

Programme Name/s : Automobile Engineering./ Mechanical Engineering/ Mechatronics/ Production Engineering/
Programme Code : AE/ ME/ MK/ PG
Semester : Second
Course Title : MANUFACTURING TECHNOLOGY
Course Code : 312313

I. RATIONALE

Diploma graduates frequently encounter diverse manufacturing processes. This core manufacturing technology course aims to enhance student's comprehension of manufacturing methods, like turning, drilling, milling, casting, forming, and joining, etc.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Produce a given component using various manufacturing processes.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Produce a part using a lathe and drilling machine as per given drawing.
- CO2 - Produce a part using a milling machine as per given drawing.
- CO3 - Produce a part using casting processes as per given drawing.
- CO4 - Produce a part using forming processes as per given drawing.
- CO5 - Produce a part using joining processes as per given drawing..

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TL				Based on SL						
				CL	TL	LL						Practical				SLA						
												FA-TH	SA-TH	Total		FA-PR		SA-PR				
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min											
312313	MANUFACTURING TECHNOLOGY	MPR	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175	

Total IKS Hrs for Sem. : 1 Hrs

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination
 Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	<p>TLO 1.1 List various angles of single point cutting tool.</p> <p>TLO 1.2 List accessories of lathe machine and their function.</p> <p>TLO 1.3 Calculate machining parameters for given component.</p> <p>TLO 1.4 Describe construction and specification of a drilling machine.</p> <p>TLO 1.5 List various drilling operations</p>	<p>Unit - I Fundamentals of Lathe and drilling machines</p> <p>1.1 Basics of Machining: Single point cutting Tool and its nomenclature, Mechanics of Chip formation, Types of Chips.</p> <p>1.2 Lathe machine: Classification, specification of centre lathe; Basic parts and accessories like chucks (three jaw, four jaw, and magnetic chuck), mandrels, rests, faceplate, centres and angle plate of centre lathe and their functions.</p> <p>1.3 Lathe operations: facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling and cutting parameters like speed, feed, depth of cut and machining time.</p> <p>1.4 Drill machine: Classification, specification of drilling machine Basic parts of radial drilling machine, Sensitive drilling and their function.</p> <p>1.5 Drilling machine operations: Drilling, reaming, boring, counter sinking, counter boring, spot facing and Cutting parameters- speed, feed, depth of cut and machining time.</p>	<p>Model Demonstration Video Demonstrations</p>
2	<p>TLO 2.1 Demonstrate working of milling machines.</p> <p>TLO 2.2 Select appropriate milling cutter for given component.</p> <p>TLO 2.3 Describe milling operations for given component.</p> <p>TLO 2.4 Illustrate procedure of indexing methods.</p>	<p>Unit - II Milling Machines</p> <p>2.1 Milling Machine: Working principle, types of milling machines.</p> <p>2.2 Milling cutter: Different types of cutters, face milling cutters end milling cutters, staggered tooth milling cutter, side and face milling cutter, form milling cutters and metal slitting saw.</p> <p>2.3 Milling Process: Plain milling, face milling, side milling, end milling, straddle milling, gang milling, up and down milling.</p> <p>2.4 Dividing head; Types, function of dividing head, method of indexing.</p>	<p>Model Demonstration Video Demonstrations</p>
3	<p>TLO 3.1 Describe significance of pattern allowances.</p> <p>TLO 3.2 Describe moulding methods.</p> <p>TLO 3.3 Classify casting processes.</p> <p>TLO 3.4 Enumerate safety guidelines and precautions for a foundry workshop.</p>	<p>Unit - III Casting processes</p> <p>3.1 Pattern making: Basic steps in making pattern, types, materials and allowances, Color coding of pattern.</p> <p>3.2 Moulding: Types and properties of moulding sands, moulding methods, cores and core prints, gating and risering system.</p> <p>3.3 Casting: Casting in Indus valley civilization (IKS), Centrifugal casting, investment casting, shell moulding and applications, Casting defects-causes and remedies.</p> <p>3.4 Safety practices/ precautions in foundry shop.</p>	<p>Chalk-Board Model Demonstration Video Demonstrations</p>
4	<p>TLO 4.1 Select the relevant forming process for given component.</p> <p>TLO 4.2 Differentiate rolling and forging process.</p> <p>TLO 4.3 List various press tool operations for given component.</p> <p>TLO 4.4 Enumerate safety guidelines and precautions for a forging/press shop</p>	<p>Unit - IV Forming processes</p> <p>4.1 Drop forging: Introduction to forging, upset forging, Press forging, open die and closed die forging operations.</p> <p>4.2 Rolling: Principle of rolling, hot and cold rolling and applications, rolling mill.</p> <p>4.3 Press tool: Various operations performed on press, press tool, simple, progressive and forming dies and applications.</p> <p>4.4 Safety practices/ precautions in forging and press shop.</p>	<p>Chalk-Board Model Demonstration</p>

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	<p>TLO 5.1 Select suitable welding process for given component.</p> <p>TLO 5.2 Describe gas welding process.</p> <p>TLO 5.3 Differentiate various arc welding processes.</p> <p>TLO 5.4 Compare soldering and brazing process.</p> <p>TLO 5.5 List causes of welding defects and suggest remedies.</p> <p>TLO 5.6 Enumerate safety guidelines and precautions for a welding shop.</p>	<p>Unit - V Metal joining processes</p> <p>5.1 Welding Processes: welding and weldability, types and classification of welding processes.</p> <p>5.2 Gas welding: gas welding equipments, oxy-acetylene welding, types of flame.</p> <p>5.3 Arc welding: arc welding equipment equipments, flux shielded metal arc welding, TIG and MIG welding.</p> <p>5.4 Soldering and brazing process, Comparison, fillers, merits, demerits and applications.</p> <p>5.5 Defects in welding joints: causes and remedies.</p> <p>5.6 Safety practices/ precautions in welding shop.</p>	Chalk-Board Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
<p>LLO 1.1 Setup a lathe machine for given job as per operations.</p> <p>LLO 1.2 Select suitable cutting parameters for operations as per given job.</p> <p>LLO 1.3 Prepare a turning job as per given drawing.</p>	1	*Produce a job on a lathe machine that comprises facing, plain turning and step turning operations as per the given drawing.	4	CO1
<p>LLO 2.1 Setup a lathe machine for taper turning operations.</p> <p>LLO 2.2 Calculate taper angle for taper turning operations as per given job.</p> <p>LLO 2.3 Prepare a taper turning job as per given drawing.</p>	2	*Produce a job on a lathe machine that comprises taper turning and grooving operations as per the given drawing.	4	CO1
<p>LLO 3.1 Setup a lathe machine for chamfering and knurling operations.</p> <p>LLO 3.2 Select suitable cutting parameters for chamfering and knurling operations.</p> <p>LLO 3.3 Prepare a chamfering and knurling job as per given drawing.</p>	3	*Produce a job on a lathe machine that comprises knurling and chamfering operations as per the given drawing.	4	CO1
<p>LLO 4.1 Setup a drill machine for given job as per operations.</p> <p>LLO 4.2 Prepare a drilling job as per given drawing.</p>	4	*Produce a job on a drilling machine comprising drilling and reaming operations as per the given drawing.	4	CO1
<p>LLO 5.1 Setup a drill machine and tool for given job as per operations.</p> <p>LLO 5.2 Prepare a tapping job as per given drawing.</p>	5	*Produce a job on drilling machine comprising tapping operation as per the given drawing.	4	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Setup a drill machine and tool for given job as per operations. LLO 6.2 Prepare a counter-boring job as per given drawing.	6	Produce a job on a drilling machine comprising counter-boring operation as per the given drawing.	4	CO1
LLO 7.1 Setup a milling machine and cutter for given job. LLO 7.2 Prepare a job on milling machine as per the given drawing.	7	Produce a job on a milling machine that comprises of plain milling operation as per the given drawing.	4	CO2
LLO 8.1 Setup a milling machine and side milling cutter for given job. LLO 8.2 Prepare a job on milling machine as per the given drawing.	8	Produce a job on a milling machine that comprises of side milling operation as per given drawing.	4	CO2
LLO 9.1 Setup a milling machine and cutter for given job. LLO 9.2 Use dividing head for indexing. LLO 9.3 Prepare a spur gear on milling machine as per the given drawing.	9	*Produce a spline shaft with 3 slots using indexing mechanism as per the given drawing.	4	CO2
LLO 10.1 Select material and tool for preparing pattern. LLO 10.2 Prepare wooden pattern as per given drawing.	10	*Produce a simple wooden pattern for the given component.	4	CO3
LLO 11.1 Choose appropriate sand and tools for moulding a given pattern. LLO 11.2 Prepare a mould for given pattern.	11	*Produce a sand mould for the given pattern.	4	CO3
LLO 12.1 Select suitable material and melt it for required casting. LLO 12.2 Prepare casting as per given drawing.	12	*Produce a casting from the given mould.	4	CO3
LLO 13.1 Identify various components of forging machine. LLO 13.2 Enlist various forging operations. LLO 13.3 Identify need of safety while working in forging shop.	13	Demonstrate components of a forging machine and its safety considerations.	4	CO4
LLO 14.1 Select tool for producing given job. LLO 14.2 Prepare a bolt head/a cold chisel/hook as per given drawing.	14	*Produce a bolt head/cold chisel/hook using forging.	4	CO4
LLO 15.1 Identify various components of rolling mill/machine. LLO 15.2 Enlist rolling methods used in industries. LLO 15.3 Identify need of safety while working rolling shop.	15	Demonstrate the various parts of rolling mill/machine and various safety aspects of it.	4	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Identify various components of Press tool. LLO 16.2 Identify type of die used for production of washer. LLO 16.3 Identify need of safety while working in press shop.	16	Demonstrate production process of washer.	2	CO4
LLO 17.1 Prepare material for fabricating structure. LLO 17.2 Select suitable equipment and tool for welding. LLO 17.3 Fabricate structure as per given drawing.	17	*Fabricate structure using arc welding machine as per given drawing.	4	CO5
LLO 18.1 Prepare joint for soldering/brazing by applying flux. LLO 18.2 Perform soldering/brazing operations on the given components.	18	*Perform soldering/brazing operations on the given components.	2	CO5
LLO 19.1 Enlist various welding defects and their causes. LLO 19.2 Identify casting defects in the given welded joints.	19	Identify various welding defects from given castings.	2	CO5

Note : Out of above suggestive LLOs -

- '* Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Justify why lathe machine is called mother of all machines.
- Collect information regarding car bonnet manufacturing in automobile industry.
- Collect information of material used for preparation of pattern.
- Justify necessity of safety precaution in industries.
- Prepare a list of machine tools seen in the industry during industrial visit.

Micro project

- Collect specifications of machine tools available in the industry you have visited.
- Prepare a list of similar operations that can be performed on different machine tools along with their specifications.
- Collect different welding equipments required for a welding shop.
- Collect a information about operations required for key manufacturing.
- Prepare a list of machine tools available in the workshop of the institute with their specifications.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Centre lathe machine. (Length between canters 1000 mm, swing 500 mm)	1,2,3
2	Pattern making, moulding and casting shop with necessary equipment.	10,11,12
3	Mini forging press (Capacity upto 1 ton)	13,14
4	Rolling mill (Laboratory type)	15
5	Mini press tool (Capacity upto 1 ton)	16
6	TIG/MIG welding equipmet (upto 160 A, 240 Volts)	17,18,19
7	Drilling Machine (drill diameter up to 40 mm)	4,5,6
8	Column and knee type milling machine along with dividing head (length X width of working table 1000 mm X 500)	7,8,9

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamentals of Lathe and drilling machines	CO1	10	4	6	6	16
2	II	Milling Machines	CO2	9	4	6	6	16
3	III	Casting processes	CO3	9	2	6	4	12
4	IV	Forming processes	CO4	8	2	4	4	10
5	V	Metal joining processes	CO5	9	4	8	4	16
Grand Total				45	16	30	24	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Tests
- Seminar/Presentation
- Term Work

Summative Assessment (Assessment of Learning)

- Practical

- Theory

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	2	2	-	2	2			
CO2	3	2	2	2	-	2	2			
CO3	3	2	2	2	-	2	2			
CO4	3	2	2	2	-	2	2			
CO5	3	2	2	2	-	2	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	P N RAO	Manufacturing Technology Vol-1	McGraw Hill, New Delhi. ISBN-1259062570, 9781259062575
2	P N RAO	Manufacturing Technology Vol-2	McGraw Hill, New Delhi, ISBN: 9789353160524
3	S K Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy	Elements Of Workshop Technology Vol-1	Media Propoters & Publisher PVT. LMT. ISBN-13 5551234102415
4	S K Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy	Elements Of Workshop Technology Vol-2	Media Propoters & Publisher PVT. LMT., ISBN: 978-8-185-09915-6.
5	D.P. Agrawal	Ancient Metal Technology and Archaeology of South Asia: a Pan-Asian perspective	Aditya Prakashan, New Delhi. ISBN: 9788173051777

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=Wc2gpWcmGK4	Lathe Machine Operations
2	https://www.youtube.com/watch?v=DGsV6RhBnbM	Radial drilling machine
3	https://www.youtube.com/watch?v=zzXdddrV2so	Simple Job on milling machine
4	https://www.youtube.com/watch?v=2CIcvB72dmk	Basics of Metal Casting
5	https://www.youtube.com/watch?v=-w7E88zox6w	Closed die forging
6	https://www.youtube.com/watch?v=RyLvVMg84xs	Basics of welding process

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

