INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**MACHINE TOOLS AND METROLOGY LABORATORY**			
Course Code	AME110			
Programme	**B. Tech**			
Semester	**V**			
Course Type	**Core**			
Regulation	**IARE - R16**			
Course Structure	**Lectures**	**Tutorials**	**Practical**	**Credits**
	-	**-**	**3**	**2**
Course Coordinator	**Dr. K. Ch Apparao, Associate Professor**			
Course Faculty	**Dr. K. Ch Apparao, Associate Professor** **Mr. C. Labesh Kumar, Assistant Professor**			

I. COURSE OVERVIEW:

The primary objective of this course is to create awareness on various machining tools and mechanical measuring instruments to make students familiar with various operations on machine tools 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. This course is designed to impart the knowledge to develop measurement procedures, conduct metrological experiments.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AME107	IV	Production Technology Laboratory	3

III. MARKS DISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Machine Tools And Metrology Laboratory	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:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by the Chairman, BOS.

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

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	**Laboratory**		**Total Marks**
Type of Assessment	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	**Performance**	**Calculations and Graph**	**Results and Error Analysis**	**Viva**	**Total**
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		**Level**	**Proficiency Assessed by**
PO1	**Engineering Knowledge** Capability to apply the knowledge of mathematics, science and engineering in the field of mechanical engineering.	3	Calculations of the observations/ Student Viva

Program Outcomes		Level	Proficiency Assessed by
PO2	**Problem Analysis:** An ability to analyze complex engineering problems to arrive at relevant conclusion using knowledge of mathematics, science and engineering.	2	Characteristic curves/ Student Viva
PO3	**Design/development of solutions:** Competence to design a system, component or process to meet societal needs within realistic constraints.	2	Seminar
PO4	**Conduct investigations of complex problems:** To design and conduct research oriented experiments as well as to analyze and implement data using research methodologies.	2	Term observations/ Student Viva

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	2	Seminar
PSO2	**Problem solving skills**: An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	2	Seminar
PSO3	**Successful career and Entrepreneurship**: To build the nation, by imparting technological inputs and managerial skills to become technocrats.	1	Presentation on real-world problems

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES:

The course should enable the students to:	
I	To learn the Step turning and taper turning and thread cutting Drilling and Tapping on the lathe machine
II	To the operations of Shaping and Planing and milling
III	To learn the measurement of the Angle and tapers by Bevel protractor, Sine bars, etc.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Explain metal cutting principles, various materials used for metal cutting and types of lathes and operations performed on lathe.	CLO 1	Perform plain turning, step turning and Grooving on a circular rod
		CLO 2	Perform the step turning and taper turning on a circular rod
		CLO 3	Perform thread cutting and knurling on a circular M.S rod and using the lathe machine
CO 2	Acquire the basic structure of various machine tool equipment commonly found in industry such as drilling	CLO 4	Drill a hole and perform tapping once given work piece.
		CLO 5	Slotting operation on a given specimen

	machines, shaping machines, planning machines, etc.	CLO 6	Shaping of square block, V- groove
CO 3	Identify the fine finishing operations to obtain dimensional accuracy and surface finish	CLO 7	Surface finish of given work piece
CO 4	Apply the concept of system of limits and fits and design limit gauges.	CLO 8	Measure the length and diameter using vernier calipers
		CLO 9	Determine angle of given specimen
CO 5	Measure surface finish, perform alignment test of machine tools and write applications of coordinate measuring machines.	CLO 10	Perform alignment test on lathe and Milling Machine

X. COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AME110.01	CLO 1	perform plain turning, step turning and Grooving on a circular rod	PO1	1
AME110.02	CLO 2	perform the step turning and taper turning on a circular rod	PO 1	2
AME110.03	CLO 3	perform thread cutting and knurling on a circular M.S rod and using the lathe machine	PO 1	2
AME110.04	CLO 4	drill a hole and perform tapping once given work piece.	PO 1	1
AME110.05	CLO 5	slotting operation on a given specimen	PO 2	2
AME110.06	CLO 6	surface finish of given work piece	PO 2	2
AME110.07	CLO 7	Shaping of square block, V- groove	PO 2	2
AME110.08	CLO 8	measure the length and diameter using vernier calipers	PO 3	3
AME110.09	CLO 9	determine angle of given specimen	PO 3	2
AME110.10	CLO 10	perform alignment test on lathe and Milling Machine	PO 3	2

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

Course Outcomes (COs)	Program Outcomes (POs)				Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3
CO 1	3		3	2	3		
CO 2	2		2	2			2
CO 3	3		3				2
CO 4		3		2			
CO 5		3	3	2			2

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XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAMOUTCOMES 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	-	2	-	-	-	-	-	-	-	-	2	2	-
CLO 2	3	1	-	1	-	-	-	-	-	-	-	-	1	1	-
CLO 3	3	-	-	2	-	-	-	-	-	-	-	-	-	2	-
CLO 4	-	3	1	2	-	-	-	-	-	-	-	-	1	2	-
CLO 5	1	3	1	-	-	-	-	-	-	-	-	-	1	-	-
CLO 6	1	3	1	-	-	-	-	-	-	-	-	-	2	2	-
CLO 7	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-
CLO 8	1	2	3	-	-	-	-	-	-	-	-	-	1	2	-
CLO 9	-	-	3	-	-	-	-	-	-	-	-	-	1	1	-
CLO 10	-	1	3	2	-	-	-	-	-	-	-	-	2	-	-

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XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PO 2 PO 3, PO 4 PSO 1, PSO3	SEE Exams	PO 1, PO 2 PO 3, PO 4 PSO 1, PSO3	Lab Exercises	PO 1, PO 2 PO 3, PO 5 PSO 1, PSO3	Seminars	-
Laboratory Practices	PO 1, PO 2 PO 3, PO 4 PSO 1, PSO3	Student Viva	PO 1, PO 2 PO 3, PO 4 PSO 1, PSO3	Mini Project	-	Certification	-

XIV. ASSESSMENT METHODOLOGIES - INDIRECT

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

XV. SYLLABUS:

LIST OF EXERCISES	
Week - 1	**LATHE MACHINE**
Step turning, taper turning, Thread cutting and knurling using lathe machine	
Week - 2	**DRILLING AND STEP BORING**

Drilling, tapping and step boring using drilling machine.	
Week - 3	**PLANNING AND SHAPING**
Shaping of V-groove using shaper	
Week - 4	**SLOTTING**
Slotting of a keyway using slotter machine.	
Week - 5	**MILLING AND SURFACE GRINDING**
Milling of gear and surface grinding.	
Week - 6	**VERNIER CALIPERS AND MICROMETER**
Length, depth, diameter measuring using vernier calipers and micrometer.	
Week - 7	**SCREW THREAD MEASUREMENT**
Screw thread measurement by three wire method.	
Week - 8	**SURFACE ROUGHNESS MEASUREMENT**
Surface roughness by talysurf	
Week - 9	**BORE GAUGE**
Bore measurement using bore gauge.	
Week - 10	**GEAR TEETH CALIPER/MICROMETER**
Use of gear teeth caliper for checking the chordal addendum and chordal height of spur gear.	
Week - 11	**ANGLE MEASUREMENTS**
Tool angle measurements using bevel protractor, sine bar, slip gauges	
Week - 12	**TAPER MEASUREMENTS**
Taper measurements using Tool Maker‘s microscope.	
Week - 13	**REVIEW**
Spare session for additional repetitions and review	
Week - 14	**EXAMINATIONS**

TEXT BOOKS:

1	B. S. Raghu Vamshi, ―Workshop Technology Vol – II‖, 9th Edition, Dhanpat Rai Publishers, New Delhi, India. 2010.
2	H.M.T. (Hindustan Machine Tools), ―Production Technology‖, Tata McGraw-Hill Education (P) Ltd, New Delhi, India, 2nd Edition, 1980.
3	Jain R.K., ―Engineering Metrology‖, Khanna Publishers, 1st Edition, 2005.

REFERENCES:

1	https://www.ocw.mit.edu/courses/mechanical-engineering/
2	http://www.nptel.ac.in/courses/112106138/

XVI. COURSE PLAN:

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

Exp. No.	Experiment	Program Out comes attained	Program specific Outcomes attained	Reference
1	Plain turning, step turning and grooving	PO1, PO2, PO4	PSO1, PSO2	T1, T2
2	Step turning and taper turning	PO1, PO2, PO4	PSO1, PSO2	T1, T2
3	Thread cutting and knurling	PO2, PO4	PSO1, PSO2	T1, T2
4	Drilling and tapping	PO2, PO3	-	T1, T2
5	Milling machine	PO1, PO3	PSO1, PSO2	T1, T2
6	Surface grinding	PO1, PO3	PSO1, PSO2	T1, T2
7	Shaping operations	PO2, PO3	PSO1, PSO2	T1, T2
8	Vernier calipers	PO1, PO2	PSO1	T1, T2, T3
9	Inside micrometer	PO2, PO3	PSO1	T1, T2, T3
10	Dial bore indicator	PO1, PO3	PSO1	T1, T2, T3
11	Spirit level	PO1, PO3	PSO1	T1, T2, T3
12	Optical bevel protractor	PO1, PO2	PSO1	T1, T2, T3
13	Sine bar	PO1, PO3	PSO1	T1, T2, T3
14	Alignment test on lathe machine	PO1, PO4	PSO1	T1, T2, T3

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

S. No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	To improve standards and analyze the concepts.	Seminars	PO 1, PO 4	PSO 1
2	Conditional probability, Sampling distribution, correlation, regression analysis and testing of hypothesis	Seminars / NPTEL	PO 4, PO3	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