

NETAJI SUBHAS ENGINEERING COLLEGE
DEPARTMENT OF MECHANICAL ENGINEERING

Department: Mechanical Engineering

Academic Year: 2018-19

Paper Name: **Machining Principles & Machine Tools (ME602)**

Contact: 3L

Session: 2018-19

Semester: VI

Paper Code : **ME 602**

Credit:3

Name of the Faculty: Prof. M N Ali

Syllabus :

Module 1: Introduction: Machining: Basic principle, purpose, definition and requirements

Module 2: Geometry of cutting tools:

- (i) Geometry of single point turning (shaping, planning and boring) tools in ASA, ORS and NRS systems---1
- (ii) Conversion of tool angles from one system to another by graphical and vector methods---2
- (iii) Geometry of drills and milling cutters---1

Module 3: Mechanism of machining:

- (i) Chip formation mechanism, yielding and brittle fracture, chip reduction coefficient, cutting ratio, shear angle and cutting strain---1
- (ii) Built-up edge formation, cause, type and effects, orthogonal cutting and oblique cutting---1
- (iii) Machining chips: types and conditions, chip formation in drilling and milling---1

Module 4: Mechanics of machining:

- (i) Chip formation mechanism, yielding and brittle fracture, chip reduction coefficient, cutting ratio, shear angle and cutting strain-1
- (ii) Purposes of determination of cutting forces and basic two approaches, cutting force components in ORS and Merchant's circle diagram---1
- (iii) Determination of cutting forces, analytical methods, measurement---1
- (iv) Dynamometers, construction and working principles of strain gauge type and piezoelectric crystals type turning drilling, milling and grinding dynamometers---1

Module 5: Cutting temperature:

- (i) Heat generators and cutting zone temperature, sources, courses and effects on job and cutting tools, role of variation of the machining parameters on cutting temperature---1
- (ii) Determination of cutting temperature by analytical and experimental methods---1
- (iii) Control of cutting temperature and application of cutting fluids (purpose, essential properties, selection and methods of application)---1

Module 6: Cutting tools-failure, life and materials:

- (i) Methods of failure of cutting tools mechanisms, geometry and assessment of tool wear---1
- (ii) Tool life, definition, assessment and measurement, Taylor's tool life equation and its use---1
- (iii) Cutting tool materials, essential properties, characteristics and applications of HSS, carbide(uncoated/coated), ceramic, diamond and CBN tools---1

Module 7: Broaching and grinding:

- (i) Modes and mechanisms of chip formation, selection and application---1
- (ii) Grinding forces, surface roughness and wheel life---1

Module 8: Machinability and machining economics:

Machinability (and grindability), definition, assessment, improvement and evaluation of optimum cutting velocity and tool life---1

Module 9: Machine tools – Introduction:

- (i) Purpose of use, definition and general features of machine tools---1
- (ii) Generatrix and Directrix and tool – work motions in different operations of conventional machine tools---1

Module 10: General constructions function of machine tools:

- (i) Major components and their functions in lathes ; shaping , planning and slotting machines ; drilling machines and melting machines---1
- (ii) Machining operations and application of the common machine tools and their way of specification---1

Module 11: Automation and classification:

- (i) Purposes, degree, type and economy of machine tool automation ; broad classification of machine tools---1

Module 12: Kinematic structure of machine tools:

- (i) Kinematic structure of centre lathe, shaping, planning and slotting machine---1
- (ii) Kinematic structure of drilling (column /radial) and milling machines, capstan lathe, turret lathes---1
- (iii) 3. Kinematic structure of single spindle automatic lathe, by hydraulically driven machine tools , hobbling machine and gear shaping machine---1

Module 13: Control of speed and feed machine tools:

- (i) Need of wide ranges of speeds and feeds , and machine tool drive--1
- (ii) Design of speed, gear box, speed layout, gear layout, ray diagrams , gears and spindle---1
- (iii) Control (selection and change) of feed in centre lathes and by hydraulically driven machine tools---1

Module 14: Machining time:

- (i) Estimation of time required for various operations like turning , drilling , shaping , milling and gear teeth generation---1

Module 15: Computer numerical controlled machine tools:

- (i) NC and CNC system ; purpose, principle , advantages, limitations and application in machine tools--- 2
- (ii) Basic features and characteristics of CNC , lathes, milling machines etc, machining centres and FMS with reference to construction, advantages and application--- 2

Text Book and Reference Book

Text Books:

- (i) A.B. Chattopadhyay, Machining and Machine Tools, Wiley India (P) Ltd., New Delhi.
- (ii) A. Bhattacharyya, Metal Cutting Theory and Practice, New Central Book Agency (P) Ltd., Kolkata.
- (iii) G. Kuppaswamy, Principles of Metal Cutting, University Press, Hyderabad.
- (iv) Stephenson & Agapion, Metal Cutting Theory and Practice, Taylor and Francis, NY.
- (v) M.C. Shaw, Metal Cutting Principles and Practices, Oxford University Press.
- (vi) G.C. Sen and A. Bhattacharyya, Principles of Machine Tools, New Central Book Agency (P) Ltd., Kolkata.
- (vii) Acharkan, Machine Tool Design, Vol. I, II, III and IV, Mir Publication, Moscow.
- (viii) B.L. Juneja and G.S. Sekhon, Fundamentals of Metal Cutting and Machine Tools, New Age International(P)Ltd., New Delhi.

- (ix) P.N. Rao, Manufacturing Technology: Metal Cutting & Machine Tools, Tata McGraw Hill.
- (x) M.P. Groover and E.W. Zimmers, CAD/CAM, Prentice Hall of India Pvt. Limited, New Delhi.
- (xi) P.N. Rao, N.K. Tewari and T.K. Kundra, Computer Aided Manufacturing, Tata McGraw Hill.
- (xii) M.P. Groover, Automation, Production Systems and CIM, Prentice- Hall of India (P) Ltd., New Delhi.

Course Outcomes:

- CO1: **Understand** the theory of metal cutting.
- CO2: **Identify** the mechanism of metal cutting process in general and various machining processes.
- CO3: **Recognize** the working principles of machine tools and various operations performed.
- CO4: **Explain** various finishing processes and gear manufacturing.
- CO5: Thorough **knowledge** and **evaluate** tool geometry and tool materials.
- CO6: **Know** and **appraising** about advanced manufacturing processes.

Lesson Plan (ME602) :

Date	Lecture No./ hr. No.	Topics	Books/References	Remarks
	1.	Introduction : Definition of Machining, basic principle ,purpose and requirements, definition of machine tool	A.B. Chattopadhyay : Machining and Machine Tools, G.C. Sen and A. Bhattacharyya :Principles of Machine Tools	
	2.	Machine tools – Introduction: general features of machine tools,, classification of machine tools	A.B. Chattopadhyay : Machining and Machine Tools, G.C. Sen and A. Bhattacharyya :Principles of Machine Tools	
	3.	Generatrix and Directrix with examples , cutting speed, feed and depth of cut, work motions in different operations of conventional machine tools	A.B. Chattopadhyay : Machining and Machine Tools A. Bhattacharyya : Metal cutting theory & Practice	

	4.	General constructions, functions of machine tools : Parts and accessories in lathe, shaping , planning , slotting drilling and milling machines	A.B. Chattopadhyay : Machining and Machine Tools, G.C. Sen and A. Bhattacharyya :Principles of Machine Tools	
	5.	Specifications of various machine tools, various machining operations and application of the common machine tools	A.B. Chattopadhyay : Machining and Machine Tools Hazra Chowdhury: Workshop technology Vol. 2	
	6.	Geometry of cutting tools: Geometry of single point turning(shaping, planning and boring) tools in ASA system	A.B. Chattopadhyay: Machining and Machine Tools A. Bhattacharyya : Metal cutting theory & Practice	
	7.	ORS and NRS systems	A.B. Chattopadhyay: Machining and Machine Tools A. Bhattacharyya : Metal cutting theory & Practice	
	8.	Conversion of tool angles by graphical and vector methods , numerical problems	A.B. Chattopadhyay : Machining and Machine Tools, A. Bhattacharyya : Metal cutting theory & Practice	
	9.	Geometry of drills and milling cutters, Feedback / Quiz	A.B. Chattopadhyay: Machining and Machine Tools A. Bhattacharyya : Metal cutting theory & Practice	
	10.	Mechanism of machining: Chip formation mechanism, yielding and brittle fracture, chip reduction coefficient, cutting ratio, shear angle and shear strain	A.B. Chattopadhyay : Machining and Machine Tools Ghosh & Mallick Manufacturing science.	
	11.	Topics above continued and numerical problems	A.B. Chattopadhyay : Machining and Machine Tools Ghosh & Mallick Manufacturing Science..	
	12.	Built-up edge formation, cause, type and effects, orthogonal cutting and oblique cutting	A.B. Chattopadhyay : Machining and Machine Tools Ghosh & Mallick Manufacturing Science..	
	13.	Machining chips: types and conditions, chip formation in drilling and milling	A.B. Chattopadhyay - Machining and Machine Tools, A. Bhattacharyya : Metal cutting theory & Practice	

	14.	Mechanics of machining: Need of knowing cutting forces, approaches, cutting force components in ORS and Merchant's circle diagram	A.B. Chattopadhyay - Machining and Machine Tools, Ghosh & Mallick: Manufacturing Science..	
	15.	Determination of cutting forces, analytical methods, measurement , Feedback/Quiz	A.B. Chattopadhyay : Machining and Machine Tools, Ghosh & Mallick: Manufacturing Science	
	16.	Numerical problems on Merchant's circle diagram/cutting forces	A.B. Chattopadhyay : Machining and Machine Tools, Ghosh & Mallick: Manufacturing science	
	17.	Dynamometers, construction and working principles of strain gauge type and piezoelectric crystals type turning drilling, milling and grinding	A.B. Chattopadhyay: Machining and Machine Tools A. Bhattacharyya : Metal cutting theory & Practice	
	18.	Cutting temperature: Heat generators and cutting zone temperature, sources, causes and effects on job and cutting tools, role of variation of the machining	A.B. Chattopadhyay: Machining and Machine Tools A. Bhattacharyya : Metal cutting theory & Practice	
	19.	Determination of cutting temperature by analytical and experimental methods , Feedback / Quiz	A.B. Chattopadhyay : Machining and Machine Tools A. Bhattacharyya : Metal cutting theory & Practice	
	20.	Control of cutting temperature and application of cutting fluids(purpose, essential properties, selection and methods of application)	A.B. Chattopadhyay : Machining and Machine Tools A. Bhattacharyya : Metal cutting theory & Practice	
	21.	Broaching and grinding: Modes and mechanisms of chip formation, selection and application, above topic contd.	A.B. Chattopadhyay : Machining and Machine Tools Hazra Chowdury - Workshop Technology - Vol 2	
	22.	Grinding forces, wheel specification and selection, various grinding machines and grinding operations, surface roughness and wheel life	A.B. Chattopadhyay : Machining and Machine Tools Ghosh & Mallick .Manufacturing Science.	
	23.	Cutting tools-failure, life and materials: Methods of failure of cutting tools mechanisms, geometry and assessment of tool wear	A.B. Chattopadhyay : Machining and Machine Tools Ghosh & Mallick Manufacturing Science..	

Date	Lecture No./ hr. No.	Topics	Books/References	Remarks
	24.	Tool life, definition, assessment and measurement, Taylor's tool life equation and its use. Feedback / Quiz	A.B. Chattopadhyay - Machining and Machine Tools Ghosh & Mallick Manufacturing Science..	
	25.	Cutting tool materials, essential properties, characteristics and applications of HSS, carbide(uncoated/coated), ceramic, diamond and CPN tools	A.B. Chattopadhyay :, Machining and Machine Tools	
	26.	Machinability and machining economics: Mach inability (and grind ability), definition, assessment, improvement and evaluation of optimum cutting velocity and tool life	A.B. Chattopadhyay: Machining and Machine Tools Ghosh & Mallick ,Manufacturing Science. ..	
	27.	Kinematic structure of machine tools :Kinematic structure of centre lathe ,shaping, planning and slotting machine	A.B. Chattopadhyay: Machining and Machine Tools G.C. Sen and A. Bhattacharyya, Principles of Machine Tools	
	28.	Kinematic structure of drilling (column /radial) and milling machines, capstan lathe, turret lathes, Feedback / Quiz	A.B. Chattopadhyay: Machining and Machine Tools G.C. Sen and A. Bhattacharyya, Principles of Machine Tools	
	29.	Kinematic structure of single spindle automatic lathe, by hydraulically driven machine tools , hobbling machine and gear shaping machine	A.B. Chattopadhyay, Machining and Machine Tools G.C. Sen and A. Bhattacharyya, Principles of Machine Tools	
	30.	Machining time : Estimation of time required for various operations like turning , drilling, shaping , milling and gear teeth generation. problems	A.B. Chattopadhyay: Machining and Machine Tools ..Hazra Chowdury - Workshop technology V-2	
	31.	Purposes, degree, type and economy of machine tool automation , broad classification of machine tools, types of automation	M.P. Groover: Automation, production system & CIM, G.C. Sen and A. Bhattacharyya, Principles of Machine Tools	

Date	Lecture No./ hr. No.	Topics	Books/References	Remarks
	32.	Control of speed and feed machine tools : Need of wide ranges of speeds and feeds , and machine tool drive, Design of speed, gear box, speed layout, gear layout, ray diagrams , gears and spindle	A.B. Chattopadhyay, Machining and Machine Tools G.C. Sen and A. Bhattacharyya, Principles of Machine Tools	
	33.	Control (selection and change) of feed in centre lathes and by hydraulically driven machine tools, Feedback/Quiz	A.B. Chattopadhyay : Machining and Machine Tools G.C. Sen and A. Bhattacharyya, Principles of Machine Tools	
	34.	Computer numerical controlled machine tools :NC and CNC system ; purpose, principle , advantages , limitations and application in machine tools	M.P. Groover: Automation, production system & CIM G.C. Sen and A. Bhattacharyya, Principles of Machine Tools	
	35.	Basic features and characteristics of CNC , lathes , milling machines etc.	M.P. Groover: Automation, production system & CIM G.C. Sen and A. Bhattacharyya, Principles of Machine Tools	
	36.	Machining centers and FMS with reference to construction, advantages and application	M.P. Groover: Automation, production system & CIM	

Signature of the HOD

Signature of the Faculty