



DEPARTMENT OF PRODUCTION TECHNOLOGY
COLLEGE OF ENGINEERING – GUINDY
ANNA UNIVERSITY: CHENNAI – 600 025.

COURSE PLAN

COURSE DETAILS:

Degree	B.E.		
Programme Name	Production engineering		
Course Code & Title	PR 5006 Theory of Metal Cutting.		
Credits	3	Session	Jan – May 2024
Course Type	Regular	Section	A
Name of the Faculty	Mr. P.Rethinam. Teaching Fellow, Department of Mechanical Engineering, MIT, Anna University, Chennai – 600044. Ponnaiah.rethinam@yahoo.com; 9710784593.		

COURSE CONTENT:

Syllabus: (Approved Syllabus as per Regulation 2019)

UNIT- I TOOL NOMENCLATURE, TOOL WEAR AND TOOL LIFE 9

Nomenclature of single point cutting tool and nomenclature of multi point cutting tools – Twist Drill – milling cutter – Tool geometry - Mechanisms of tool wear – Abrasion – Adhesion – Diffusion – Types of tool wear – flank wear – crater wear – Tool life – Tool life equations - factors affecting tool life – Illustrative problems – Theory of chatter.

UNIT- II MECHANICS OF METAL CUTTING 9

Types of chips – Continuous chips – Discontinuous chips – continuous chips with BUE – Mechanism of chip formation- Chip thickness ratio - Orthogonal cutting – Oblique cutting - Merchant circle diagram – Force relationships - shear angle - shear stress - shear strain – velocity relationships – Illustrative Problems.

UNIT -III THERMAL ASPECTS AND CUTTING FLUIDS 9

Sources of heat generation in metal cutting- Experimental determination of tool temperatures – Tool – work piece thermocouple- embedded thermocouple – Infrared photographic technique- Economics of metal cutting - Cutting fluid – properties – types of cutting fluids – Selection of cutting fluids.

UNIT- IV CUTTING TOOL MATERIALS 9

Types of motions in machining – Desirable properties of tool materials – Characteristics of cutting tool materials – High carbon steel, High speed steel, cast alloys, carbides, ceramics, Diamond and CBN tools- coating of tools – bits and inserts - Need for rational approach to the problem of cutting materials – Machinability.

UNIT- V GEAR CUTTING 9

Methods of gear manufacture – Gear Generation Methods; Gear shaping - gear planning - gear hobbing – kinematics - Bevel gear generation – Gear finishing methods – burnishing - shaving – grinding - lapping and gear honing.

TOTAL: 45 PERIODS

COURSE OBJECTIVES:

1. To impart the knowledge to the students about the tool nomenclature and the mechanisms of tool wear
2. To make the students familiar with the principles of mechanics of metal cutting
3. To learn about the thermal aspects of machining and the usage of cutting fluids
4. To familiarize about the various cutting tool materials
5. To impart knowledge about the various gear cutting methods

COURSE OUTCOMES:

At the end of the course, students will be able to:

CO1: Apply the principles of metal cutting theory.

CO2: Employ the various aspects of mechanics of metal cutting in manufacturing activities.

CO3: Understand the thermal aspects of metal cutting and identify the appropriate cutting fluid for the given metal cutting operation.

CO4: Identify the appropriate cutting tool material for the given metal cutting operation.

CO5: Employ the most suitable gear cutting operation for the given application.

TEXT BOOKS

1. Juneja B.L., Sekhan G.S. and Nitin Seth, "Fundamentals of metal cutting and machine tools", New Age International Publishers, 2012.
2. Nagpal G.R., "Machine Tool Engineering", Khanna Publishers, 2011.

REFERENCES

1. Bhattacharya.A., "Metal Cutting Theory and practice", Central Book Publishers, India, 1984.
2. Boothroyd D.G. & Knight W.A., "Fundamentals of machining and machine tools", Marcel Dekker, Newyork, 1989.
3. Shaw.M.C., "Metal cutting principles", Oxford Clare don press, 1984.
4. David A.Stephenson and JognS.Agapiou, "Metal Cutting and Theory Practices", Taylor and Francis, CRC press, 3rd Edition, 2016.
5. Geoffrey Boothroyd, Winston A,Knight, "Fundamentals of Machining and Machine Tools", Taylor and Francis, CRC press, 3rd Edition, 2006

COURSE ARTICULATION MATRIX

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	✓		✓	✓	✓										✓
2	✓		✓	✓	✓										✓
3	✓		✓	✓	✓										✓
4	✓		✓	✓	✓										✓
5	✓		✓	✓	✓										✓

The correlation levels:0.3: Low;0.6: Medium;0.9: High.

COURSE ALIGNED PROGRAMME OUTCOMES (PO) & PROGRAMME SPECIFIC OUTCOMES (PSO)

PO	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply knowledge of mathematics, basic science and engineering science.
2	Problem analysis	Identify, formulate and solve engineering problems.
3	Design/development of solutions	Design a system or process to improve its performance, satisfying its constraints.
4	Conduct investigations of complex problems	Conduct experiments & collect, analyze and interpret the data.
5	Modern tool usage	Apply various tools and techniques to improve the efficiency of the system.
6	The Engineer and society	Conduct selves to uphold the professional and social obligations.
7	Environment and sustainability	Design the system with environment consciousness and sustainable development.
8	Ethics	Interacting industry, business and society in a professional and ethical manner.
9	Individual and team work	Function in a multidisciplinary team.
10	Communication	Proficiency in oral and written Communication.
11	Project management and finance	Implement cost effective and improved system.
12	Life-long learning	Continue professional development and learning as a life-long activity.

PSO	Graduates demonstrate
1	Apply the knowledge gained in Mechanical Engineering for design and development and manufacture of engineering systems.
2	Apply the knowledge acquired to investigate research oriented problems in mechanical engineering with due consideration for environmental and social impacts.
3	Use the engineering analysis and data management tools for effective management of multidisciplinary projects.

COURSE TENTATIVE SCHEDULE / PLAN

Week	Day	Date	Hrs	Unit	Topics	Text / Ref.
1	M	22.01.2024	1,2	1	UNIT- I TOOL NOMENCLATURE, TOOL WEAR AND TOOL LIFE Basic concepts of metal cutting	T1
2	M	29.01.2024	1,2	1	Nomenclature of single point cutting tool and nomenclature of multi point cutting tools	T1
3	TH	01.02.2024	5	1	Twist Drill – milling cutter – Tool geometry.	T1
	M	05.02.2024	1,2	1	Mechanisms of tool wear – Abrasion – Adhesion – Diffusion. Types of tool wear – flank wear – crater wear.	T1
4	TH	08.02.2024	5	1	Tool life – Tool life equations - factors affecting tool life.	T1
	M	12.02.2024	1,2	1,2	Tool life – Illustrative problems – Theory of chatter.	T1

					UNIT- II MECHANICS OF METAL CUTTING Types of chips – Continuous chips – Discontinuous chips – continuous chips with BUE.	
5	TH	15.02.2024	5	2	Mechanism of chip formation.- Chip thickness ratio.	T1
6	M	19.02.2024	1,2	2	Chip breakers.	T1
	TH	22.02.2024	5	2	Orthogonal cutting – Oblique cutting.	T1
	M	26.02.2024	1,2	2	Merchant circle diagram.	T1
7	TH	29.02.2024	5	2	Force relationships - shear angle - shear stress - shear strain – velocity relationships.	T1
	M	04.03.2024	1,2	2,3	Force relationships - shear angle - shear stress - shear strain – velocity relationships – Illustrative Problems. UNIT -III THERMAL ASPECTS AND CUTTING FLUIDS Sources of heat generation in metal cutting	T1
	TH	07.03.2024	5	3	Experimental determination of tool temperatures	T1
8	M	11.03.2024	1,2	3	Tool – work piece thermocouple- embedded thermocouple.	T1
	TH	14.03.2024	5	3	Infrared photographic technique.	T1
9	M	18.03.2024	1,2	3	Economics of metal cutting.	T1
	TH	21.03.2024	5	3	Cutting fluid – properties – types of cutting fluids.	T1
10	M	25.03.202	1,2	3,4	Selection of cutting fluids. UNIT- IV CUTTING TOOL MATERIALS Types of motions in machining.	T1
	TH	28.03.2024	5	4	Desirable properties of tool materials.	T1
11	M	01.04.2024	1,2	4	Characteristics of cutting tool materials.	T1
12	TH	04.04.2024	5	4	High carbon steel, High speed steel, cast alloys	T1
	M	08.04.2024	1,2	4	carbides, ceramics, Diamond and CBN tools-coating of tools	T1
13	TH	11.04.2024	5	4	Bits and inserts.	T1
	M	15.04.2024	1,2	4,5	Need for rational approach to the problem of cutting materials – Machinability UNIT- V GEAR CUTTING Methods of gear manufacture – Gear Generation Methods	T1
	TH	18.04.2024	5	5	Gear shaping	T1
	M	22.04.2024	1,2	5	Gear planning - gear hobbing.	T1
	TH	25.04.2024	5	5	Kinematics - Bevel gear generation – Gear finishing methods.	T1
	M	29.04.2024	1,2	5	Burnishing – shaving.	T1
	TH	02.05.2024	5	5	grinding	T1
	M	06.05.2024	1,2	5	Lapping and gear honing.	T1

COURSE DELIVERY/INSTRUCTIONAL METHODOLOGIES:

<input checked="" type="checkbox"/> Chalk & Talk	<input checked="" type="checkbox"/> Stud. Assignments	<input checked="" type="checkbox"/> Web Resources
<input checked="" type="checkbox"/> LCD/Smartboards	<input checked="" type="checkbox"/> Stud. Seminars	<input type="checkbox"/> Add-On Courses

COURSE ASSESSMENT METHODOLOGIES-DIRECT

<input checked="" type="checkbox"/> University (End Semester) Examination	<input checked="" type="checkbox"/> Internal Assessment Tests		
<input checked="" type="checkbox"/> Assignments	<input type="checkbox"/> Laboratory Practices	<input type="checkbox"/> Mini/Major Projects	<input checked="" type="checkbox"/> Stud. Seminars
<input type="checkbox"/> Viva Voce	<input type="checkbox"/> Certifications	<input type="checkbox"/> Add-On Courses	<input type="checkbox"/> Others

COURSE ASSESSMENT METHODS

S.N.	Mode of Assessment	Date	Duration	% Weight
1	Internal Assessment Tests1	18.03.2024	1½ hr	25 %
2	Internal Assessment Tests2	06.05. 2024	1½ hr	25 %
3.	University Examination		3 hr	50 %
Additional marks may be given for Assignments / Group/ Team SeminarPresentation)				

COURSE ASSESSMENT METHODOLOGIES-INDIRECT

<input checked="" type="checkbox"/> Assessment of CO (By Feedback, Once)	<input checked="" type="checkbox"/> Student Feedback On Faculty (Once)
<input type="checkbox"/> Assessment of Mini/Major projects by Ext. Experts	<input type="checkbox"/> Others

COURSE (EXTRA) ESSENTIAL READINGS:

1. NPTE - Review of at <https://nptel.ac.in/courses/112103019/>
2. NPTEL - **Tool wear and tool life** at <https://nptel.ac.in/courses/112107078/>
3. NPTEL – Mechanics of metal cutting at <https://nptel.ac.in/courses/112107144/>
4. NPTEL- Thermal aspects and cutting fluids at <https://nptel.ac.in/courses/112105127/>
5. NPTEL–Cutting tool materials at <https://nptel.ac.in/courses/112107083/>
6. NPTEL–Gear cutting at <https://nptel.ac.in/courses/112103263/>

COURSE EXIT SURVEY (will be collected at end of the course)

The purpose of this survey is to find out from students about their learning experiences and their thoughts about the course.

Rating:	1: Slight (Low)	2: Moderate (Medium)	3: Substantial (High)
CO1:			
CO2:			
CO3:			
CO4:			
CO5:			

COURSE POLICY (Compensation Assessment)

1. Attending all the assessment is mandatory for every student
2. Course policy will be followed as per the academic course regulation

COURSE ACADEMIC DISHONESTY AND PLAGIARISM

1. All rules and regulation prescribed by the ACOE, University Departments, are applicable in the Internal Assessment Tests and University (End Semester) Examinations. (https://acoe.annauniv.edu/download_forms/student_forms/Guidelines.pdf)
2. In general, possessing a mobile phone, carrying bits of paper with materials, talking to other students, copying from other students during Internal Assessment Tests and University (End Semester) Examinations will be treated as Malpractice and punishable as per the rules and regulations. The misuse of Assignment / Project / Seminar works from others is considered as academic dishonesty and will be treated with the rules and regulations of the University.

COURSE ADDITIONAL INFORMATION

Queries / clarifications / discussion (if required) may be e-mailed to / contact the course instructors during their Office Hours.

For Approval


Course Faculty


Prof. In charge

HOD (Prod)