INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

MECHANICALENGINEERING

COURSE DESCRIPTOR

Course Title	**PRODUCTION ENGINEERING**				
Course Code	AME006				
Programme	B.Tech				
Semester	IV	ME			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	3	2
Chief Coordinator	Dr. G. Naveen Kumar, Professor, ME				
Course Faculty	Dr. G. Naveen Kumar, Professor, ME Mr. C. LabeshKumar, Assistant Professor , ME				

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	AME005	III	Metallurgy and material science	3

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Production Technology	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 units and each unit 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 unit. 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 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	**Theory**		**Total Marks**
Type of Assessment	CIE Exam	Quiz / AAT	
CIA Marks	25	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 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five 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 / Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

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 3	**Design / development of solutions:** Competence to design a system, component or process to meet societal needs within realistic constraints.	2	Assignments
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.	2	Seminar
PO 5	**Modern tool usage:** An ability to formulate solve complex engineering problem using modern engineering and information Technology tools.	1	Seminar

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.	3	Assignments
PSO 2	**Problem solving skills:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	2	Projects
PSO 3	**Successful career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become technocrats.	1	Guest Lectures

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Comprehensive understanding of different manufacturing processes for product development.
II	Apply casting, metal joining and forming processes for various industries.
III	Select process parameters, equipment for material processing

IX. 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
AME006.01	CLO 1	Understand various manufacturing processes used in various industries.	PO 1	3
AME006.02	CLO 2	Explain the steps involved in casting processes	PO 1	3

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AME006.03	CLO 3	Use design principles to incorporate sprue, runner, gates, and risers in foundry practice.	PO 1	3
AME006.04	CLO 4	Evaluate properties of sand for use in sand casting.	PO 2	2
AME006.05	CLO 5	Solve problems and find methods to rectify casting defects.	PO 2	2
AME006.06	CLO 6	Demonstrate the preparation of moulds for various casting processes	PO 2	2
AME006.07	CLO 7	Describe applications of various casting processes	PO 4	1
AME006.08	CLO 8	Explain principles of welding, brazing and soldering processes.	PO 4	1
AME006.09	CLO 9	Demonstrate use of welding equipment for various industrial applications.	PO 5	2
AME006.10	CLO 10	Demonstrate use of Brazing and soldering equipment for various industrial applications.	PO 5	2
AME006.11	CLO 11	Explain design of welded joints, residual stresses, distortion and control.	PO 3	3
AME006.12	CLO 12	Explain causes and remedies of welding defects.	PO 3	3
AME006.13	CLO 13	Compare destructive and non-destructive testing techniques.	PO 3	3
AME006.14	CLO 14	Understand the effect of heat input in welds.	PO 1, PO 5	3
AME006.15	CLO 15	Understand the importance of sheet metal forming, bending, and deep drawing.	PO 2	2
AME006.16	CLO 16	Compare extrusion and forging processes to identify advantages and limitations.	PO 2	2
AME006.17	CLO 17	Enable students to understand various manufacturing processes for industrial applications.	PO 1, PO 2	3
AME006.18	CLO 18	Enable students to understand importance of manufacturing for life long learning, Higher Education and competitive exams.	PO 1, PO 5	3

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC 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	2											1		
CLO 2	3	2											1		
CLO 3		3	2											1	
CLO 4			2		2								3		
CLO 5		1	3										2		
CLO 6		1			2								2		

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 7			3	2										1	
CLO 8	3		3	2	3								2		
CLO 9		3													
CLO 10	3			3										3	
CLO 11	2	2		3										2	
CLO 12	3			3	2								2		
CLO 13	3		3	3										2	
CLO 14				3	2									2	
CLO 15	3	2	3	3									2	3	
CLO 16	3	2	3		3									2	
CLO 17	2	2			3									2	
CLO 18		3												2	

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO 1, PO 2, PO 3, PO 4, PO 5	SEE Exams	PO 1, PO 2, PO 3, PO 4, PO 5	Assignments	PO 3	Seminars	PO 2, PO 4, PO 5
Laboratory Practices	PO 3	Student Viva	PO 3	Mini Project	-	Certification	-

XII. ASSESSMENT METHODOLOGIES-INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✔	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Unit-I	CASTING	Classes:09
Casting: Steps involved in making a casting, it's applications, patterns and types of patterns, pattern allowances and their construction, types of casting processes, solidification of casting.		
Unit-II	**WELDING-I**	**Classes:09**
Welding: Welding types, Oxy-fuel gas welding, cutting, standard time and cost calculations, arc welding process, forge welding, resistance welding, thermit welding		

Unit-III	WELDING-II	Classes:09
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.		
Unit-IV	**FORMING**	**Classes:09**
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.		
Unit-V	**EXTRUSION, FORGING**	**Classes:09**
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; 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. P. N. Rao, "Manufacturing Technology", Tata McGraw-Hill, 2ndEdition,2013. 2. Hajra Chowdhary, "Workshop Technology", Asia Publishing House, 2ndEdition,2008.		
Reference Books:		
1. Sarma P C, "Production Technology", S.Chand& CO, New Delhi, 7thEdition,2006. 2. R. K. Jain, "Production Technology", Khanna Publishers, 17thEdition,2013. 3. T. V. Ramana Rao, "Metal Casting", New Age, 1stEdition,2010. 4. Philips Rosenthal, "Principles of Metal Castings", Tata McGraw-Hill, 2ndEdition,2001. 5. B. S. Raghuwamshi, "A Course in Workshop Technology", Dhanpat Rai & Sons,2014. 6. Kalpakjain S, "Manufacturing Engineering and Technology", Pearson Education,7thEdition,2014. 7. HMT, "Production Technology", McGraw-Hill Education, 1stEdition,2013.		

XIV. 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
1-4	Define principle of casting process	CLO 1	T1:3.1 R1:3.1
5-7	Examine various types of pattern designs	CLO 1	T1:3.2.5 R1:3.3.4
8-10	Relate various types of casting processes	CLO 1	T1:3.1.5 R1:3.1.3
11-14	Describe the principles of welding processes	CLO 2	T1:9.1 R1:5.1
15-16	Compare various flames	CLO 2	T1:9.2.1 R1:5.2.3
17-20	Explain arc,forge and resistance welding	CLO 3	T1:9.4.2 R1:5.3
21-23	Explain Inert gas welding, welding processes	CLO 3	R2:9.16 R6:27.5

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
24-26	Discuss various types of advances welding processes	CLO 4	R2:9.16.12 R6:27.1
27-28	Define brazing and soldering	CLO 5	R2:9.64 R6:30.2
29-30	Describe defects and evaluation	CLO 5	R2:9.55 R6:29.3
31-32	Describe hot and cold working	CLO 6	T1:7.1.1 R1:4.6
33-34	Discuss recrystallization and grain growth	CLO 7	T1:7.1 R1:3.6.1
35	Compare cold and hot working	CLO 8	T1:7.1.1 R1:4.6
36-37	Discuss Rolling	CLO 8	T1:7.2 R1:4.2
38	Explain Blanking and piercing processes	CLO 9	T1:8.3 R6:6.5
39	Discuss bending and forming	CLO 9	T1:8.7 R1:4.8.12
40-41	Discuss wire and tube drawing	CLO 10	T1:8.4 R1:4.5
42	Explain coining	CLO 11	T1:8.9 R1:4.8.15
43-44	Discuss hot and cold spinning	CLO 12	T1:8.6 R1:4.8.15
45-47	Explain various types of Press tools	CLO 12	T1:8.1 R1:4.8.6
48-49	Explain extrusion process	CLO 13	T1:7.4 R1:4.4
50-52	Compare hot and cold extrusion	CLO 14	T1:7.4.2 R1:4.4.1
53-55	Explain equipment used for extrusion of pipes	CLO 15	T1:7.4.4 R1:4.4.2
56-57	Discuss forging processes	CLO 16	T1:7.3 R1:4.3
58-59	Explain drop and roll forging	CLO 17	T1:7.3.3 R1:4.3.2
59-60	Discuss forces in forging operations	CLO 18	T1:7.3.5 R1:4.3.6

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

S NO	Description	Proposed Actions	Relevance with POs	Relevance with PSOs
1	Advances in manufacturing processes	Seminars / Guest Lectures / NPTEL	PO 1, PO 2, PO 3	PSO 1
2	Interaction of materials and manufacturing processes	Seminars / Guest Lectures / NPTEL	PO 2, PO 5	PSO 2
3	Recommended practices in casting, welding, and forming	Assignments / Laboratory Practices	PO 1, PO 3, PO 4	PSO 2

Prepared by:
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