Course code	Course Name	L-T-P-Credits	Year of Introduction
MP202	**MACHINING OF MATERIALS**	3-1-0-4	2016

Prerequisite : MP201 Machine tool technology

Course Objective

- To familiarize the student with tool geometry and cutting forces
- To enable the students to grasp the fundamental principles of the tribology of metal cutting and machinability of work materials
- To impart knowledge on tool materials, tool wear and tool life

Syllabus

History and development of tool materials, Orthogonal and oblique cutting, selection of cutting tools, Mechanism of chip formation in machining, Cutting forces and their represent them in Merchant's circle diagram, Estimation of cutting forces, Relevance of cutting temperature, estimation and its control, Concept of machinability and its improvement, Failure mechanism of cutting tools and assessment of tool life, Cutting tool materials, economics of machining, advanced machining process.

Expected Outcome

The students will be able to

  i. identify the tool parameters and convert them from one system to another.
 ii. determine cutting forces and temperature during machining.
iii. assess tool life for given cutting conditions.
 iv. select suitable tools for different applications and identify methods to improve machinability.

References

- Chattopadhyay A.B., Chattopadhyay A. K. and Paul S. Manufacturing Processes II, NPTEL Online Lecture Series (accessed on Nov. 2015)
- Childs T., Maekawa K., Obikawa T. and Yamane Y. Metal Machining Theory and Applications, Arnold, London (2000)
- Astakhov V.P., Metal Cutting Mechanics, CRC Press (1999).
- Boothroyd G., Fundamentals of Metal Machining and Machine Tools, CRC Press (1988)
- Stephenson D. A. and Agapiou J. S. Metal Cutting Theory and Practice, CRC Press (2005)
- MC Shaw, Metal Cutting Principles, Oxford and IBH Publications, New Delhi (1969)
- Cyril Donaldson, V.C.Goold, Tool design, Tata McGraw-Hill Education, 1976

	Course Plan		
Module	Contents	Hours	Sem. exam marks
I	History and development of tool materials - general requirements of tool materials-tool geometry-systems of cutting tool nomenclature- single point and multipoint tools-	8	15%

	Orthogonal and oblique cutting different machining processes and selection of tools. - Simple problems.		
II	Mechanism of chip formation: Mechanism of chip formation in ductile and brittle materials. Geometry and characteristics of chip forms: cutting ratio, shear angle and cutting strain Built up edge (BUE) formation and characteristics of BUE. Types of chips and conditions of their formation,	8	15%
First Internal Exam			
III	Machining forces and Merchants' Circle diagram: Cutting force components and their significance. Merchant's circle diagram and its advantageous use. Lee and Shaffer's Theory, Evaluation of cutting power consumption. Estimation of cutting forces: Development of equations for cutting forces under orthogonal and oblique turning. Direct and indirect methods of measurement of cutting forces. Dynamometers for measurement of cutting forces.	10	15%
IV	Cutting temperature: Sources and causes of heat generation and development of temperature in machining, Effects of the high cutting temperature on tool and job. Determination of cutting temperature, Role of variation of the various machining parameters on cutting temperature. Control of cutting temperature. Cutting fluids and their action, properties and heir selection of cutting fluids.	8	15%
Second Internal Exam			
V	Machinability: Concept and definition, Role of different machining parameters on machinability of work materials. Methods of improving machinability. machinability rating. Failure of cutting tools, Mechanisms and pattern (geometry) of cutting tool wear, chatter in machining, types of chatters, mechanism of chatter, Factors effecting chatter in machining. assessment of tool life, Taylor's tool life equation	10	20%
VI	Essential properties for cutting tool materials, Characteristics and applications of common cutting tool materials (HSS, carbides, ceramics and diamond). Introduction to advanced cutting tool materials and their application. Tool Coatings and their characteristics. Economics of machining – choice of parameters – metal removal rates. Advanced machining processes – introduction – operating principles – process parameters and application of USM, AJM, WJM, ECM, ECG, EDM, EBM, LBM, PAM and chemical milling.	12	20%
End Semester Exam			

Question Paper Pattern

Total marks: 100, Time: 3 hrs

The question paper should consist of three parts

Part A

4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.