

22ME301 MACHINING SCIENCE AND TECHNOLOGY

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Manufacturing Processes.

COURSE DESCRIPTION AND OBJECTIVES:

This course offers knowledge on mechanics of metal cutting in different conventional and unconventional operations. The objectives of this course is to train the students to select suitable cutting operations, machines and cutting tools based on variety of product. The second objective is to address the issues related to high cutting forces, work locating devices, low machinability and tool life.

MODULE-1

UNIT-1

9L+0T+6P=15 Hours

Conventional Machining Process: Geometry of cutting tools, Effect of tool geometry on tool life and surface finish, Mechanics of chip formation, Merchant's theory, Force relationship and velocity relationship, Cutting tool materials. Types of Tool Wear: Flank wear, Crater wear, Cutting fluid and its effect; Machinability Criteria, Tool life and Taylor's equation, Effect of variables on tool life and surface finish, Measurement of cutting force, Lathe tool dynamometer, Drill tool dynamometer.

UNIT-2

15L+0T+10P=25 Hours

Conventional Machine Tools and Kinematics: Turning, Drilling, Shaping, Planning, Milling, Grinding Machine Tools, Capstan and turret lathes. Conventional machining processes- Turning, Drilling, Shaping, Planning, Gear cutting, Grinding Operations. Simulation of turning, drilling and milling and estimation of cutting forces, tool wear and temperature using DEFORM 2D/3D software. Speed transmission from motor to spindle, mechanism for feed motion, thread Cutting mechanism, Quick return mechanism.

PRACTICES:

- To estimate taper angle and perform step and taper turning.
- To perform thread cutting and knurling.
- To calculate indexing and execute gear turning.
- To Simulate and estimate cutting forces in step turning using DEFORM 2D software.
- To simulate and estimate thrust force in drilling process using DEFORM 2D software.

MODULE-2

UNIT-1

9L+0T+6P=15 Hours

Introduction to Advanced Machining Processes: Recent developments in non-traditional machining processes, their working principles, equipment's, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes. Unconventional machining Process, Need, classification, Energy and mechanics of metal removal, merits, demerits and applications. Design of Tool and Work Holding Devices.

UNIT-2

15L+0T+10P=25 Hours

Advanced Machining Processes: Abrasive Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining, Electro Discharge Machining, Wire EDM, Application of Jig and Fixtures.



Source: <https://www.google.com/search?q=machining+science&tbm=isch&ved=2ahUKEwiTyI3xp9X5AhUIgmMGHZPhAysQ2->

SKILLS:

- ✓ Identify required operations and prepare sequence of operations to produce a product.
- ✓ Operate different machine tools to perform various machining operations.
- ✓ Design and use work and cutting tool holding devices.
- ✓ Estimate cutting forces and tool life.
- ✓ Study effect of process parameters on machining characteristics.

PRACTICES:

- To measure cutting forces in turning and drilling process and estimation of power consumption.
- To perform step cutting on planer machine.
- To perform slot cutting on internal surface using slotting machine.
- To perform surface grinding on surface grinding machine.
- To evaluate effect of process parameters on MRR in EDM.
- To estimate electrode wear and surface roughness in EDM.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Learn the principle of machining in conventional and unconventional processes.	Understanding	1, 2	1, 2, 4, 9, 10
2	Analyse the part geometry to select suitable cutting operations, machines and cutting tools.	Analyse	1, 2	1, 2, 8, 9, 10
3	Measure and estimate cutting forces in different metal cutting processes.	Apply	1, 2	1, 2, 3, 5, 9, 12
4	Evaluate effect of process parameters on the machining characteristics.	Evaluate	1, 2	1, 2, 3, 9, 10, 12

TEXT BOOKS:

1. D.A. Stephenson and J.S. Agapiou, "Metal Cutting Theory and Practice", CRC Press, 3rd Edition, 2016.
2. H.A.Youssef, Stephenson D A and H. El-Hofy, "Metal Cutting Theory and Practice", Taylor and Francis, 3rd Edition, 2016.

REFERENCE BOOKS:

1. P.N. Rao, "Manufacturing Technology-Metal cutting and Machine tools", Tata McGraw Hill publication, Volume-II, 4th Edition, 2018.
2. P.C. Pandey, H.S. Shan, "Modern Manufacturing Processes", Tata McGraw Hill, 1st Edition, 1980.