, types of presses and press tools, forces and power requirements for the above operations.	

Module-IV	EXTRUSION AND RAPID PROTOTYPING
Extrusion of Metals: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, forward extrusion and backward extrusion, impact extrusion, extruding equipment, tube extrusion and Pipe making, hydrostatic extrusion, forces in extrusion; Additive manufacturing: Rapid prototyping and rapid tooling.	
Module-V	FORGING
Forging processes: Forging operations and principles, tools, forging methods, Smith forging, drop forging, roll forging, forging hammers: Rotary forging, forging defects, cold forging, swaging, forces in forging operations.	
Text Books:	
1. Kalpakjian and Schmid, Manufacturing processes for engineering materials -Pearson India, 5 th Edition 2014.	
Reference Books:	
1. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems John Wiley & Sons Inc., 4th Edition, 2008. 2. Degarmo, Black & Kohser, Materials and Processes in Manufacturing (9th Edition) John Wiley & Sons Inc., 7 th Edition, 2012.	

XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Introduction to manufacturing processes.	CLO 1	T2:2.3
2	Review on casting and pattern	CLO 1	R1:2.6
3	Discuss the casting processes and their types	CLO 2	T1:2.6
4	Describe the solidification of casting	CLO 2	T2:2.7 R1:2.18
5	Describe the welding techniques	CLO 3	T2:2.22
6	Discuss the effect of TIG and MIG welding	CLO 3	T2:2.25
7	Discuss the effect of Heat affected zone in welding	CLO 3	T2:2.26 R1:2.55
8	Discuss the welding defects	CLO 4	T2:2.16 R1:2.61
9	Discuss the causes and remedies	CLO 4	T2:2.30 R1:2.58
10	Introduction to destructive and non-destructive testing of welds.	CLO 5	T2:3.6 R1:4.29
11	Classifying and Demonstration of metal forming	CLO 5	T2:3.14 R1:4.31
12	Discuss the hot and cold working.	CLO 6	T2:3.14 R1:4.33
13	Discuss the strain hardening recovery & recrystallization	CLO 6	R1:4.36
14	Comparison of properties of cold and hot worked parts	CLO 6	T2:3.18 R1:4.64
15	Introduction to rolling	CLO 7	T2:3.22
16	Demonstration of working of rolling operations	CLO 7	T2:3.28 R1:4.67

17	Classifying rolling types.	CLO 8	T2:4.2
18	Demonstration of rolling theory	CLO 8	T2:4.3 R1:4.71
19	Introduction to mills and products and stamping	CLO 9	T1:4.8 R2:4.68
20-21	Demonstration of forces in rolling and their calculations	CLO 9	T2:4.15 R1:5.74
22	Discuss stamping forming and other cold operations.	CLO 10	T1:4.12 R2:5.75
23-24	Explanation of blanking and piercing operations	CLO 11	T1:4.8 R1:5.72
25	Introduction to drawing and its types.	CLO 12	T1:5.8 R1:5.73
26-27	Discuss the wire and tube drawing techniques	CLO 12	T1:5.14 R1:6.78
28	Explain extrusion of metals	CLO 13	T2:5.19 R1:6.81
29-30	Discuss the characteristics of extrusion types	CLO 13	T1:6.4 R2:6.8
31	Describe the importance of impact and extruding equipment.	CLO 14	T2:7.7 R1:7.74
32-33	Describe hydrostatic extrusion, forces in extrusion	CLO 14	T1:7.12 R2:8.75
34	Introduction to Additive manufacturing	CLO 15	T1:7.8 R1:8.72
35	Draw & Describe Forging operations and principles	CLO 15	T1:8.8 R1:8.73
36	Discuss the tools, forging methods.	CLO 16	T1:9.14 R1:10.78
37-38	Describe the Smith forging, drop forging	CLO 17	T2:9.19 R1:10.814
39-40	Describe the importance of roll forging, forging hammers.	CLO 18	T1:10.4 R2:11.68
41-43	Discuss the rotary forging, forging defects	CLO 19	T2:10.7 R1:12.74
44-45	Describe the cold forging, swaging, forces in forging operations.	CLO 19	T1:11.12 R2:12.75

XVII. GAPS IN THE SYLLABUS-TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSO s
1	To improve standards and analyze the concepts.	Seminars	PO 1	PSO 1
2	To understand the technology of advanced manufacturing techniques and additive manufacturing, etc.	Seminars / NPTEL	PO 4	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL	PO 2	PSO 1

Prepared by:

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HOD, ME