SHRI VENKATESHWARA UNIVERSITY

Syllabus

Diploma

Mechanical Engineering (Production)

IVth Semester

(Three Years Programme)

(w.e.f. 2019-20)

SCHOOL OF ENGINEERING & TECHNOLOGY

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	PPE- 401	Industrial Production Technology-II	3	0	0	20	10	30		70		100	3
	PPE- 402	Theory of Machines and Mechanisms	2	1	0	20	10	30		70		100	3
3	PPE-403	Strength of Materials	2	1	0	20	10	30		70		100	3
4	PME-404	Advanced Manufacturing Processes	3	0	0	20	10	30		70		100	3
5	PME-405	Total Quality Management	3	0	0	20	10	30		70		100	3
6	PPE- 411	Industrial Production Technology Lab-II	0	0	2				10		15	25	1
7	PPE-412	CAD/CAM Lab	0	0	2				10		15	25	1
8	PPE-413	Strength of Materials & Hydraulic Machinery Lab	0	0	2				10		15	25	1
9	PPE-414	Minor Project	0	0	4				50			50	2
10	PMC-418	Essence of Indian Knowledge and Tradition	2	0	0								0
	Essence of Indian Knowledge and Tradition - Noncredit Mandatory courses											625	20

Course Code		**PPE-401**
Course Title		**INDUSTRIAL PRODUCTION TECHNOLOGY-II**
Number of Credits		**3 (L: 3, T: 0, P: 0)**
Prerequisites		**PEPC208 INDUSTRIAL PRODUCTION TECHNOLOGY LAB-II**
Course Category		**PC**

Course Learning Objectives:

- To understand basic production processes and technologies of relevance to the manufactur- ing industry and related sectors, particularly in the production, process and development areas.
- To select, operate and control the appropriate processes for specific applications and pro- duction processes, surface finishing processes and plastic processes.

Course Content:

UNIT-I: Theory of Metal Cutting: Theory of Metal Cutting: Cutting tool material-High carbon Steel-High Speed Steel-Stellites-Cemented carbides-ceramics-Composition and applications for the above-Single point cutting tool-nomenclature-tool life- Chip Breakers.

Drilling Machines: Drills-Flat drills-Twist drills-Nomenclature-Types of drilling machines-Bench type-Floor type-Radial type-Gang drill-Multi-spindle type-Principle of operation in drilling-Speeds and feeds for various materials-drilling holes-methods of holding drill bit-drill chucks-socket and sleeve-drilling-operation-reaming-counter sinking-counter boring-spot facing-tapping-deep hole drilling.

Boring Machines: Boring machines-horizontal and vertical types-fine boring machines-boring tools

UNIT-II: Reciprocating Machines: Planer: Types of planers-description of double housing planer specifications- principles of operation-drives-quick return mechanism-feed mechanism- work hold- ing devices and special fixtures-types of tools various operation.

Shaper: Types of shapers-specifications-standard-plain-universal principles of opera- tions-drives-quick return mechanism-crank and slotted link-feed mechanism-work holding devic- es-Special fixture-various operations.

Slotter: Types of slotters-specifications-method of Operation-Whitworth quick return mecha- nism-feed mechanism-work holding devices-types of tools.

UNIT-III: Milling Machines: Types-column and knee type-plain-universal milling machine-vertical milling machine-specification of milling machines principles of operation-work and tool holding de- vices-arbor-stub arbor spring collet-adapter-milling cutters-cylindrical milling cutter-slitting cutter- side milling cutter-angle milling cutter-T-slot milling cutter-woodruff milling cutter-fly cutter-no- menclature of cylindrical milling cutter-milling process conventional milling-climb milling-milling operations-straddle milling-gang milling-vertical milling attachment.

Gear Generating Processes: Gear shaper-Gear hobbing-Principle of operation only-Gear finishing processes-Burnishing-Shaving-Grinding and Lapping; Gear materials-Cast iron, Steel, Alloy steels, Brass, Bronze, Aluminum and Nylon

UNIT-IV: Abrasive Process and Broaching: Abrasive Process: Types and classification-specifica- tions-rough grinding – pedestal grinders- portable grinders- belt grinders-precision grinding cy- lindrical grinder-centerless grinders – surface grinder- tool and cutter grinder - planetory grind- ers-principles of operations-grinding wheels abrasives- natural and artificial diamond wheels-types of bonds-grit, grade and structure of wheels-wheel shapes and sizes-standard marking systems of

grinding wheels-selection of grinding wheel-mounting of grinding wheels-Dressing and Truing of wheels-Balancing of grinding wheels.

Broaching: Types of broaching machine-horizontal, vertical and continuous broaching-principles of operation-types of broaches classification- broach tool nomenclature-broaching operations-simple examples

UNIT-V: Jigs & Fixtures: Definitions and concept of Jig and fixture-Advantages of jigs and fixtures-el- ements of jigs and fixtures-locating devices-'V' locators-fixed stop locators-adjustable stop loca- tors-clamping devices strap clamp, screw clamp-cam action clamp-types of jigs-box drill jig indexing drill jig-types of fixtures-keyway milling fixture-string milling fixture.

Press Working: Types of presses-mechanical and hydraulic presses press tools and accessories-press working operations-bending operations angle bending-channel bending -curling-Drawing-shearing operations - blanking, piercing, trimming-notching-lancing-shaving-parting off.

Non-Conventional Machining Processes: Construction, working and applications of Ultrasonic machining-chemical machining-electro chemical grinding-electrical discharge machining-plasma arc machining-LASER machining-Advantages – Disadvantages.

Reference Books:

1. Elements of Workshop Technology- Vol. I & II, Hajra Choudry & Battacharya, , Ed. 11, published by Media Promoters and Publishers Pvt. Ltd.,
2. Production Technology, HMT, , Edn. 18, Tata McGraw Hill Publishing Co.
3. Manufacturing process, Myro N Begman, Edn. 5, Tata McGraw Hill Publishing Co. Ltd.
4. Workshop Tech Vol I,II, III, WAJ. Chapman, published by Viva Books Pvt. Ltd. New Delhi
5. Production processes, NITTTR, published by 5, Tata McGraw Hill Publishing Co. Ltd.

Course outcomes:

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

	Use the basic machine tools like lathe, drilling and milling.
	Understand and select the gear cutting processes.
	Demonstrate understanding of metal cutting principles and mechanism
	Identify cutting tool geometry of single point and multipoint cutting tool
	Demonstrate concepts and use of jigs and fixtures

****

Course Code		**PPE-403**
Course Title		**STRENGTH OF MATERIALS**
Number of Credits		**3 (L: 2, T: 1, P: 0)**
Prerequisites		**Engineering Mechanics (ESC201)**
Course Category		**PC**

Course Learning Objectives

- To understand the concept of Simple Stresses and Strains.
- To understand the concept of Strain Energy.
- To understand the concept of Shear Force and Bending Moment Diagrams.
- To understand the concept of Theory of Simple Bending and Deflection of Beams.
- To understand the concept of Torsion in Shafts and Springs.

- To understand the concept of Thin Cylindrical Shells.

Course Content

UNIT-I: Simple Stresses and Strains: Types of forces; Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress – strain dia- gram for M.S. and C.I. specimens; Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite sections; Related nu- merical problems on the above topics.

Strain Energy: Strain energy or resilience, proof resilience and modulus of resilience; Derivation of strain energy for the following cases: i) Gradually applied load, ii) Suddenly applied load, iii) Impact/ shock load; Related numerical problems.

Unit-II: Shear Force & Bending Moment Diagrams: Types of beams with examples: a) Cantilever beam, b) Simply supported beam, c) Over hanging beam, d) Continuous beam, e) Fixed beam; Types of Loads – Point load, UDL and UVL; Definition and explanation of shear force and bending moment; Calculation of shear force and bending moment and drawing the S.F and B.M. diagrams by the analyt- ical method only for the following cases: a) Cantilever with point loads, b) Cantilever with uniformly distributed load, c) Simply supported beam with point loads, d) Simply supported beam with UDL, e) Over hanging beam with point loads, at the centre and at free ends, f) Over hanging beam with UDL throughout, g) Combination of point and UDL for the above; Related numerical problems.

Unit-III: Theory of Simple Bending and Deflection of Beams: Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; As- sumptions in theory of simple bending; Bending Equation $M/I = \sigma/Y = E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross- section; Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems.

Unit-IV: Torsion in Shafts and Springs: Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation $T/J=f_s/R=G\theta/L$; Problems on design of shaft based on strength and rigidity; Numerical Problems related to com- parison of strength and weight of solid and hollow shafts; Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.

Unit-V: Thin Cylindrical Shells: Explanation of longitudinal and hoop stresses in the light of cir- cumferential and longitudinal failure of shell; Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure.

Reference Books:

1. Strength of Materials, R. S. Khurmi, , S. Chand & Co., Ram Nagar, New Delhi – 2002
2. Strength of Materials, D.S. Bedi, Khanna Book Publishing Co., Delhi
3. Strength of Materials, S. Ramamrutham, 15 th Edn 2004, Dhanpat Rai Pub. Co., New Delhi.
4. Strength of Materials ,R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
5. Strength of Materials, S. S. Rattan, Tata Mcgraw hill, New Delhi, 2008, ISBN 9780070668959
6. Strength of Materials, B K Sarkar, I Edition, 2003 Tata Mcgraw Hill, New Delhi.

7. Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2nd Edition, 2007

Course outcomes:

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

		Compute stress and strain values and find the changes in axial, lateral and volumetric di- mensions of bodies of uniform section and of composite section under the influence of normal forces.
		Calculate thermal stresses, in bodies of uniform section and composite sections.
		Define resilience, proof – resilience and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.
		Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams of for UDL and Point loads.
		Calculate the safe load, safe span and dimensions of cross section.
		Compare strength and weight of solid and hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.

****

Course Code		**PPE-402**
Course Title		**THEORY OF MACHINES AND MECHANISMS**
Number of Credits		**3**
Prerequisites (Course code)		**Engineering Mechanics (ESC201)**
Course Category		**PC**

Course Learning Objectives

- To understand different types of cams and their motions and also to draw cam profiles for vari- ous 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; Classi- fication 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 lubri- cation;

Gear Drives – Spur gear terminology; Types of gears and gear trains, their selection for differ- ent 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); Co- efficient 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; Con- cept 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) Hydrau- lic 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 numer- icals 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.
6. Theory of machines – P.L.Ballaney, Khanna Publications

Course outcomes

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

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

****

Course Code	**:**	**PPE-411**
Course Title	**:**	**INDUSTRIAL PRODUCTION TECHNOLOGY LAB-II**
Number of Credits	**:**	**1 (L: 0, T: 0, P:**
Prerequisites	**:**	**Industrial Production Technology-II**
Course Category	**:**	**PC**

Course Learning Objectives:

- Operate various machines like lathe, shaper etc.
- Perform plain turning, taper turning, and screw cutting etc. on lathe machine.
- Perform machining operations on shaper.
- Perform shaping operations

Course Content:

1.0 DRILLING EXERCISE (Three models)

1.1 Preparation of model with two or three different sizes holes for different materials

1.2 Preparation models of different holes by maintain minimum distance between them

2.0 SHAPING SQUARE (Three models)

2.1 Hexagon on a round bar, key ways, grooves splines,

2.2 Shaping step block cut dovetail to angles 60, 90, 120 degrees.

3.0 SIMPLE PLANNING EXERCISE CUTTING 'T' SLOTS (One model)

4.0 PRACTICES ON MILLING MACHINE (Three models)

4.1 Milling-square-hexagon from round bars with indexing and without indexing

4.2 Milling key ways of different types

4.3 Generation of spur gear teeth on a round bar.

4.4 Milling flutes of a twist drill

4.5 Milling splines and T-slots

5.0 MOUNTING BALANCING AND DRESSING OF GRINDING WHEELS

5.1 Grinding flat surface on a surface grinder using magnetic chuck and clamping devices

5.2 Cylindrical grinding of external surface and internal surface using universal grinding machines

5.3 Grinding Cutting tools to the required angles

5.4 Grinding of milling cutters etc, on a tool and cutter grinder

6.0 LATHE OPERATIONS

6.1 Facing, Step turning & Chamfering

6.2 Step turning & Groove cutting

6.3 Step turning & Taper turning

6.4 Step turning & Knurling

6.5 Step turning &Thread cutting (L.H)

6.6 Bush: Turning & Drilling

Reference Books:

1. Elements of Workshop Technology- Vol. I & II, Hajra Choudry & Battacharya, Ed. 11th, Media Promoters and Publishers Pvt. Ltd.

2. Production Technology, HMT, , Ed. 18th, Tata McGraw Hill Publishing Co. Manufacturing Process, Myro N Begman, Ed. 5th, Tata McGraw Hill Publishing Co. Ltd.

Course Code	**:**	**PPE-412**
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 Learning 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:

PART A: Solid modelling

Introduction

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 Drawing

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: CNC Programming and Machining

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.

PART C: CNC Turning Machine Material: Aluminium/Acrylic /Plastic rod

1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.
2. Using Stock removal cycle – Create a part program for multiple turning operations and pro- duce component in the Machine.
3. Using canned cycle - Create a part program for thread cutting, grooving and produce compo- nent in the Machine.

PART D: CNC Milling Machine Material: Aluminium/ Acrylic/ Plastic

1. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.
2. Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine.
3. Using subprogram - Create a part program for mirroring and produce component in the Ma- chine.

Reference Books:

1. Machine Drawing P.S. Gill S. K. Kataria & Sons, Delhi., 17th Revised edition 2001
2. Mechanical Draughtsmanship, G.L. Tamta Dhanpat Rai & Sons, Delhi, 1992
3. Inside AutoCAD D. Raker and H. Rice, BPB Publications, New Delhi, 1985
4. CAD/CAM/CIM P. Radhakrishnan, S. Subramaniyan & V. Raju, New Age International Pvt. Ltd., New Delhi, 3rd Edition, 2008

Course outcomes:

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

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

****

Course Code		**PPE-413**
Course Title		**STRENGTH OF MATERIALS & HYDRAULIC MACHINERY LAB**
Number of Credits		**1 (L: 0, T: 0, P: 2)**
Prerequisites		**Strength of Materials (PEPC204) and Fluid Mechanics & Hydraulic Machinery (PEPC203)**
Course Category		**PC**

Course Learning Objectives

- Define the various properties of materials such as: Yield stress, Ultimate stress, percentage elon- gation, Young's Modulus.

- Appreciate the importance of various mechanical properties such as hardness, impact strength.
- Appreciate the practical applications of orifice meter and venturi meter.
- Understand flow through pipes and the importance of pipe friction in practical environment.
- Understand the method of evaluating the performance characteristics of turbine, for a given set of input data.

Course Content:

Strength of Materials Laboratory Exercises

1. Test on Ductile Materials:

Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.

2. Hardness Test:

Determination of Rockwell's Hardness Number for various materials like mild steel, high car- bon steel, brass, copper and aluminum

3. Torsion test:

Torsion test on mild steel – relation between torque and angle of twist- determination of shear modulus and shear stress

4. Impact test:

Finding the resistance of materials to impact loads by Izod test and Charpy test

5. Tests on springs of circular section:

Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflec- tion method (Open / Closed coil spring)

6. Shear test:

Single or double shear test on M.S. bar to finding the resistance of material to shear load

Fluid Mechanics Laboratory Exercises

1. Verify the Bernoulli's Theorem.
2. Determination of co-efficient of discharge of a mouth piece / orifice by variable head meth- od.
3. Determination of co-efficient of discharge of a venturimeter / orifice meter.
4. Determination of the friction factor in a pipe.
5. Performance test on reciprocating pump / centrifugal pump and to draw the characteris- tics curves.
6. Performance test on impulse turbine / reaction turbine and to find out the Efficiency.

Reference Books:

1. Strength of materials by R.S. Khurmi.
2. Strength of Materials by D.S. Bedi.
3. Applied Mechanics & Strength of Materials by S. Ramamrutham.
4. Hydraulic and Pneumatic Controls by K. S. Sundaram.
5. Fluid Power with Applications by Anthony Esposito.

Course outcomes:

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

	Determine the various types of stress and plot the stress strain diagram for mild steel.
	Determine the Rockwell hardness for various materials.

	Determine the torsion, bending, impact and shear values of given materials
	Determine the Cd of orifice meter, venturi meter, orifice, mouth piece and pipe friction fac- tor
	Determine performance of pumps and turbines

****