PRODUCTION PROCESSES **Course Code : 314340**

Programme Name/s : **Mechanical Engineering/ Production Engineering**
Programme Code : **ME/ PG**
Semester : **Fourth**
Course Title : **PRODUCTION PROCESSES**
Course Code : **314340**

I. RATIONALE

This course is designed to elevate students knowledge of production processes by engaging them in analyzing and evaluating various production processes. Students will progress from understanding of basic concepts to selecting appropriate production methods for specific engineering applications. The aim of this course is to increase the ability to make effective decisions in production planning and control.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select relevant production processes in different industrial/field applications.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use appropriate CNC machine as per given application.
- CO2 - Prepare the component using grinding and various finishing operation.
- CO3 - Produce gears using various gear manufacturing methods.
- CO4 - Select the press and its components for various applications.
- CO5 - Select suitable Non-Traditional machining process for given component.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314340	PRODUCTION PROCESSES	PPR	DSC	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125

Total IKS Hrs for Sem. : 2 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	TLO 1.1 Classify CNC machines. TLO 1.2 List functions of different elements of CNC machine. TLO 1.3 Draw a basic schematic diagram of a CNC machine, labeling key components. TLO 1.4 Explain the different constructional details of CNC machine. TLO 1.5 Explain the various inserts used in CNC machine.	**Unit - I Fundamentals of CNC machine** 1.1 Introduction: Definition, advantages and applications of CNC 1.2 Classification of CNC: Point-to-point, continuous path, straight path, absolute and incremental co-ordinate system, open loop and closed loop control system. 1.3 Constructional elements of CNC: Machine structure-Bed, slide ways, column and tables.Spindle drives-Stepper motor, servo motor & hydraulic motor. Movement's actuators- re-circulating ball screw, linear motion bearings. Feedback elements- Positional and velocity feed backs. Automatic tool changer- Tool magazine, turret head. Pallet changer- Linear and rotary pallet changer. 1.4 Tooling: Indexable inserts, ISO code and nomenclature	Lecture Using Chalk-Board Presentations Video Demonstrations

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.
2	TLO 2.1 Define the surface finish. TLO 2.2 Designate the grinding wheels. TLO 2.3 Explain process of grinding wheel dressing and truing. TLO 2.4 Explain construction and working of different grinding machines. TLO 2.5 Explain the different superfinishing process	**Unit - II Grinding and Superfinishing** 2.1 Introduction: Definition of surface finish. Significance of grinding in manufacturing. 2.2 Grinding wheels: Abrasives, Grit size, Grade structure and bond type. 2.3 Grinding wheel dressing and truing-Purpose and methods 2.4 Types of Grinding machines: Construction and working of Surface, cylindrical and Internal grinders. 2.5 Super finishing Processes: Lapping, Honing, Buffing, Polishing etc.	Lecture Using Chalk-Board Presentations Video Demonstrations
3	TLO 3.1 List different gear cutting methods. TLO 3.2 Explain the working principle of gear cutting methods. TLO 3.3 Differentiate amongst different gear cutting methods. TLO 3.4 Identify typical applications of gear shaping for different gear types. TLO 3.5 Explain the working principle of various gear manufacturing methods. TLO 3.6 List different gear finishing methods. TLO 3.7 State the importance of gear finishing.	**Unit - III Gear Manufacturing Methods** 3.1 Importance of gear cutting, Gear manufacturing methods. 3.2 Gear Milling: Types of milling operations for gear manufacturing, cutter selection, advantages, limitations, and applications. 3.3 Gear Shaping Process: Basics of gear shaping, tooling requirement, machining considerations, advantages, limitations, and applications. 3.4 Gear Broaching Process: Working Principle, broaches for gear teeth, applications and limitations of gear broaching. 3.5 Gear Hobbing: Working principle, equipment setup, cutting parameters, advantages, disadvantages, and applications. 3.6 Gear Finishing methods: Importance and need of gear finishing, Introduction to Gear Finishing processes like Gear grinding, Gear Honing, Gear Burnishing, Gear Lapping	Lecture Using Chalk-Board Presentations Video Demonstrations
4	TLO 4.1 Name different sheet metals used in press industry. TLO 4.2 Classify press. TLO 4.3 Name different components of press. TLO 4.4 Explain working of press with neat sketch. TLO 4.5 Compare between Jigs and Fixtures. TLO 4.6 Explain locations methods of jigs and fixtures. TLO 4.7 Explain the principle of Jig and fixtures.	**Unit - IV Press and Accessories** 4.1 Introduction: Common sheet metals used in industry. 4.2 Presses and their classification: Mechanical, Hydraulic and Pneumatic, Selection criteria for presses (Force, Speed, Production volume and type of operation) 4.3 Press tools and dies: Components of press tool. 4.4 Jigs and Fixtures: Introduction, Types, Principles of Jigs and fixtures, Methods of location.	Lecture Using Chalk-Board Presentations Video Demonstrations

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	TLO 5.1 Classify Non traditional machining processes. TLO 5.2 List the factors to be considered for non-traditional process selection . TLO 5.3 Explain working principle of USM/EDM/ECM/LBM process. TLO 5.4 Compare various Non traditional processes on given parameters. TLO 5.5 State the factors considered for process selection of Non traditional machining. TLO 5.6 Describe the RP cycle. TLO 5.7 Draw block diagram of CIM.	**Unit - V Non-Traditional Machining Processes** 5.1 Need for Non-Traditional Machining processes, Limitations of conventional processes, Classification of Non-Traditional Processes, Factors considered for process selection. 5.2 Electrical Discharge Machine(EDM) : Working Principle, Process parameters, applications, advantages, and disadvantages. 5.3 Ultrasonic Machining(USM): Working Principle, Process parameters, applications, advantages, and disadvantages. 5.4 Electrochemical Machining (ECM): Working Principle, Process parameters, applications, advantages, and disadvantages. 5.5 Laser Beam Machining (LBM): Working Principle, Process parameters, applications, advantages, and disadvantages. 5.6 Rapid Prototyping (RP):Introduction,Definition Cycle and applications 5.7 Computer Integrated Manufacturing (CIM): Introduction, Components of CIM, Benefits of CIM.	Lecture Using Chalk-Board Presentations Video Demonstrations

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
LLO 1.1 Identify different components of CNC LLO 1.2 Set the machine for given operation by using suitable parameters	1	*CNC machine.	2	CO1
LLO 2.1 Perform the surface grinding machine to finish the given job surface. LLO 2.2 Compare the pre finish and post finish condition using surface tester.	2	*Preparation of given job using Surface Grinding operation.	4	CO2
LLO 3.1 Use of grinding and lapping machine for finishing the given job surface with different surface finish operations. LLO 3.2 Compare the surface finish with justification.	3	Comparison of surface finish using i. Grinding machine ii. Lapping operation	4	CO2
LLO 4.1 Calculate the number of teeth of gears using dividing head. LLO 4.2 Measure the dimensions of gear teeth thickness.	4	*Required data for gear manufacturing.	4	CO3
LLO 5.1 Prepare given sheet metal component as per given drawing. LLO 5.2 Fabricate any sheet metal utility job as per drawing. (any one)	5	*Manufacturing of a sheet metal component	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Prepare a Jig as per requirement using relevant principles. LLO 6.2 Prepare a Fixture as per requirement using relevant principles.	6	Jig/Fixture Manufacturing for different machines available in workshop.	6	CO4
LLO 7.1 Prepare a colored chart showing working principle of non-traditional machining process.	7	*Non Traditional machining processes (any two).	2	CO5
LLO 8.1 Prepare a colored chart showing constructional features of non-traditional machining process.	8	Non Traditional machining processes (any two).	4	CO5
LLO 9.1 Collect information regarding tool sharpening methods in ancient India.	9	*Information collection for tool sharpening in ancient India.(IKS)	2	CO1 CO2 CO3 CO4 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) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	CNC Turning 250 with standard accessories and multi controller changing facility with simulated control panel and related software. Training or Productive type minimum diameter 25 mm, Length 120 mm with ATC, (Suggested)	1
2	CNC Milling 250 with standard accessories and multi-controller changing facility with simulated control panel and related software. Training or Productive type-X axis travel - 225 mm, Y axis travel - 150 mm, Z axis travel - 115 mm, with ATC. (Suggested)	1
3	Surface Grinder (200*13*31.75) Spindle speed 2800 rpm; Surface Table-225*450 mm Vertical Feed Graduation 0.01 mm 0.01 mm, Cross Feed Graduation 0.05 mm 0.05 mm	2
4	Semi automatic Lapping machine,Dimension:30 X 28 X 47, 1 KW,230 V,50 Hz,	2,3
5	Milling machine, face milling cutter, side and face milling cutter, end mill cutter. Minimum 500 mm longitudinal traverse, with required indexing head, set of work holding devices, cutting tools, accessories, and tool holders.	4,6
6	Hydraulic Press Machine 10 Ton,Non CNC,H ype, 230 V,50Hz,Semi-automatic (10-50 Ton),	5
7	Centre lathe machine. (Length between centers 1000 mm, swing 500 mm,) 3 Jaw self centred chuck,Chucking Diameter Range 25-200 mm,	6
8	Drilling Machine (drill diameter up to 40 mm),1.5 HP, Base size 500 x 500,Spindle Speed 110-1500 rpm, Drilling Capacity 40 mm,	6

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 CNC machine	CO1	10	2	4	6	12
2	II	Grinding and Superfinishing	CO2	10	2	4	6	12
3	III	Gear Manufacturing Methods	CO3	15	4	6	8	18
4	IV	Press and Accessories	CO4	15	4	6	8	18
5	V	Non-Traditional Machining Processes	CO5	10	2	4	4	10
Grand Total				**60**	**14**	**24**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two Unit Tests of 30 Marks and average of two unit tests.For Laboratory learning Term Work -25 Marks ; For Self Learning-25 Marks

Summative Assessment (Assessment of Learning)

- End Semester Assessment of 70 Marks

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	-	-	3	-	-	2			
CO2	3	2	2	3	-	-	2			
CO3	3	3	2	3	-	-	2			
CO4	3	3	2	3	-	-	2			
CO5	3	-	-	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

PRODUCTION PROCESSES **Course Code : 314340**

Sr.No	Author	Title	Publisher with ISBN Number
1	Rao P.N.	Manufacturing Technology Vol-2	McGraw Hill, New Delhi, ISBN: 9789353160524,July 2018, Fourth Edition
2	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,Jan 2010,Fifteenth Edition.
3	O. P. Khanna & Lal	Production Technology Volume- II	Dhanpat Rai Publications ISBN: 978-81-7409-099-7,1976,Nineteenth Edition.
4	Dr.P.C.Sharma	Production Technology	S.Chand Publications.ISBN: 978-93-550-1069-8,Dec 2006,Seventh Edition.
5	P.K.Mishra	Non-conventional Machining	Narosa Publishing House ISBN: 978-8173191381,Jan 1997,Reprint 2018.
6	S.F.Krar,A.R.Gill,P.Smid	Technology of Machine Tools	Tata-McGraw Hill ISBN: 9781260087932,April 2019, Eighth Edition.
7	Mikell P.Groover	Fundamentals of Modern Manufacturing	John Wiley & Sons, Inc.ISBN: 978-1-119-47521-7,Jan 2010,Fourth Edition.
8	Kenneth G. Cooper	Rapid Prototyping Technology	Marcel Dekker Inc.ISBN :9780824702618,Jan 2001,First Edition.

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/Oy875yOH1bc	CNC Machine Animation
2	https://youtu.be/jh8852sfhpw	Ultrasonic machining animation
3	https://youtu.be/06QxjEAMrKc?list=PLwFw6Nkm8oWqFJUxiUuu5c0uHK076lz2K	Non-conventional machining

Note :

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