



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## MECHANICAL ENGINEERING

### COURSE DESCRIPTION FORM

<b>Course Title</b>	<b>MACHINE TOOLS</b>			
<b>Course Code</b>	<b>A50321</b>			
<b>Regulations</b>	<b>R13-JNTUH</b>			
<b>Course Structure</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>	<b>Credits</b>
	4	1	-	4
<b>Course Coordinator</b>	Mr. C. Labesh Kumar, Assistant Professor			
<b>Team of Instructors</b>	Mr. C. Labesh Kumar, Assistant Professor, Mr. M. Prashanth Reddy, Assistant Professor			

#### I. COURSE OVERVIEW

Machine Tool Technology is an instructional program that prepares individuals to shape metal parts on machines such as lathes, grinders, drill presses, milling machines and shapers. This program includes instruction in safety, making computations related to work dimensions testing feeds and speeds of machines using precision measuring instruments.

#### II. PREREQUISITE(S)

Level	Credits	Periods	Prerequisite
UG	4	4	Production Technology, Kinematics of Machinery, Mechanics of Solids, Metallurgy and Material Science, Thermodynamics, Engineering Drawing, Machine Drawing

#### III. MARKS DISTRIBUTION

Sessional Marks	University End Exam Marks	Total Marks
<p>There shall be 2 midterm examinations. Each midterm examination consists of subjective type and Objective type tests. The subjective test is for 10 marks, with duration of 1 hour. Subjective test of each midterm exam shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective type test is for 10 marks with duration of 20minutes. It consists of 10 Multiple choice and 10 objective type questions. The student has to answer all the questions and each carries half mark.</p> <p>First midterm examination shall be conducted for the first 2 ½ units of syllabus and second midterm examination shall be conducted for the remaining 2 ½ units.</p> <p>Five marks are earmarked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course reason whatsoever, will get zero marks(s).</p>	75	100

#### IV. EVALUATION SCHEME

S.No	Component	Duration	Marks
1	I Mid examination	90 minutes	20
2	I Assignment	--	05
3	II Mid examination	90 minutes	20
4	II Assignment	--	05
5	External examination	3 hours	75

#### V. COURSE OBJECTIVES

- I. **Understand** the basic parameters in the metal cutting operation Appreciate different types of chips formed in metal cutting ,their relevance in manufacturing
- II. **Calculate** analytically the forces and other parameter associated with orthogonal cutting Understand tool wear and tool life and the variables that control them
- III. **Understand** the various cutting fluids and their application methods
- IV. **Understand** the importance of lathe, its many varieties and basic structure of center lathe Choose various aids that are used to locate and support work pieces in a lathe.
- V. **Understand** the various methods used to carry out the taper turning operations and thread cutting operations in a lathe .Utilize the capstan and turret lathe for different parts Understand different types of automatic lathe and their application methods. Understands operation of shaper, slotter and planer.

#### VI. COURSE OUTCOMES

**After completing this course the student must demonstrate the knowledge and ability to:**

1. **Understand** about the basic parameters in the metal cutting operation
2. **Calculate** analytically the forces and other parameter associated with orthogonal cutting.
3. **Describe** about various cutting fluids and their application methods
4. **Understand** about working principles of different metal cutting machines .
5. **Understand** about the importance of lathe, its many varieties and basic structure of center lathe.
6. **Understand** about operation of shaper machines
7. **Understand** about operation of slotter
8. **Understand** about operation of planer
9. **Understand** about operation of drilling machine.
10. **Classify** the various types of milling machine
11. **Understand** about operation of boring machines
12. **Understand** about operation of grinding machine

#### VII. HOW PROGRAM OUTCOMES ARE ASSESSED

Program outcomes		Level	Proficiency assessed by
PO1	Capability to apply the knowledge of mathematics, science and engineering in the field of mechanical engineering.	H	Assignments and Tutorials
PO2	An ability to analyze complex engineering problems to arrive at relevant conclusion using knowledge of mathematics, science and engineering.	H	Tutorials
PO3	Competence to design a system, component or process to meet societal needs within realistic constraints.	S	Exams
PO4	To design and conduct research oriented experiments as well as to analyze and implement data using research methodologies.	S	Mini Projects
PO5	An ability to formulate solve complex engineering problem using modern engineering and information Technology tools.	H	Assignments, Exams

PO6	To utilize the engineering practices, techniques, skills to meet needs of the health, safety, legal, cultural and societal issues.	N	Assigning Mini Projects
PO7	To understand impact of engineering solutions in the societal context and demonstrate the knowledge for sustainable development.	S	Assignments
PO8	An understanding and implementation of professional and ethical responsibilities.	H	-----
PO9	To function as an effective individual and as a member or leader in multi disciplinary environment and adopt in diverse teams.	S	Assignments, Tutorials and Exams
PO10	An ability to assimilate, comprehend, communicate, give & receive instructions to present effectively with engineering community and society.	S	-----
PO11	An ability to provide leadership in managing complex engineering projects at multidisciplinary environment and to become a Technocrat.	H	Mini Projects
PO12	Recognition of the need and an ability to engage in lifelong learning to keep abreast with technological changes.	S	-----

### VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes		Level	Proficiency Assessed by
PSO 1	<b>Professional Skills:</b> To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	H	Lectures, Assignments
PSO 2	<b>Design/ Analysis:</b> An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	S	Lectures, Assignments
PSO 3	<b>Successful Career and Entrepreneurship:</b> To build the nation, by imparting technological inputs and managerial skills to become Technocrats.	H	Guest Lectures

N - None

S - Supportive

H – Highly Related

### IX. SYLLABUS

#### UNIT-I

Elementary treatment of metal cutting theory - Element of cutting pro Geometry of single point tool and angles chip formation and types of u built up edge and its effects, chip breakers. Mechanics of orthogonal - Merchant's Force diagram, cutting forces - cutting speeds, feed, depth of cut, tool life, coolants, machinability - Tool materials.

#### UNIT-II

Engine lathe - Principle of working, specification of lathe - types of la t work and tool holding devices, Taper turning, Thread turning -attachments. Turret and capstan lathe - Principal features of automatic lathes - classification: Single spindle and multi-spindle automatic Iathes-tool layouts.

#### UNIT-III

Shaping, slotting and planning machines - Principles of working - Pr parts- specification, classification, and operations performed. Kinematic s of the shaping, slotting and planning machines, machining time calculations Drilling and Boring Machines - Principles of working, specifications, operations performed - tool holding devices - twist drill - Boring ma - Fine boring machines - Jig boring machine. Deep hole drilling machine Kinematics scheme of the drilling and boring machines

#### UNIT-IV

Milling machine - Principles of working - specifications - classification of milling machines - Principal features of horizontal, vertical and universal milling machines - machining operations Geometry of milling cutters methods of indexing - Accessories to milling machines, kinematic scheme of milling machines. Lapping, honing and broaching machines - comparison of grinding, lapping and honing. Kinematics scheme of Lapping, Honing and Broaching machines. Constructional features of speed and feed Units, machining calculations

#### UNIT-V

Finishing Processes: Grinding - fundamentals - theory of grinding classification of grinding machines - cylindrical and surface grinding machine\* Tool and cutter grinding machine - special types of grinding machines Different types of abrasives - bonds specification of a grinding wheel and selection of a grinding wheel, kinematic. Scheme of grinding machines

#### TEXT BOOKS:

1. B. S. Raghu Vamshi (2010), Workshop Technology, Vol - II, 9th Edition, Dhanpat Rai Publishers, New Delhi, India.
2. R. K. Jain (2010), Production Technology, 16th edition, Khanna publishers, New Delhi, India.
3. G. C. Sen, A. Bhattacharya (2010), Principles of machine tools, 3rd edition, new central book agency (P) Ltd, New Delhi, India.

#### REFERENCE BOOKS:

1. H.M.T. (Hindustan Machine Tools) (1980), Production Technology, 2nd edition, TataMcGraw-Hill education (P) Ltd, New Delhi, India.
2. Dr. R. Kesavan, B. Vijaya Ramanath (2012), Manufacturing Technology - II, 2nd edition, Laxmi publications, New Delhi, India.

#### X. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
1	<b>Define</b> to metal cutting	<b>UNIT-I</b> Elementary treatments of metal cutting theory – Element of cutting process	T1
2	<b>Explain</b> Single point cutting tool	Geometry of single point tool	T1
3	<b>Determine</b> Tool angles of single point cutting tool	Tool angles	T1
4	<b>Define</b> Chip formation	Chip formation	T1
5	<b>Describe</b> Chips types	types of chips – built up edge and its effects	T1
6	<b>Explain</b> Chip breakers	Chip breakers	T1
7-9	<b>Draw and Analyze</b> Merchant's Force diagram	Mechanics of orthogonal cutting –Merchant's Force diagram	T1
10	<b>Derive</b> cutting forces	cutting forces ,power requirement	T1
11-12	<b>Define</b> tool life and factor affecting the tool life	cutting speeds, feed, depth of cut, tool life	T1
13	<b>Explain</b> Coolants and its types	Coolants and Machinability	T1

14	<b>Explain</b> Tool materials and diving mechanism	Tool materials. Kinematic schemes of machine tools	T1
15	<b>Introduction</b> to lathe	<b>UNIT-II</b> Engine lathe – Principle of working, specification of lathe	T1
16	<b>Explain</b> Types of lathe	Types of lathe	T1
17	<b>Explain</b> Lathe accessories	work holders tool holders	T1
18-19	<b>Define</b> Taper Turning methods	Box tools Taper turning thread turning	T1
20	<b>Define</b> Thread cutting on lathe	Lathes and attachments	T1, T2
21	<b>Describe</b> Turret and capstan lathes	Turret and capstan lathes	T1
22	<b>Describe</b> Work holding devices	Collect chucks –other work holders – tool holding devices.	T1
23	<b>Explain</b> Automatic lathe	Principal features of automatic lathes – classification	T1
24	<b>Classification</b> of Lathe	Single spindle and multi-spindle automatic lathes.	T1
25	<b>Introduction</b> to shaping	<b>UNIT-III</b> Shaping slotting and planing machines-principle parts of shaping	T1
26	<b>Define</b> working principle of shaping ,slotting and planing	Principles of working Shaping slotting and planing machines	T1
27	<b>Explain</b> Size and specification	specification classification, operations performed	T1
28-29	<b>Derive</b> Driving mechanism	Kinematics scheme of the shaping	T1, T2
30-31	<b>Formulating</b> Driving mechanism	Kinematics scheme of the planing	T1
32	<b>Derive</b> Machining time	Machining time calculation	T1
33	<b>Introduction</b> milling machine	<b>UNIT-IV</b> Milling machine and principle of working – specification	T1
34-35	<b>Explain</b> Classification milling machine	Classification milling machine Principle features of horizontal, vertical and universal milling machine	T1, T2
36	<b>Explain</b> Operations of milling machine	Milling machine operation	T1
37	<b>Describe</b> Milling cutters	Milling cutters	T1, T2
38-39	<b>Describe</b> Methods of milling ,accessories of milling	Methods of indexing, accessories of milling	T1
40	<b>Explain</b> Drilling	Drilling Principles of working, specifications	T1
41-42	<b>Explain</b> Drilling Machines types	Drilling Machines types and deep hole drilling machine	T1, T2
43	<b>Analysis</b> of drilling operations performed	operations performed	T1
44	<b>Explain</b> tool holding devices	Tool holding devices	T1
45-46	<b>Explain</b> twist drill Boring machines detailed description of jig boring machine	Twist drill Boring machines Fine boring machines – Jig Boring machine	T1
47	<b>Define</b> introduction to grinding and types of grinding m/c	<b>Grinding Machine:</b> Fundamentals, basic kinds of grinding machine classification of grinding machine	T1, T2
48	<b>Explain</b> types of cylindrical	cylindrical grinding machine	T1

	grinding machine		
49	<b>Explain</b> types of surface grinding machine	surface grinding machine	T1
50	<b>Derive</b> Tool and cutter grinding machine	Tool and cutter grinding machine and internal grinding machine	T1
51	<b>Classify</b> special types of grinding machines	special types of grinding machines	T1, T2
52	<b>Analyze</b> grinding wheel specification	Different types of abrasives, bonds specification of a grinding wheel and selection of a grinding wheel.	T1
53	<b>Explain</b> super finishing operations	comparison to grinding, lapping	T1
54	<b>Explain</b> types of honing operations	honing-hand honing, horizontal honing	T1
55-56	<b>Introduction</b> of Broaching	Broaching, details of broach construction	T1, T2
57	<b>Introduction</b> of Jig and fixtures	Principles of design of Jigs and fixtures and uses.	T1
58	<b>Classification</b> of Jigs & Fixtures	Classification of Jigs & Fixtures	T1
59	<b>Explain</b> Principles of location	Principles of location, locating devices and methods	T1
60	<b>Derive</b> to describe types of pins , diamond pin l	supporting pins ,locating pins, diamond pin locators	T1
61-62	<b>Derive</b> to understand the concept of CLAPMS	VEE locators, external pin locators, bush location and types of clamps	T1
63	<b>Explain</b> to classify the drilling Jig and boring jig types	types of Jigs	T1
64	<b>Describe</b> to understand the concept of fixtures	types of fixtures	T1

**XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF THE PROGRAM OUTCOMES**

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
I	H				S			H					S		
II					S						H				S
III	H		S				S					H		H	
IV		S									H				S
V						S			H				H		
VI				H				S			S			H	S

N = None

S = Supportive

H = Highly related

**XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF TSHE PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	H				S										S
2		H									S		S		
3		H			S										
4	S										H			H	
5											H	S			S
6					S										
7		S									H		S		
8					H							S			
9			H						S					H	
10		H									S				S
11	H											S	S		
12					H		S								

**N = None**

**S = Supportive**

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**Prepared by:** Mr. C. Labesh Kumar, Assistant Professor  
Mr. M. Prashanth Reddy, Assistant Professor

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