

# SHRI VENKATESHWARA UNIVERSITY



## Syllabus

### Diploma

### Mechanical Engineering

### V<sup>th</sup> Semester

(THREE Years Programme)

(w.e.f. 2019-20)

**SCHOOL OF ENGINEERING &  
TECHNOLOGY**

**Mechanical Engineering SEMESTER-V**

Sl No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	C T	T A	Tot al	P S	TE	P E		
1	<b>PME – 501</b>	Advanced Manufacturing Processes	3	0	0	20	10	30		70		100	3
2	<b>PME -502</b>	Theory of Machines & Mechanisms	2	1	0	20	10	30		70		100	3
3	<b>PME -503</b>	Industrial Engineering & Management	3	0	0	20	10	30		70		100	3
4	<b>PME - 504</b>	Computer Integrated Manufacturing	3	0	0	20	10	30		70		100	3
5	<b>PME -505</b>	Farm Equipment & Farm Machinery	3	0	0	20	10	30		70		100	3
6	POE-051	Operation Research	3	0	0	20	10	30		70		100	3
7	PME-511	Manufacturing Engineering Lab-II	0	0	2				10		15	25	1
8	<b>PME-512</b>	CAD/CAM Lab	0	0	2				10		15	25	1
9	PME-513	Summer Internship-II	0	0	0				50			50	3
10	<b>PME-514</b>	Project PHASE-I	0	0	4				50		50	100	2
												<b>800</b>	<b>25</b>

Summer Internship-II (6 weeks) after IVth Sem

Course Code	:	PME 501
Course Title	:	ADVANCED MANUFACTURING PROCESSES
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Basic Mechanical Engineering Manufacturing Engineering (
Course Category	:	PC

Course Objectives:

- To Know the functions of Jigs and Fixtures.
- To know the applications of jig-boring machines.
- To identify different fabrication methods of plastic processing viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
- To distinguish between non-conventional machining and traditional machining processes.
- To know about the advancements in the area of manufacturing and production processes.
- To impart knowledge & skills necessary for working in modern manufacturing environment.
- To get familiarized with working principles and operations performed on non-traditional machines, machining center, SPM, automated machines and maintenance of machine tools.

Course Content:

**UNIT-I: Jigs & Fixtures:** Definition of jig; Types of jigs: Leaf jig, Box and Handle jig, Template jig, Plate jig, Indexing jig, Universal jig, Vice jigs - constructional details of the above jigs; General consideration in the design of drill jigs; Drill bush; Types of fixtures: Vice fixtures, Milling fixtures, Boring fixtures, Grinding fixtures - constructional details of the above fixtures; Basic principles of location; Locating methods and devices; Basic principles of the clamping; Types of clamps: Strap clamps, Cam clamps, Screw clamps, Toggle clamps, Hydraulic and Pneumatic clamps.

**Unit-II: Jig Boring:** Introduction; Jig boring on vertical milling machine; Types jig boring machines: Open front machine, Cross rail type machine - constructional details & their working; System of location of holes.

**Plastic Processing:** Processing of plastics; Moulding processes: Injection moulding, Compression moulding, Transfer moulding; Extruding; Casting; Calendering; Fabrication methods-Sheet forming, Blow moulding, Laminating plastics (sheets, rods & tubes), Reinforcing; Applications of Plastics.

**Unit-III: Modern Machining Processes:** Introduction – comparison with traditional machining; Ultrasonic Machining: principle, Description of equipment, applications; Electric Discharge Machining: Principle, Description of equipment, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, applications; Wire cut EDM: Principle, Description of equipment, Controlling parameters; applications; Abrasive Jet Machining: principle, description of equipment, application; Laser Beam Machining: principle, description of equipment, application; Electro Chemical Machining: description of equipment, application.

**Unit-IV: CNC Milling Machines:** Vertical and horizontal machining center: Constructional features, Axis identification, Electronic control system. Automatic tool changer and tool magazine. CNC programming: Preparatory functions (G code), miscellaneous functions (M code), Part programming including subroutines and canned cycles. Principles of computer aided part programming.

**Machine Tool Automation:** Introduction and Need; (A) Single spindle automates, transfer lines.

(B) Elements of control system, Limit switches, Proximity switches, Block diagram for feedback and servo control system, Introduction to PLC, Block diagram of PLC.

**Unit-V: Special Purpose Machines (SPM):** Concept, General elements of SPM, Productivity improvement by SPM, Principles of SPM design.

**Maintenance of Machine Tools:** Types of maintenance, Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records, Housekeeping. Introduction to Total Productive Maintenance (TPM).

Reference Books:

1. Production Technology – HMT, Bangalore, Tata Mc-Graw Hill
2. CNC machines – Pabla B. S. & M. Adithan, New Age international limited.
3. Non conventional Machining – P.K. Mistra, Narvasa PublishingHouse
4. Manufacturing Processes – Begman & Amsted, John Willey and Sons.
5. Advanced manufacturing technology – David L. Goetsch
6. Exploring Advanced Manufacturing Technologies – Stephen F. Krar & Arthur Gil, Industrial Press

Course outcomes:

At the end of the course, the student will be able to:

CO1	Know the Operation and control of different advanced machine tools and equipments.
CO2	Produce jobs as per specified requirements by selecting the specific machining process.
CO3	Develop the mind set for modern trends in manufacturing and automation.
CO4	Identify the different fabrication methods viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
CO5	Know different non-traditional machining processes, CNC milling machines, special purpose machines.
CO6	Work as maintenance engineer.

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Course Code	:	PME 502
Course Title	:	THEORY OF MACHINES & MECHANISMS
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Engineering Mechanics (ESC201)
Course Category	:	PC

Course Objectives:

- To understand different types of cams and their motions and also to draw cam profiles for various motions.
- To understand the mechanism of various types of drives available for transmission of power.
- To understand the design of Brakes, Dynamometers, Bearings and Clutches and their function and working.
- To understand the need for balancing of masses in the same plane
- To Know different types of governors.

Course Content:

**UNIT I: Cams and Followers:** Concept; Definition and application of Cams and Followers; Classification of Cams and Followers; Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation; Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method).

**UNIT II: Power Transmission:** Types of Drives – Belt, Chain, Rope, Gear drives & their comparison; Belt Drives - flat belt, V- belt & its applications; Material for flat and V-belt; Angle of lap, Belt length. Slip and Creep; Determination of Velocity Ratio, Ratio of tight side and slack side tension; Centrifugal tension and Initial tension; Condition for maximum power transmission (Simple numericals); Chain Drives – Advantages & Disadvantages; Selection of Chain & Sprocket wheels; Methods of lubrication; Gear Drives – Spur gear terminology; Types of gears and gear trains, their selection for different applications; Train value & Velocity ratio for compound, reverted and simple epicyclic gear train; Methods of lubrication; Law of gearing; Rope Drives – Types, applications, advantages & limitations of Steel ropes.

**UNIT III: Flywheel and Governors:** Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals); Coefficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance; Governors - Types and explanation with neat sketches (Centrifugal, Watt and Porter); Concept, function and applications & Terminology of Governors; Comparison between Flywheel and Governor.

**UNIT IV: Brakes, Dynamometers, Clutches & Bearings:** Function of brakes and dynamometers; Types of brakes and Dynamometers; Comparison between brakes and dynamometers; Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake; Concept of Self Locking & Self energizing brakes; Numerical problems to find braking force and braking torque for shoe & band brakes; Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometers; Clutches- Uniform pressure and Uniform Wear theories; Function of Clutch and its application; Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch and v) Diaphragm clutch. (Simple numericals on single and Multiplate clutch); Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numericals.

**UNIT V: Balancing & Vibrations:** Concept of balancing; Balancing of single rotating mass; Graphical method for balancing of several masses revolving in same plane; Concept and terminology used in vibrations, Causes of vibrations in machines; their harmful effects and remedies.

Reference Books:

1. Theory of machines – S.S .Rattan ,Tata McGraw-Hill publications.
2. Theory of machines – R.K.Bansal ,Laxmi publications
3. Theory of machines – R.S. Khurmi & J.K.Gupta , S.Chand publications.
4. Dynamics of Machines – J B K Das, Sapna Publications.
5. Theory of machines – Jagdishlal, Bombay Metro – Politan book Ltd.

Course outcomes:

At the end of the course, the student will be able to:

CO1	Know different machine elements and mechanisms.
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C02	Understand Kinematics and Dynamics of different machines and mechanisms.
C03	Select Suitable Drives and Mechanisms for a particular application.
C04	Appreciate concept of balancing and Vibration.
C05	Develop ability to come up with innovative ideas.
C06	Understand different types of cams and their motions and also draw cam profiles for various motions

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Course Code	:	PME 503
Course Title	:	INDUSTRIAL ENGINEERING & MANAGEMENT
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

#### Course Objectives:

- To take the right decisions to optimize resources utilization by improving productivity of the Lands, Buildings, People, Materials, Machines, Money, Methods and Management effectively.
- To eliminate unproductive activities under the control of the Management, Supervisor, worker and the Design of Products and Processes.
- To use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.

#### Course Content:

**UNIT-I: Plant Engineering:** Plant; Selection of site of industry; Plant layout; Principles of a good layout; Types; Process; Product and Fixed position; Techniques to improve Layout; Principles of Material handling equipment; Plant maintenance; Importance; Break down maintenance; Preventive maintenance and Scheduled maintenance.

**Plant Safety:** Importance; Accident: Causes and Cost of an Accident, Accident Proneness, Prevention of Accidents; Industrial disputes; Settlement of Industrial disputes; Collective bargaining; Conciliation; Mediation; Arbitration; Indian Factories Act 1948 and its provisions related to health, welfare and safety.

**UNIT-II: Work Study:** Productivity; Standard of living; Method of improving Productivity; Objectives; Importance of good working conditions.

**Method Study:** Definition; Objectives; Selection of a job for method study; Basic procedure for conduct of Method study; Tools used; Operation process chart; Flow process chart; Two handed process chart; Man Machine chart; String diagram and flow diagram.

**Work Measurement:** Definition; Basic procedure in making a time study; Employees rating factor; Application of time allowances: Rest, Personal, Process, Special and Policy allowances; Calculation of standard time; Numerical Problems; Basic concept of production study; Techniques of Work Measurement; Ratio delay study; Synthesis from standard data; Analytical estimating and Pre determined Motion Time System (PMTS).

**UNIT-III: Production Planning and Control:** Introduction; Major functions of Production Planning and Control; Pre planning; Methods of forecasting; Routing and Scheduling; Dispatching and Controlling; Concept of Critical Path Method (CPM); Types of Production: Mass Production, Batch Pro-

duction and Job Order Production; Characteristics; Economic Batch Quantity (EBQ); Principles of Product and Process Planning; Make or Buy decision; Numerical problems.

**Quality Control:** Definition; Objectives; Types of Inspection: First piece, Floor and Centralized Inspection; Advantages and Disadvantages; Statistical Quality Control; Types of Measurements; Method of Variables; Method of Attributes; Uses of X, R, p and c charts; Operating Characteristics curve (O.C curve); Sampling Inspection; Single and Double Sampling plan; Concept of ISO 9001:2008 Quality Management System Registration/Certification procedure; Benefits of ISO to the organization.

**UNIT-IV: Principles of Management:** Definition of Management; Administration; Organization; F.W. Taylor's and Henry Fayol's Principles of Management; Functions of Manager; Types of Organization: Line, Staff, Taylor's Pure functional types; Line and staff and committee type; Directing; Leadership; Styles of Leadership; Qualities of a good leader; Motivation; Positive and Negative Motivation; Modern Management Techniques; Just In Time; Total Quality Management (TQM); Quality circle; Zero defect concept; 5S Concept; Management Information Systems. **Personnel Management:** Responsibility of Human Resource Management; Selection Procedure; Training of Workers; Apprentice Training; On the Job training and Vestibule School Training; Job Evaluation and Merit Rating; Objectives and Importance; Wages and Salary Administration; Components of Wages; Wage Fixation; Type of Wage Payment: Halsey's 50% Plan, Rowan's Plan and Emerson's efficiency plan; Numerical Problems.

**UNIT-V: Financial Management:** Fixed and Working Capital; Resources of Capital; Shares Preference and Equity Shares; Debentures; Type of debentures; Public Deposits; Factory Costing: Direct Cost; Indirect Cost; Factory Overhead; Selling Price of a product; Profit; Numerical Problems; Depreciation; Causes; Methods: Straight line, sinking fund and percentage on Diminishing Value Method; Numerical Problems.

**Material Management:** Objectives of good stock control system; ABC analysis of Inventory; Procurement and Consumption cycle; Minimum Stock, Lead Time, Reorder Level-Economic Order Quantity problems; Supply Chain.

Reference Books:

1. Industrial Engineering & Management, S.C. Sharma, Khanna Book Publishing Co. (P) Ltd., Delhi
2. Industrial Engineering and Management, O.P. Khanna, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi – 110002.
3. Management, A global perspective, Heinz Wehrich, Harold Koontz, 10<sup>th</sup> Edition, McGraw Hill International Edition 1994.
4. Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.
5. Principles and Practices of Management, Premvir Kapoor, Khanna Publishing House, N. Delhi

Course outcomes:

At the end of the course, the student will be able to:

CO1	Explain the different types of layout and plant maintenance with safety
CO2	List and explain the need of method study and work measurements
CO3	Explain the production planning and quality control, and its functions
CO4	Understand the basic principles, approaches and functions of management and identify concepts to specific situations
CO5	List and explain the different financial sources and methods of inventory management

Course Code	:	PME-504
Course Title	:	COMPUTER INTEGRATED MANUFACTURING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

Course Objectives:

- To understand General Principles of Mechanical Engineering.
- To understand laws of thermodynamics, thermal and thermodynamic Processes
- To understand working principles of power developing and power absorbing devices
- To understand basic materials and manufacturing processes

Course Content:

**UNIT-I:** Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors

**Unit-II:** Computer Aided Design (CAD): CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.

**Unit-III:** Computer Aided Manufacturing (CAM), Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP)

**Unit-IV:** Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.

**Unit-V:** Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting; office automation

Reference Books:

1. CAD, CAM, CIM - P.Radhakrishnan and S.Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing - Paul G. Rankey, Prentice Hall.
3. Robotics Technology and Flexible Automation – S.R. Deb, Tata McGraw Hill.

Course outcomes:

At the end of the course, the student will be able to:

CO1	Understand the formulation of Linear Programming
CO2	Analyze and Convert the problem into a mathematical model.
CO3	Understand the dual LP and Primal Dual relation problems
CO4	Understand and implement the transportation problems at workplace
CO5	Solve the assignment problems, solving linear programming approach using software



Course Code	:	PME 505
Course Title	:	FARM EQUIPMENT AND FARM MACHINERY
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

**Course Learning Objectives:**

- Able to find and characterize the machinery based on crop production.
- Able to find the field efficiency and capacities to calculate the economics of machinery.
- Able to find the machines usages for different tillage, and its power requirement calculations.
- Able to understand sowing, planting & transplanting equipment based on crop.
- Able to understand machinery materials and heat effects for different farm machinery equipment

Course Content:

**UNIT-I:** Introduction to farm mechanization; Classification of farm machines; Unit operations in crop production; Identification and selection of machines for various operations on the farm; Hitching systems and controls of farm machinery.

**Unit-II:** Calculation of field capacities and field efficiency; Calculations for economics of machinery usage, comparison of ownership with hiring of machines;. Introduction to seed-bed preparation and its classification. Familiarization with land reclamation and earth moving equipment.

**Unit-III:** Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage; Measurement of draft of tillage tools and calculations for power requirement for the tillage machines; Introduction to tillage machines like mould-board plough, disc plough, chisel plough, sub-soiler, harrows, puddler, cultivators, identification of major functional components; Attachments with tillage machinery.

**Unit-IV:** Introduction to sowing, planting & transplanting equipment; Introduction to seed drills, no-till drills, and strip-till drills; Introduction to planters, bed planters and other planting equipment like sugarcane, potato; Study of types of furrow openers and metering systems in drills and planters; Calibration of seed-drills/ planters; Adjustments during operation.

**Unit-V:** Introduction to materials used in construction of farm machines; Heat treatment processes and their requirement in farm machines; Properties of materials used for critical and functional components of agricultural machines; Introduction to steels and alloys for agricultural application; Identification of heat treatment processes specially for the agricultural machinery components.

Reference Books:

1. Principles of Farm Machinery by R.A. Kepner, Roy Bainer, and E. L. Berger
2. Farm Machinery and Equipment by H. P. Smith
3. Farm Machinery and equipment by C. P. Nakra
4. Engineering principles of Agril. Machines by Dr. Ajit K. Srivastav, Caroll E. Goering and Roger P. Rohrbach.
5. Farm Machinery – an Approach by S. C Jain & Grace Phillips
6. Agril. Engineering through worked out examples by Dr. R. Lal and Dr. A.C. Dutta
7. Farm Power and Machinery Engineering by Dr. R. Suresh and Sanjay Kumar

Course Code	:	POE-051
Course Title	:	OPERATIONS RESEARCH
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

**Course Learning Objectives:**

- To provide a broad and in depth knowledge of a range of operation research models and techniques, which can be applied to a variety of industrial applications.

Course Content:

**UNIT-I:** Development, Definition, Characteristics and phase of Scientific Method, Types of models; General methods for solving operations research models.

**UNIT-II:** Allocation: Introduction to linear programming formulation, graphical solution, Simplex Method, artificial variable technique, Duality principle. Sensitivity analysis.

**UNIT-III:** Transportation Problem Formulation optimal solution. Unbalanced transportation problems, Degeneracy. Assignment problem, Formulation optimal solution.

**UNIT-IV:** Sequencing: Introduction, Terminology, notations and assumptions, problems with n-jobs and two machines, optimal sequence algorithm, problems with n-jobs and three machines.

**UNIT-V:** Theory of games: introduction, Two-person zero-sum games, The Maximum –Minimax principle, Games without saddle points – Mixed Strategies,  $2 \times n$  and  $m \times 2$  Games – Graphical solutions, Dominance property, Use of L.P. to games.

Reference Books:

1. Operations Research: an introduction, Hamdy A. Taha, Pearson Education.
2. Operations. Research: theory and application, J.K. Sharma, Macmillan Publishers.
3. Introduction to Operations Research: concept and cases, Frederick S. Hillier and Gerald J. Lieberman, Tata McGraw-Hill

Course outcomes:

At the end of the course, the student will be able to:

CO1	Understand the formulation of Liner Programming
CO2	Analyze and Convert the problem into a mathematical model.
CO3	Understand and implement the transportation problems at workplace
CO4	Understand sequencing to optimize the process time for n- job and m-machine
CO5	Identify and select suitable methods for various games and apply the LP

Course Code	:	<b>PME 511</b>
Course Title	:	MANUFACTURING ENGINEERING LAB-II
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Manufacturing Engineering (MEPC205)
Course Category	:	PC

Course Objectives:

- To Know the working of Drilling machine, shaper, slotter, planer, milling and grinding machines and be in a position to operate the same.
- To make use of various measuring instruments for taking dimensions.
- To Practice different operations on drilling shaper, slotter, planer, milling and grinding machines.

Course Content:

S.No.	Topics for practice
I	Drilling Exercise (Three different sized holes for different materials maintaining uniform distance between them)
II	Milling-square-hexagon from round bars with indexing and without indexing
III	Generation of spur gear teeth on a round bar
IV	Simple planning exercise cutting 'T' slots (one model)
V	Shaping a Hexagon on a round bar, key ways, grooves splines
VI	Shaping step block cut dovetail to angles 60, 90, 120 degrees
VII	Cylindrical grinding of external surface and internal surface using universal grinding machines
VIII	Grinding Cutting tools to the required angles
IX	Grinding of milling cutters etc, on a tool and cutter grinder

X	Grinding flat surface on a surface grinder using magnetic chuck and clamping devices
XI	Dismantling some of the components of drilling machine and service, assemble the same
XII	Dismantling some of the components of shaper head and then assemble the same
XIII	Dismantling some of the components of Milling machines and service, assemble the same
XIV	Servicing of universal grinding machine

Reference Books:

1. Elements of Workshop Technology (Volume I & II) – Hajra Chowdry & Bhattacharaya, Media Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology – Rajendersingh, New age International (P) Ltd. NewDelhi, 2006
3. Production Technology – HMT, 18<sup>th</sup> edition, Tata McGraw Hill, New Delhi
4. Manufacturing process – Myro N Begman, 5<sup>th</sup> edition, Tata McGraw Hill, New Delhi

Course outcomes:

At the end of the course, the student will be able to:

CO1	Dismantle and assemble the components on drilling, shaping, milling and grinding machines.
CO2	Perform operations on drilling, shaping, milling and grinding machines.
CO3	Produce articles of industrial application such as Spur gear, square headed bolt, V- block
CO4	Make use of various measuring instruments for taking dimensions

Course Code	:	PME 512
Course Title	:	CAD/CAM LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Computer Aided Machine Drawing (MEPC104)
Course Category	:	PC

Course Objectives:

- To understand the fundamentals and use CAD.
- To conceptualize drafting and modeling in CAD.
- To interpret the various features in the menu of solid modeling package.
- To synthesize various parts or components in an assembly.
- To prepare CNC programmes for various jobs.

Course Content:

S.No.	Topics for practice
PART-A	<b>Introduction:</b> Part modelling; Datum Plane; constraint; sketch; dimensioning; extrude; revolve; sweep; blend; protrusion; extrusion; rib; shell; hole; round; chamfer; copy; mirror; assembly; align; orient.
	Exercises: 3D Drawings of 1). Geneva Wheel; 2). Bearing Block; 3). Bushed bearing; 4). Gib and Cotter joint; 5). Screw Jack; 6). Connecting Rod: Note: Print the orthographic view and sectional view from the above assembled 3D drawing.

PART-B	<p><b>CNC Programming and Machining:</b>  Introduction; 1). Study of CNC lathe, milling; 2). Study of international standard codes: G-Codes and M-Codes; 3). Format – Dimensioning methods;  4). Program writing – Turning simulator – Milling simulator, IS practice – commands menus; 5). Editing the program in the CNC machines; 6). Execute the program in the CNC machines;  Exercises:  Note: Print the Program from the Simulation Software and make the Component in the CNC Machine.</p>
	<p><b>CNC Turning Machine:</b> (Material: Aluminium/Acrylic/Plastic rod)</p> <ol style="list-style-type: none"> <li>Using Linear and Circular interpolation - Create a part program and produce component in the Machine.</li> <li>Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine.</li> <li>Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine.</li> </ol>
	<p><b>CNC Milling Machine</b> (Material: Aluminium/ Acrylic/ Plastic)</p> <ol style="list-style-type: none"> <li>Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.</li> <li>Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine.</li> <li>Using subprogram - Create a part program for mirroring and produce component in the Machine.</li> </ol>

Reference Books:

- Machine Drawing – P.S. Gill S. K. Kataria & Sons, Delhi., 17th Revised edition, 2001
- Mechanical Draughtsmanship - G.L. Tamta Dhanpat Rai & Sons, Delhi, 1992
- Inside AutoCAD – D. Raker and H. Rice, BPB Publications, New Delhi, 1985
- CAD/CAM/CIM – P. Radhakrishnan, S. Subramaniyan & V. Raju, New Age International Pvt. Ltd., New Delhi, 3rd Edition,
- Engineering AutoCAD, A.P. Gautam & Pradeep Jain, Khanna Book Publishing Co., Delhi

Course outcomes:

At the end of the course, the student will be able to:

CO1	Explain the 3D commands and features of a CAD software
CO2	Create 3D solid model and find the mass properties of simples solids
CO3	Demonstrate the working of CNC turning and milling machine
CO4	Develop the part program using simulation software for Lathe and Milling
CO5	Assess the part program, edit and execute in CNC turning and machining centre

Course outcomes:

At the end of the course, the student will be able to:

C01	Describe the objectives of Farm mechanization.
C02	Classify the Farm Machineries, equipment and materials.
C03	Explain selection of the machineries.
C04	Discuss the forces acting on tillage tools and hitching systems.
C05	Understand the calibration, constructional features and working of various farm equipment.