15MH401J	Manufacturing Processes	L	T	P	C
		3	0	2	4
Co-requisite:	Nil				
Prerequisite:	Nil				
Data Book / Codes/Standards	Nil				
Course Category	P Professional Core	Mechanical Engineering			
Course designed by	Department of Mechatronics Engineering				
Approval	32nd Academic Council Meeting held on 23.07.2016.				

Purpose	To acquaint the different manufacturing processes used in the industries to manufacture a product.							
Instructional Objectives		**Student Outcomes**						
At the end of the course, student will be able to								
1.	Explain the process of different metal forming process.	a		c				
2.	Distinguish the different of metal cutting process.	a	b	c				
3.	Implement the concept of computerized machine tool for metal cutting process.	a	b	c	k			
4.	Understand the concept of additive manufacturing process.	a		c				
5.	Classify the unconventional machining process.	a	b	c				

Session	Description of Topics	Contact hours	C-D-I-O	IOs	Reference
	Unit I: Metal Forming Processes	**7**			
1.	Casting process: Introduction, classification, mould. Pattern: types of pattern.	1	C	1	1,2
2.	Special casting techniques: Expandable mould casting, shell mould casting, investment casting.	1	C	1	1,2
3.	Permanent mould casting, die casting and its types, centrifugal casting and its types, defects in casting.	1	C	1	1,2
4.	Mechanical working of metals: Rolling, mechanism, types, defects.	1	C	1	1,2
5.	Forging: Mechanism, types, machine used for forging, defects.	1	C	1	1,2
6.	Extrusion: Mechanism, classification, defects.	1	C	1	1,2
7.	Drawing: Mechanism, tube drawing, deep drawing, defects.	1	C	1	1,2
	Unit II: Metal Cutting Processes	**9**			
8.	Cutting tools, classification: Single point cutting tool nomenclature, multi point cutting tool nomenclature (Milling cutter).	1	C,D	2	1,2
9.	Tool wear, tool life, prediction of tool life.	1	C,D	2	1,2
10.	Orthogonal and oblique cutting, mechanics of orthogonal cutting using single point cutting tool, cutting forces in orthogonal cutting, Merchant circle analysis.	2	C,D	2	1,2
11.	Calculation of various forces involved during orthogonal cutting.	1	C,D	2	1,2
12.	Methods to gear generation: Gear shaping, milling and hobbing process.	1	C	2	1,2
13.	Grinding: Cylindrical, surface and centreless grinding process.	2	C	2	1,2
14.	Super Finishing: Lapping, honing, buffing.	1	C	2	1,2
	Unit III: CNC Machine Tools	**10**			
15.	NC, DNC and CNC machines: Introduction, classification of CNC machines.	1	C	3	3,4
16.	Constructional feature of CNC turning centre and CNC machining centre.	1	C	3	3,4
17.	Open loop and closed loop CNC systems, CNC controllers.	1	C	3	3,4
18.	Structural members of CNC machines, slide ways, linear motion bearings, ball screws.	2	C	3	3,4
19.	Work holding and tool holding devices, automatic tool changer.	1	C	3	3,4
20.	Feedback devices used in machining centre.	2	C	3	3,4
21.	Fundamentals of part programming, G and M codes. Types of programming: Manual part programming, canned	2	C,D	3	3,4

Session	Description of Topics	Contact hours	C-D-I-O	IOs	Reference
	cycle and subroutines.				
	Unit IV: Additive Manufacturing and PCB Manufacturing Process	**6**			
22.	Additive manufacturing: Concept, types. Fused deposition method: Working principle, advantages, limitations, applications.	1	C	4	7
23.	Selective Laser Sintering process, working principle, advantages, limitations, applications.	1	C	4	7
24.	Stereo lithography process: Working principle, advantages, limitations, applications.	1	C	4	7
25.	3D printing technique: Working process, advantages, limitations, applications.	1	C	4	7
26.	PCB Manufacturing process: Silicon wafer production process, diffusion, masking, photolithography technique.	1	C	4	8
27.	Etching, cleaning. types of PCB: Single sided, double sided, multilayer and flexible PCB board, inspection of PCB boards.	1	C	4	8
	Unit V: Unconventional Machining Process	**9**			
28.	Electrical Discharge Machining: Working principle, advantages, limitations, applications.	2	C	2	5
29.	Electro Chemical Machining, drilling, grinding: Working principle, advantages, limitations and applications.	2	C	2	5
30.	Electron Beam Machining: Working principle, advantages, limitations and applications.	1	C	2	5
31.	Plasma Arc Machining: Working principle, advantages, limitations and applications.	1	C	2	5
32.	Jet Machining: Working principle, Types: Abrasive, water , ice advantages, limitations and applications	2	C	2	5
33.	Ultrasonic Machining: Working principle, advantages, limitations and applications.	1	C	2	5
	Assessment	**4**			
34.	Cycle test - I	1			
35.	Cycle test - II	2			
36.	Surprise test / Assignment and Quiz	1			
	Total contact hours	**45**			

Sl.No.	Description of Experiments	Contact hours	C-D-I-O	IOs	Reference
1.	Machining of spur gear using universal milling machine.	2	I,O	2	6,7
2.	Machining of helical gear using gear hobbing machine.	2	I,O	2	
3.	Finishing operation using cylindrical and surface grinding process.	2	I,O	2	
4.	Manufacturing a single point cutting tool using tool and cutter grinder.	2	I,O	2	
5.	Facing, turning and thread cutting using conventional lathe.	2	I,O	2	
6.	Step turning using CNC turning centre.	2	D,I,O	3,4	
7.	Multiple turning by applying canned cycle using CNC turning centre.	2	D,I,O	3,4	
8.	Multiple turning with grooving and thread cutting by applying canned cycle using CNC turning centre.	2	D,I,O	3,4	
9.	Pocketing of Linear and Circular profile using CNC vertical machining centre.	2	D,I,O	3,4	
10.	Drilling and peck drilling using CNC vertical machining centre.	2	D,I,O	3,4	
11.	Profile cutting by applying Mirroring operation using CNC vertical machining centre.	2	D,I,O	3,4	
12.	Profile cutting using Wire cut Electrical Discharge Machine (WEDM).	2	D,I,O	5	
13.	Extra practice session.	2			
14.	Extra practice session.	2			

15.	Model Examination.	2			
	Total contact hours	**30**			

Learning Resources	
Sl. No.	**Text Books**
1.	Sharma.P.C, *"A textbook of Production Technology",* Vol I and II, S. Chand And Company Ltd., New Delhi, 2007.
2.	Serope Kalpakjian and Steven Schmid, *"Manufacturing Engineering and Technology*", Pearson Education, 7th edition, 2014.
3.	Radhakrishnan.P, "*CNC Machines"*, New Central Book Agency, 2000.
4.	HMT Limited, "*Mechatronics*", Tata McGraw-Hill Publishing Co Ltd, 2002.
5.	Pandey and H.S.Shah, "*Modern Machining Process"*, Tata McGraw Hill Publishing Co., New Delhi, 2008.
6.	Chapman.W.A.J, "*Workshop Technology"* Vol. I and II, Arnold Publisher, 1996.
7.	Chua C.K., Leong K.F., and Lim C.S., "*Rapid Prototyping: Principles and Applications*", 3rd edition, World Scientific Publishers, 2010.
8.	R. S. Khandpur*"Printed Circuit Boards: Design, Fabrication, and Assembly"* Tata McGraw Hill Publishing Co., New Delhi,2010.
9.	S.K. Hajra Choudry, S.K.Bose, A.K. Hajra Choudry , "*Elements of Workshop Technology Vol II: Machine tools*", Media promoters and Publishers Pvt Ltd, 2002.
	Reference Books/Other Reading Materials
10.	Rao.P.N., "*Manufacturing Technology"*, Vol. I & II, Tata McGraw Hill Publishing Co., New Delhi, 1998.
11.	Jain.R.K., "*Production Technology"*, Khanna Publishers, New Delhi, 11th edition.
12.	Vijay K Jain, "*Advanced Machining Processes*", Allied publishers, 2005.
13.	Groover.M.P., "*Automation, Production System and CIM*", Prentice Hall of India Pvt. Ltd, 2003.
14.	Mishra.P.K., "*Non-Conventional Machining"*, The Institution of Engineers (India), Text Book Series, New Delhi, 1997.

Course nature					**Theory + Practical**		
Assessment Method – Theory Component (Weightage 50%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination weightage:							**50%**
Assessment Method – Practical Component (Weightage 50%)							
In-semester	**Assessment tool**	Experiments	Record	MCQ/Quiz/Viva Voce	Model examination		**Total**
	Weightage	**40%**	**5%**	**5%**	**10%**		**60%**
End semester examination weightage:							**40%**