T. Y. B. Tech (Production Engineering) –Semester V.

METALLURGY

Course Code: PCC-PE 301

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. / Week Theory Paper (3 Hrs)	ESE: 70 Marks
Practical: 2 Hrs. / Week/ Batch	CIE: 30 Marks
Credits : 4	Term Work: 25

Pre-requisite: Fundamental knowledge of crystals structure and meaning of materials, chemistry of Metals and alloys.

Course Objectives :

1) To select proper ferrous or nonferrous metal material as per given application by considering metallurgical and mechanical properties in accordance with its phase diagram with proper justification.
2) To explain cooing of any given alloy schematically.
3) To calculate percentage of various phases present in solid solution at given temp and composition by using lever rule analytically.
4) To draw various types of equilibrium diagrams of Ferrous and Non Ferrous materials, TTT and CCT diagram graphically.
5) To clearly distinguish between various types of heat treatment process.
6) To understand processing of Powder Metallurgy parts.

Course Outcomes : At the end of successul completion of course, the studentswill be able to

1. Understand basic concept of metal structure.
2. Understand fundamental knowledge of Ferrous and Non Ferrous Metal.
3. Selection of Metals and Alloys for different engineering application.
4. Understand need of Heat treatment and various heat treatment processes.
5. Understand and distinguish between various types of heat treatment process
6. Applications of Powder Metallurgy.

Unit 1: Introduction to Composite Materials, Metals and alloy system (07)

Introduction to Advanced & Composite materials for manufacturing Industrial Application/s, phases, components, degree of freedom, Construction of phase diagram using cooling curves, Isomorphous systems, Eutectic system, Eutectoid, Peritectic. Solid solutions and its types, Intermediate phases

Unit 2: Study of ferrous equilibrium diagrams, with respect to compositions, properties and applications for following alloys (07)

Fe-Fe3C Equilibrium diagram for plain carbon steels, Effect of carbon on structure and properties, Free cutting steels, Alloy steels , Dual phase steels, micro alloyed steels, High strength low alloy steels, Tool steels, Stainless steels, Heat resisting steels, HSLA steels, Low temperature alloys, Invar, Hadfield steel, Spring steel, Cast Irons - Fe-C Equilibrium Diagram, Factors Affecting Structure of C.I.(graphitization), C.E of cast iron, Alloy C.I., SG Iron, Ni-Hard, modified Ni- Hard and Ni-Resists,

Unit 3: Study of non-ferrous equilibrium diagrams, compositions, properties, and applications of important alloys and material testing (05)

Copper-based alloys, Aluminum-based alloys, modification treatment, Titanium- and Mg based, Non-ferrous equilibrium diagrams - Pb-Sn : solders, Sn-Sb : Babbit

Material testing- Tensile test, Izod and charpy impact test, Fatigue test, Hardness measurement methods.

Unit 4: Introduction and Principles of Heat Treatment Processes of Steels , Heat treatment furnaces, atmospheres, defects and energy economy (08)

Introduction to heat treatment Process, purpose, process variables, Transformation of Pearlite on heating and cooling, Bainite and martensite Transformation, TTT and CCT Diagram and significance, Effect of alloying dements on TTT diagram and its significance, Heat treatment furnaces, control systems, furnace atmospheres, Heat treatment defects, causes and remedies, Energy economy of heat treatment processes.

Unit 5: Heat treatment process of steels, cast iron and Non-ferrous alloys. (09)

Annealing, Hardening, Normalizing - Classification comparison and application of processes, hardenability, factors affecting hardenability, determination of hardenability, hardening methods, Tempering- Purposes, types, structural changes during tempering, temper brittleness. Heat treatment process of Cast Irons-Stress relief annealing, normalizing, hardening, surface, hardening and malleablising. Surface and case hardening processes: Case Hardening, Carburizing, Nitriding, Surface Hardening: Flame hardening, induction hardening, electron beam hardening and laser hardening, Case depth measurement - hardness method, chemical method, microstructure method.

Unit 6: Powder Metallurgy (04)

Importance of process as a manufacturing technique, advantages and limitations of powder metallurgy, Methods of powder manufacture, powder conditioning, blending and mixing, Powder compaction - Methods of compaction, Sintering - Types of sintering, structure and property changes during sintering, sintering atmospheres and their importance. Finishing operations - Sizing, heat treatment, surface treatment, electroplating and impregnation treatments, Applications as Self-lubricating (porous) bearings, electric contact materials, filters, magnets, sintered friction materials, cutting tools and cermets, flow charts for

manufacturing of above components.

Term Work : Study should conduct following experiments

Experiment No.1 Study of Metallurgical microscope and Metallography
Experiment No.2 Study of microstructure of hypo eutectoid, Eutectoid steel and Hypereutectoid
Experiment No.3 Study of microstructure of cast iron as SG, Gray, White, Chilled, Malleable Cast Irons
Experiment No.4 Study of microstructure of Non-ferrous alloys as Brass, Bronze, Babbits
Experiment No.5 Tensile test of MS, Al and Brass material
Experiment No.6 Izod and charpy impact test of MS, Al and Brass material
Experiment No.8 Study of Hardenability of steel
Experiment No.09 Study of heat treatment processes and furnaces
Experiment No.09 Hardness measurement by Brinell and Rockwell method.

Textbooks:

[1] Vijendra Singh. Engg. Physical Metallurgy, Standard Publishers, Delhi
[2] V.D. Kodgire, Material science and metallurgy, Everest Publishers Pune
[3] T.V. Rajan & C.P. Sharma, Heat Treatments Principles & Practices, PHI.
[4] Material science and Metallurgy, C. Daniel Yesudin, D. G. Harris Samuel Scitech
[5] A.K. Sinha, Powder Metallurgy
[6] Heat treatment of metals by Vijendra Singh, Standard Publishers Distributors, 2006.
[7] V.K.Agarwal, Material Science, Mcgraw hill publications
[8] Higgins R. A., Hodder, Engineering Metallurgy I and II, English language Book Society.

Reference Books:

[1] Prabhudev, Heat treatment of Steels, HMT Handbook
[2] S.H.Avner, Physical Metallurgy, TMH publication.
[3] Rollson , Metallurgy for Engg. Technicians, English language Book Society
[4] Higgins R. A., Hodder, Engineering Metallurgy I and II, English language Book Society.
[5] Prabhudev, Heat treatment of Steels, HMT Handbook
[6] G.E. Dieter, Mechanical Metallurgy, Tata McGraw-Hill, New Delhi.
[7] Engineering Physical Metallurgy - Lakhtin, C.B.S. Publishers & Distributors
[8] Heat treatment of Metals – B. Zaharov, C.B.S. Publishers & Distributors India
[9] Material science and Metallurgy, C. Daniel Yesudin, D. G. Harris Samuel Scitech

[10] Material Science And Engineering , Callister Wiley India Edition
[11] G.E. Dieter, Mechanical Metallurgy, Tata McGraw-Hill, New Delhi.
[12] Engineering Physical Metallurgy - Lakhtin, C.B.S. Publishers & Distributors
[13] Heat treatment of Metals – B. Zaharov, C.B.S. Publishers & Distributors India
[14] Material Science And Engineering , Callister Wiley India Edition
[15] ASM Handbooks, American Society of Metals
[16] ASM Handbooks, American Society of Metals
[17] Phase transformation in metals and alloys by K.E Easterling, D.A. Poater, Chapman & Hall, 1992.
[18] Structure & properties of alloys: the application of phase diagrams to the interpretation and control of industrial alloy structures by Brick, Gordon and Phillips, McGraw-Hill.

T. Y. B. Tech (Production Engineering) –Semester V

THEORY OF MACHINE II

Course Code:PCC-PE302

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. / Week	Theory Paper: 3 Hrs
Practical: 2 Hrs. / Week/ Batch	ESE: 70 Marks, CIE: 30 Marks
Credits : 4	Term Work: 25 Marks

Pre-requisites: Theory of machines - I

Course Learning Objectives:

1) To understand the basics of gear, motion analysis and selection of gears for various applications.

2) To demonstrate different types of gear trains and its applications.

3) To acquaint with working principles and applications of gyroscope and governors

4) To evaluate the effect of static and dynamic balancing of rotary and reciprocating masses.

5) To aware the students about the phenomenon of vibrations and its effects.

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

1. Understand the need of gear, gear train, governors, gyroscope etc.

2. Analyze different types of gear trains.

3. To solve the problems on static and dynamic balancing using graphical and analytical method.

4. Understand the concept of basics of vibrations from application point of view.

Unit-1

Gear: Introduction, law of gearing, gear terminology, involute and cycloidal profiles, length of path of contact, arc of contact, contact ratio, interference of involute gear teeth,

helical and double helical gears
(5)

Unit-2

Gear Trains: Types of gear trains, analysis of gear trains, analysis of differential gear box, torques in epicyclic gear train.

(4)

Unit-3

Balancing: Static and dynamic balancing, Balancing of rotary masses: masses rotating in the same plane and masses rotating in different planes, Balancing of reciprocating masses: primary and secondary balancing, Balancing of locomotives, Balancing of multi-cylinder inline engines, balancing of V-engines.
(6)

Unit-4

Gyroscope: Introduction, Gyroscopic couple, Effect of gyroscopic couple on motion of aero plane, naval ship, two and four wheelers, Gyroscopic stabilization
(5)

Unit-5

5.1 Governors: Functions of governor, types of governors, characteristics of governor, effort and power of governor.
(5)

Flywheel: Crank effort, turning moment on crankshaft, turning moment diagram, fluctuations of energy and speed.
(4)

Unit-6

Vibrations:

6.1 Longitudinal and transverse vibrations: Simple Harmonic Motion vibration of single degree freedom system: Undamped, damped and forced vibration systems, Two degrees of freedom systems.
(4)

6.2 Torsional vibrations: Introduction, natural frequency for single, two and three rotor system, bifilar, trifler suspension system, torsionally equivalent shafts, free torsional vibrations of a geared system.
(5)

Term Work:

Minimum 8 experiments out of first 10 experiments from the following list.

1) Generation of involute gear tooth profile.
2) Study and analysis of differential gear box.
3) Experiment on verification of static and dynamic balancing principle.
4) Experimental verification of gyroscopic principle.
5) Determination of the governor characteristics of Porter and/or Hartnell governor.
6) Experiment on free longitudinal vibrations
7) Experiment on trifler suspension system.
8) Experiment on two rotor system.
9) Experiment on forced vibration
10) Measurement of vibrations by using vibration-measuring instrument.

11) At least one industrial visit to study applications related to the subject and submission of the relevant report.

Text Books:

1) Theory of Machines and Mechanisms, by P. L. Ballaney, (Khanna Publishers, Delhi)
2) Theory of Machines, by S. S. Ratan, (TMH)
3) Theory of Mechanism and Machines by Ghosh and Mallik (EWP)
4) Theory of machines, by Dr. R.K.Bansal, Laxmi Publication
5) Theory of Machines by R.S. Khurmi, S.Chand and co.
6) Theory of Machines, by Thomas Bevan, (CBS Publishers, Delhi)

Reference Books:

1) Theory of Machines and Mechanisms, by John Uiker, Garden Pennock & Late. J. F. Shigley, (McGraw Hill Publications)
2) Theory of Machines, by W.Green
3) Mechanical vibrations, G.K.Grover
4) Mechanical Vibration Analysis, P.Srineevasan- Tata McGraw Hill
5) Theory and Practice of mechanical vibrations, J.S.RaoK.Gupta – New Age International Publications.
6) Machines and Mechanisms Applied Kinematic Analysis, David H. Myszka, Pearson Education, Asia.
7) Design of Machinery, R. L. Norton, McGraw-Hill.
8) Theory of vibrations with applications, W.T.Thompson, Prentice Hall of India
9) Mechanical Vibrations, Schaum's outline series, McGraw Hill

T. Y. B. Tech (Production Engineering) –Semester V.

DESIGN OF MACHINE ELEMENTS

Course Code: PCC-PE303

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. / Week Theory Paper (3 Hrs.)	ESE: 70 Marks
Practical: 2 Hrs. / Week/ Batch	CIE: 30 Marks
Credits : 4	Term Work: 25

Pre-requisites: Machine Drawing, Theory of Machine-I

Course Learning Objectives:

1) To study the different types load considerations and design aspects of various machine members.
2) To study the different types of joints and design.
3) To study the different types of Gear design

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

1) Different types load considerations and design aspects of various machine members.
2) Different types of joints and design.
3) Design the shaft, keys, spline and coupling.
4) Design of springs and power screw.
5) Different types of Gear design.

Unit-1

Introduction: Concept of machine design, general design considerations, design procedure; factor of safety for different types of loading its significance and selection ;theories of failures, Selection of engineering materials for a component considering functionality, raw material generating process, strength, cost, quantity and aesthetics, use of IS codes. (5)

Unit-2

a). Design for static loading: Knuckle joint, turnbuckle, cotter joint, levers. (3)

b). Design for fluctuating loads: Fatigue phenomena, concept of stress vs. number of cycles diagram and endurance limit, stress concentration and remedies, use of Goodman and Soderberg diagram in design of machine elements like shafts, springs and couplings. (5)

Unit-3

Design of shafts, keys, splines and couplings: Design of solid and hollow shafts for strength and rigidity against pure torsion, pure bending, combined bending, torsion and axial loads; design of keys and splines; design of rigid and flexible couplings. (6)

Unit-4

a) Design of pressure vessels: Classification and design of thick a thin pressure vessels and cylinders. (2)

b) Design of joints: Design of bolted, riveted, and welded joints subjected under transverse and eccentric loading, materials for bolts, initial tightening loads on bolts, effect of washer and gasket, uniform strength bolts. (3)

Unit-5

a). Design of springs: Types, applications, spring materials, stress deflection equation of helical spring, Whal's stress factor, style of ends, design of springs for valves, clutches, buffers etc., design considerations for leaf spring. (4)

b). Design of power screw: Types, materials used, thread forms and their applications. Types of stresses induced, overhauling and self-locking properties, re-circulating ball screw, design of nuts, methods of pitch error compensation for machine tools. (4)

Unit-6

a). Design of gears: a) Spur gears- materials, gear tooth loads, number of teeth, face width, strength of gear teeth, static beam strength (Lewis equation), dynamic tooth load, Wear strength (Buckingham's equation), estimation of module based on beam strength and wear strength, gear design for maximum power. (4)

b) Helical gears- No. of teeth, force analysis, beam and wear strength, effective load and design procedure. (2)

c) Construction details of gears i.e. hub, web, arms, rim, gear Lubrication, gear tooth failures and remedies. (1)

Term Work:

Any Six of the following exercises.

(Note: Standard components shall be selected from relevant I.S. codes and Design Data Hand Books for the exercises given below.)

1) Study of Engineering Materials, their applications and selection as per different standards used in practice.

2) Design, stress analysis and working drawing of components and assembly of Cotter Joint, Knuckle Joint and Turnbuckle.

3) Design of Coupling and Detailed Working drawings with assembly.

4) Design of bolted, riveted and welded joints for transverse and eccentric loading.

5) Design of Gear Drive involving Gears, Shafts, and Keys with working drawings.

6) One assignment using CAD package on any one of the exercises 2, 3, or 5 above.

7) Two computer programs (or use of spreadsheet) on any of the above exercise.

Reference Books:

1) Design of Machine Elements, V. B. Bhandari, (Tata McGraw-Hill Publishing Company Ltd.)

2) Elements of Machine Design, N. C. Pandya and C. S. Shaha, (Charotar Publishing House)

3) Mechanical Engineering design, J. E. Shigley, Mitchell, (McGraw-Hill Publishing Co. Ltd)

4) Machine Tool Design, N. K. Mehta, (Tata McGraw-Hill Publishing Company Ltd.)

5) Design of Machine Elements, Dbrovalsky(MIR Publisher)

6) A Text Book of Machine Design, R. S. Khurmi, (S. Chand)

7) Design of Machine Elements by M. F. Spoots, T.E.Shoup (PHI)

8) Machine Design, R. K. Jain, (Khanna Publishers.)

9) Engg. Design, a Materials & Processing Approach, G. Dieter, (Tata McGraw-HillPublishing Company Ltd.)

10) Computer Aided Analysis and Design of Machine Elements by Dukki Patti, Rao,Bhat , (New Age, Delhi)

11) CMTI Machine Tool Design Handbook (TMH)

12) Design of Machine Elements, An Integrated Approach by Robert and Norton,(Pearson)

13) Machine Design by Black and Adams (McGraw-Hill Publishing Company Ltd)

T. Y. B. Tech (Production Engineering) –Semester V.

METROLOGY

Course Code: PCC-PE304

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. / Week Theory Paper (3 Hrs):	ESE: 70 Marks
Practical: 2 Hrs. / Week/ Batch	CIE: 30 Marks
Credits : 4	Term Work: 25
	Practical Oral Examination: 25 Marks

Pre-requisites: Machine Drawing, Workshop Practice

Course Learning Objectives: A Student should be -

1) Able to explain the principles of measurement and its techniques.

2) Able to demonstrate the design, construction and accuracy features of various instruments.

3) Able to acquire hands-on skills of measurement by using different instruments and gauges.

Course Outcomes: A Student should have-

1) Ability to describe measurement aspects.

2) Ability to design a measuring instrument.

3) Ability to maintain and service measuring instruments.

4) Develop the hands on skill in solving problems encountered during inspection.

5) Ability to use all types of measuring instruments.

Unit-1 Fundamental Principles of Metrology and Basic Measuring Instruments Definition and scope of metrology, definition of measurement, primary, secondary, tertiary and working standards, line and end standards, advantages of optical standard precautions to minimize errors, measurement system and its characteristics, Vernier calipers, micrometers, height and depth gauges, - types, design considerations, specifications, applications, sources of errors and handling precautions, selection and general care of measuring instruments. Slip gauge box - Grades, materials, wringing, setting to sizes, precautions while use and storage

Accessories - Bench centers, surface plates, V-blocks, angle plates.
(8)

Unit-2 Comparators and Advance Measuring Instruments

Need for comparators, comparison of principles, mechanical, pneumatic, optical and electrical and electronic instruments, dial indicator, bore gauges and master rings, optical profile projector, tool makers microscope, electrical and electronic comparators, differential pneumatic comparator, and applications of pneumatic gauging.
(5)

Unit-3 Gauges and Gauge Design

Concept of limit gauging, Taylor‘s principle, various types of plug, ring and snap gauges for plain and taper dimensions, gauge design for a given dimension for workshop, inspection and general grade gauges, fixtures and gauges for measurement ofpitch circle diameter, center distance between holes, positioning of holes and surfaces. (IS:919, Part 1, 1993-ISO system for limits, fits and tolerances, is to be used for gauge design)
(4)

Unit-4 Measurement of Angles and Geometric Features

Bevel protractor, clinometers, sine bar, angle dekor, angle slip gauges, measurement of taper, angle and radius with the help of simple inspection set-ups using standard pins and balls Measurement of straightness, flatness, parallelism, squareness, circularity, roundness, concentricity, symmetry, distance between axes and other geometrical features Straightedge, level beam comparator, autocollimator. (5)

Unit-5 Gear, Thread and Surface Finish Measurement

a) Measurement of Screw Threads

Basic terminology, measurement of major, minor and effective diameter, Screw thread micrometer, floating carriage diameter measuring machine, two wire and three wire method, measurement of pitch and pitch error, thread pitch gauges, limit gauges for thread measurements

b) Measurement of gears

Basic terminology, measurement of pitch, lead, run out, back lash and tooth thickness, constant chord and base tangent method, Gear tooth Vernier caliper, David Brown tangent comparator, errors in gear geometry, measurement of composite error, Parkinson gear tester

c**) Measurement of surface properties**

Waviness and roughness, causes of variation in surface quality, different parameters for assessment of surface roughness, methods of calculation, instruments for surface roughness

measurement.

(10)

Unit-6 Advances in Industrial Metrology

Types, applications, Principle of digital measurement instruments and examples, Instrument-computer interface, Co-ordinate Measuring Machines (CMM), construction, working principle and applications, Objectives, Non Contact inspection methods, equipment; contact type inspection, Inspection robots.

(4)

Term Work:

The term work shall consist of the following.

A) All the experiments listed below-

1. Measurement of linear dimensions using vernier, micrometer and bore gauge

2. Measurement of angle by using bevel protractor and sine bar

3. Dimensional measurement by using pneumatic comparator

4. Measurement of effective diameter of a screw thread by using floating carriage diameter measuring machine

5. Measurement of gear tooth thickness by Chordal thickness method.

6. a) Measurement of roundness and concentricity by using dial indicator

   b) Measurement of radius by using inspection setup like rollers and pins

7. Measurement of roughness of machined surface

8. Assessment of profile of a component by using profile projector.

B) One assignment on Gauge design problem

C) One industrial visit to study inspection practices and submission of the report

Practical Examination: Each student shall perform individually, one assigned experiment from the above list and submit the result, followed by an oral examination.

Reference Books:

1. Engineering Metrology, -K. J. Hume, McDonald London

2. Engineering Metrology, -D. M. Anthony, Oxford University Press (I)

3. The Quality Technician‘s Handbook,- Garry Griffith, Prentice Hall

4. Engineering Metrology,- I. C. Gupta, Dhanpat Rai Publications

5. Principles of Machine Tool Design, -Sen, Gupta, New Central Book Agency

6. Basic Machine Technology, -C. Thomas Olivo, Bobbs-Merrill Educational Publishing

7. Machine Tool Practices,-Kibbe, Neely, Meyer, White, Prentice Hall

9. Engineering Metrology, -R. K. Jain, Khanna Publishers, Delhi

8. Testing of Machine Tools, -Dr. George Schlesinger, Pergamon Press

9. Basic Rules on using Measuring Tools, -Mitutoyo Metrology Institute

10. A Text Book of Metrology, -M. Mahajan, DhanpatRai and Co.

T. Y. B. Tech (Production Engineering) –Semester V.

MANUFACTURING TECHNOLOGY

Course Code: PCC-PE305

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. / Week Theory Paper (3 Hrs)	ESE: 70 Marks
Practical: 2 Hrs. / Week/ Batch	CIE: 30 Marks
Credits : 4	Term Work: 25

Pre-requisites: Foundry Technology, Machine Tools and Processes

Course Learning Objectives: A Student should be -

1) To Understand principles of rolling & forging processes.

2) To demonstrate the fundamental of principles of metal forming processes.

3) To Understand principles in metal removal process.
4) To develop knowledge & importance of metal cutting parameters.
5) To study the metal cutting technology including the process, measurements, design and selection of various cutting tools and their industrial specifications.

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

1) Understand function & application of metal forming process.

2) Ability to describe plastic manufacturing processes.

3) Apply cutting mechanics to metal machining based on cutting force & power consumption.
4) To Select cutting materials & tool geometries for different materials
5) To solve problems on Single point cutting tool & Broach tool Design

Unit-1: Rolling and Forging : Rolling process , types of rolling mills, production of seamless pipes by rolling process, rolling defects. Forging process, types of forging, forging equipment's, forging defects.

Unit-2 :Extrusion ,Drawing and Advance metal forming processes: Process, types, extrusion defects, wire and rod drawing process, drawing defects, Explosive forming, Electro-hydraulic forming, Electromagnetic forming.

Unit-3: Plastic Manufacturing : Thermoplastics and thermosetting plastics, injection molding, plastic extrusion, blow molding, rotational molding, thermoforming , compression molding, calendaring.

Unit-4: Theory of Metal Cutting: Speed, Feed, Depth of Cut, Orthogonal Cutting and Oblique Cutting, Geometry of single point cutting tool, Mechanism of chip formation, Chip Breaker, Strain in Chip, Shear plane angle, Cutting ratio, Force relationship, Velocity relationship, Merchant circle, Ernst Merchant theory, dynamometer.Design of Single point cutting tool. (9)

Unit-5 Machinability: Concept of Machinability,

i) Cutting force: Effect of speed, feed, depth of cut, tool materials, angles and work material on cutting forces, specific cutting force, specific power consumption.
ii) Tool life: Flank and Crater wear, Mechanism of wear, effect of cutting parameter on tool life, Taylor's tool life equation.
iii) Surface Roughness: : Effect of speed, feed, depth of cut, tool materials, angles and work material on surface roughness, built up edge, chatter and its elimination. (9)

Unit-6 Design of Form Tool: Design of flat form tool and circular form tool. Geometry, nomenclature, types, selection and applications of drills, reamers, milling cutters and broach. (4)

Term Work:

1) Machining of minimum two jobs of different materials such as C.I., Steel, Aluminium etc. and measurement of surface roughness to study the effect of parameters such as feed, tool nose radius, depth of cut on the surface roughness.
2) Design of form tool and broach for given components
3) Industrial visit to study applications of tools for different metal cutting processes.
4) Study of Rolling Process
5) Study of Forging Process
6) Study of extusion Process.

Reference Books:

1. Manufacturing Processes – Begman, Amstead etc.(John Wiley)

2. Forging and Forging Die Design - Sharan, Prasad, Saxena.

3. Rolling of Metals: Ivankove and Chaturvedi (Yantrik Publications, Mumbai)

4. Extrusion - Pearson (McGraw Hill)

5. Manufacturing Technology: Foundry, Forming and Welding by P.N. Rao (TMH)

6. Plastic Technology: Theory, Design & Manufacture – William J. Patton

7. Cutting tools - P.H. Joshi - Tata McGraw Hill Publishing Co. Ltd..
8. Production Technology - HMT Handbook (TMH)
9.Metal Cutting Theory and Cutting Tool Design - Arshinov V. Mir Publication.
10.Metal cutting Theory and Practice- A. Bhattacharya, New Central Book Agency.
11.Metals Handbook, Vol. 16 Machining, A.S.M., Metals Park, Ohio.
12.Metal Cutting and Tool Design - Dr. Ranganath - Vikas Publishing House.
13.Machine Tool Engineering: K. R. Nagpal, Khanna Publication.
14.Tool Engineering handbook - ASTME, Frank Wilson (Editor) (TMH)

T. Y. B. Tech (Production Engineering) –Semester VI.

INDUSTRIALHYDRAULICSANDPNEUMATICS

Course Code:PCC-PE308

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. / Week Theory Paper (3 Hrs):	ESE: 70 Marks
Practical: 2 Hrs. / Week/ Batch	CIE: 30 Marks
Credits : 4	Term Work: 25
	Practical Oral Examination: 25 Marks

Pre-requisites: Basics of Mechanical Engineering, Fluid Mechanics

Course Learning Objectives:

1. To understand and demonstrate of fluid power terms, concepts, and calculations for simple applications.
2. Able to select components for application of fluid power (Hydraulics and Pneumatics) in Industries.
3. To demonstrate the ability to use and apply hydraulic, Pneumatic and Electro hydraulic schematics to build circuits.

Course Outcomes:

1. Understand application of fluid mechanics and governing laws in hydraulic and pneumatic systems.

2. To acquaint with working principle of various components used in hydraulic and pneumatic systems.

3. Able to study of ISO symbols of fluid power systems.

4. Understand selection of different components used in hydraulic and pneumatic systems.

5. Design of hydraulic and pneumatic circuits.

6. Design industrial applications of hydraulic and pneumatic circuits.

Unit-1

Fundamental concepts of fluid & Introduction to fluid power: (3)

Classification of fluids, derivation of Pascal law, continuity equation and Bernoulli"s equation

Introduction to fluid power: (4)

Types, advantages and applications, ISO symbols for hydraulic and pneumatic systems; hydraulic fluids- functions, desirable properties, grades and selection of fluid, conditioning of fluids, study of reservoirs, strainers, filters, heat exchangers.

Unit-2

Hydraulic system elements: pumps – (4)

Types, working, characteristics and applications, power and efficiency calculations (numerical treatment expected), types of conductors and connectors, their selection, seals and packing – types, materials, applications, hydraulic actuators – linear and rotary - types, working, cushioning effect, mounting, calculation of force and velocity of piston (numerical treatment expected), system components: accumulators, intensifiers, their types, working, applications,

Control Elements: (4)

a) Construction and working of pressure control valves – direct acting type, pilot operated, sequence, counterbalancing, unloading, pressure reducing,

b) Direction control valves – types, construction and working, spool actuation methods, spool centre positions,

c) Flow control valves – compensated and non-compensated types, construction and working.

Unit-3

Hydraulic circuits and their applications: (5)

Speed control circuits, regenerative, sequencing, counterbalancing, interlocking, synchronizing circuits, use of accumulator and intensifier, methodology to design hydraulic circuits. , maintenance of fluid power system, Electro -Hydro systems: concept, working and applications (descriptive treatment only)

Unit-4

Pneumatics: (3)

Basic principle, applications, comparison with hydraulic system, Pneumatic system elements: Piping, materials and pressure ratings, piping layout, calculation of pressure drop in pneumatic line; air compressors, types, selection criteria;

FRL unit- (3)

Construction and working of pneumatic cylinders and air motors- construction, working and types, calculation of force and air consumption, comparison of air, hydraulic and electric motors.

Unit-5

Pneumatic system control elements: (6)

Direction control valves- types and working, flow control valves, working of variable flow control, quick exhaust, time delay and shuttle valve. Fluidics: Concept, study of logic gates and applications.

Unit-6

Pneumatic circuits: (4)

Basic circuit, impulse operation, speed control, sequencing, time delay circuits and their applications, pneumatic clamping systems, pneumatic power tools , maintenance of pneumatic system.

Term Work:

1) Verification of Bernoulli"s Theorem on Bernoulli"s apparatus.
2) Study of pressure, direction and flow control valves in hydraulics and pneumatics using cut section models
3) Meter-in, Meter-out and Bleed-off, Sequencing, Counterbalancing, Synchronizing, Interlocking, pressure reducing circuits on hydraulic trainer.
4) Manual / automatic forward – reverse, sequencing, Basic logic circuits on pneumatic strainer.
5) Electro-Hydraulic systems- study and simple circuits.
6) Design of a hydraulic circuit for a given application and selection of components from commercial catalogues.
7) At least one industrial visit to study industrial applications of hydraulics and pneumatics with submission of the relevant report.

Reference Books:

1) Fluid Power with Applications by A. Esposito (Pearson)
2) ABCs of hydraulic Circuits by H. L. Stewart and J. M. Storer (Taraporwala)
3) ABCs of Pneumatic Circuits by H. L. Stewart and J. M. Storer (Taraporwala)

4) Industrial Hydraulics by J. J. Pipenger, Hicks (McGraw Hill)
5) Hydraulic and Pneumatic Power for Production by H. L. Stewart (Industrial Press)
6) Fluid mechanics by R.K.Bansal, Laxmi publications. New Delhi.
7) Oil Hydraulic Systems by S. R. Majumdar (TMH)
8) Industrial Hydraulics Manual by Vickers Sperry
9) Pneumatic Systems-Principles and Maintenance by S. R. Majumdar (TMH)
10) Hydraulic Text Book Basic Level (Festo Controls Pvt. Ltd. Bangalore, (Part No. 93281)
11) Pneumatic Text Book Basic Level (Festo controls Pvt. Ltd. Bangalore) (Part No. 93131)
12) Pneumatics and Hydraulics by H. L. Stewart (Taraporwala)
13) Hydraulics and Pneumatics, A Technician‟s and Engineer‟s Guide by Andrew Parr.
14) Fluid power engineering, M Galal Rabie, (McGrawHill)

T. Y. B. Tech (Production Engineering) –Semester VI.

DESIGN OF JIGS, FIXTURE & DIES

Course Code:PCC-PE309

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs. / Week	Theory Paper: 3.5Hrs
Practical: 2 Hrs. / Week/ Batch	ESE: 70 Marks, CIE: 30 Marks
Credits : 4	Term Work: 25 Marks, O. E.: 25 Marks

Pre-requisites: Machine Drawing, Metallurgy, Machine Tools and Processes, Cutting Tools, Metrology, Computer Aided Design.

Course Learning Objectives:

1) To understand the working principles of Jigs, fixtures and dies.
2) To understand the functions of Jigs, fixtures and dies.
3) To understand the design practices of Jigs, fixtures and dies .
4) To understand the locating principles of locating elements
5) To understand the principles of clamping devices

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

1) Use design principles while designing jigs and fixtures
2) Prepare manufacturing drawings of jigs, fixture and dies
3) Design drilling jig and milling fixture
4) Design drawing die and progressive die.

Unit-1 Introduction to Jigs and Fixtures:

Necessity, applications and types, basic concept of jigs and fixtures for different manufacturing processes, dependency of jig and fixture design on operation sequence. (4)

Unit-2 Location and clamping system:

Location - Principles, Location by nesting and sighting, locating pins, pads, diamond pin,post locator, adjustable supports, Vee locators,

Clamping - Principle, types of clamps like screw clamp, strap, lever, hinge type, cam operated, toggle clamps, centralizer and equalizer clamp, multiple clamping, quick acting clamps, pneumatically operated clamps. (9)

Unit-3 Design of Jigs & fixtures:

A) Design of jigs: Principles of Jig design, types of jigs- plate, template, box, channel, sandwich,latch, turn-over, tumble jig etc., types of bushes, selection of bushes and liners, construction of Jigand fixture bodies, use of fasteners and standard parts for assembling different elements

B) Design of fixtures: Principles of fixture design, types of fixtures- gang, straddle, string milling fixture etc, selection of the suitable cutting tool and machine tool for different milling operations, design of different elements of milling fixtures like setting block, tenon, T-bolt and T-nut etc, Introduction to different fixtures like turning/lathe fixture, welding fixture, Inspection fixture Indexing device for jigs and fixtures, Concept of Modular Fixtures.
(15)

Unit-4 Introduction to press tools:

Dies, punches, types of presses, types of dies, simple, compound,combination and progressive dies, press tools for operations like blanking, piercing, drawing,shaving, trimming, etc., Theory of metal cuttingMiscellaneous dies like- cut off dies, trimming, shaving, bulging, rubber, lancing, slitting,horn type, side cam dies, bending, forming, curling dies etc. (theoretical treatment only)
(10)

Unit-5 Design of die of progressive die for cutting operations:

Fourteen steps of die design - cutting force and blank holding force estimation, punch and die clearance, scrap strip layout, design of punches, design of dies, pilots, strippers, stock stops, finger stops, auto stops, center of pressure, selection of die set etc (8)

Unit-6 Design of drawing die:

Blank size determination, no. of draws, stage wise achievement of drawn component, stage wise component drawings, drawing radii and clearance, drawing forces, defects in drawing,
(6)

Term Work:

The term work shall consist of the following.

A) Study of various elements of jigs and fixtures

B) All Design and Drawing mentioned below

1) Design and drawing of two drilling / reaming jigs. (Details of at least one A2 size sheet showing manufacturing drawing with tolerances, material specification and heat treatment.)

2) Design and drawing of two milling fixtures. (Details of at least one A2 size sheet showing manufacturingdrawing with tolerances, material specification and heat treatment.)

3) Design and drawing of one progressive die.

4) Design and drawing of one drawing die.

C) Design and drafting using any CAD software for above any one Jig, fixture or die showing assembly

D) At least one industrial visit to study industrial practices related to the subject and submission ofthe visit report.

Text Books:

1) Tool Design, Donaldson, TMH

2) Tool Design, Pollock, Reston Pub. Co. Inc.

3) An Introduction to Jig & Tool Design, M.H.A. Kempster, ELBS

4) Fundamentals of Tool Design, Ed. Frank Wilson, ASTME, TMH

5) Jigs and Fixture Design Manual, Henrikson, Industrial Press, NY

6) A Text Book of Prod. Engineering, P. C. Sharma, S. Chand

7) Techniques of Press Working of Metals by Eary and Reed

Reference Books:

1) Handbook of Die Design- Suchy, McGraw Hill
2) Die Design Fundamentals, J. R. Paquin, R. E. Crowley, Industrial Press Inc.
3) Jigs and Fixture, P. H. Joshi, Tata Mc-Graw Hill Pub. Co.
4) CMTI Machine Tool Design Handbook, TMH
5) Design Data Handbook –PSG College of Tech., Coimbtore

T. Y. B. Tech (Production Engineering) –Semester VI.

INDUSTRIAL MANAGEMENT & QUALITY MANAGEMENT

Course Code: PCC-PE310

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. / Week Theory Paper (3 Hrs):	ESE: 70 Marks
Practical: 2 Hrs. / Week/ Batch	CIE: 30 Marks
Credits : 4	Term Work: 25

Pre-requisites: Knowledge of Statistics and management is required**.**

Course Objectives: A Student should be -

1) Able to describe knowledge of functions of industrial management and an ability to identify, formulate and solve industrial management problems.

2) Able to know behavior at workplace and role of supervisor in industry.

3) Able to demonstrate to the core concepts and the emerging trends in Quality Management.

4) Able develop hands-on-skills on tools & techniques of Quality Management for industrial problem-
solving.

5) To student should able to demonstrate implementation and documentation requirements for Quality system.

6) To choose and demonstrate the statistical process control to describe a quality system

Course Outcomes: A Student should have-

1) Ability to describe management aspects.

2) Ability to describe functions of management.

3) To define quality and explain the evolution of quality

4) To select and explain tools and techniques for problem solving.

5) To select and explain management tools used for problem solving.

6) To choose and demonstrate the statistical process control to describe a quality system

Unit 1 Functions of Management **[08]**

Definition of Management, Management environment. Planning – Need, Objectives, Strategy, Policies, Procedures, Steps in Planning, Decision making Forecasting. Organizing – Process of Organizing importance and principle of organizing, Departmentation, Organizational relationship, Authority, Responsibility, Delegation, Span of control. Staffing – Nature, Purpose, Scope, Human resource management, Policies, Recruitment procedure training and development, Appraisal methods. Leading – Communication process, Barriers, Remedies, Motivation, Importance, Theories, Herzberg‟s theory, Maslow‟s theory, McGrager‟s theory, Leadership style. Controlling – Process, requirement for control Management, Accountability.

Unit 2 Marketing Management, Materials Management
[06]

i. Marketing Management: Marketing Concepts –Objective –Types of markets – Market Segmentation, Market strategy – 4 AP‟s of market, Market Research, Salesmanship, Advertising.

ii. Materials Management: Definition, Scope, advantages of materials management, functions of materials management, Purchase Objectives, 5-R Principles of purchasing, Functions of Purchase department, Purchasing cycle, Purchase policy and procedure, Evaluation of Purchase Performance.

Unit 3 Production , Quality management & industrial psychology
[06]

Primary and secondary objectives, functions, organization, types and procedure of purchasing. Basic concepts of psychology, industrial psychology, scope, causation of behaviour, individual differences, differences in psychological characteristics – intelligence, interest, physique, learning ability, perception, concept of psychological test .Quality Management : Principles and Practice Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM. 3Hrs. Leadership Definition, characteristics of quality leaders, leadership concept, the Deming philosophy, role of TQM leaders, core values, concepts and framework, strategic , decision making,

Unit 4 Quality Management Tools **[06]**

Why-Why analysis, nominal group technique, affinity diagram, interrelationship digraph, tree diagram, prioritization matrices, process decision program chart, activity network diagram.

Unit 5 Statistical Process Control **[06]**

Pareto diagram, process flow diagram, cause and- effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

Unit 6 Quality Improvement
[06]

ISO 9001:2015 & IATF , ISO 14001, ISO 45001: 2018, ISO 22000:2018 Only clauses introduction
Single parameter experiments, Orthogonal array, Analysis of Variance ANOVA (one - way), Process capability, Correlation analysis and Linear regression models.

Tutorial work:

1. Assignment of problems on Quality loss function.

2. Case study using any quality control tool.

3. Industrial case study on Variables control charts (X-bar &R charts).

4. Industrial case study on Attributes control charts (P-chart).

5. Process capability study. ISO 9001:2015 & IATF, ISO 14001, ISO 45001: 2018, ISO 22000:2018 & one page report.

6. Single parameter experiment and statistical inferences using one-way ANOVA.

Textbooks:

1] Dale H. Besterfiled, "Total Quality Management", Pearson Education Asia

2] Rose, J.E. Total Quality Management, Kogan Page Ltd. 1993.

3] John Bank, The essence of total quality management, Prentice Hall, 1993.

4] Masaki Imami, KAIZEN, McGraw Hill, 1986.

5] Phil Crosby, Quality Without Tears, McGraw Hill

6] Six Sigma: Hemant Urdhwareshe Statistical Process Control

7] Design and analysis of experiments, Douglas C. Montegomery, WILEY INDIA publications.

8] Total Quality Management,B.Sentil Arasu, SCITECH publications.

9] Total Quality Management, NVR Naidu, NEW AGE INTERNATIONAL PUBLICATIONS.

10] Quality Engineering Using Robust Design, Madhav S. Phadke

11] Statistical Quality Control, M. Mahajan, Dhanpat Rai & Co.

12] Research Methodology, C.R.Kothari, New Age International Publications. .

Reference Books

1. Management by James A. F. Stoner, R. Edward Freeman, PHI

2. Management Today: Principles and Practice by Gene Burton and Manab Thakur, TMH

3. Essentials of Management by Koontz and O‟Donell, TMH

4. Organizational Behavior by Keith Davis, TMH

5. Management (Tasks, responsibilities and Practices) by Peter Drucker, Harper Business

6. Production Management by Lockyer, ELBS

7. John Bank, The essence of total quality management, Prentice Hall, 1993.

8. Greg Bounds and Lyle Yorks, Beyond Total Quality Management, McGraw Hill, 1994.

9. Managing For Total Quality ,N. LOGOTHETIS, Prentice Hall

Shivaji University, Kolhapur.

T. Y. B. Tech (Production Engineering) –Semester VI.

Course Code: PCC-PE311

5. MACHINE TOOL DESIGN

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. / Week Theory Paper (3 Hrs):	ESE: 70 Marks
Practical: 2 Hrs. / Week/ Batch	CIE: 30 Marks
Credits : 4	Term Work: 25

Pre-requisites: Workshop Practice, Theory of Machine-I

Course Objectives:

1. To understand core concepts of Machine Tool & Product Design.
2. To understand the basic approach for designing machine tool components and implement the appropriate method.
3. To compute the power requirements of various machine tools.
4. To learn to design quality based manufacturing system.
5. To learn to design a product using innovative concepts of „Product Design"

Course Outcomes: At the end of this course the student will be able to -

1. Apply the concepts of machine tool design.
2. Select the correct design approach & design the important components of machine tools.
3. Calculate the forces acting and the subsequent power requirements of machine tools.
4. Specifically design the critical components comprising a manufacturing system & emphasize on the quality of the system.
5. Analyses the various phases of the design cycle sequentially and envision the concept of "Scratch to Market" w. r. t a product.

Unit-1

Introduction to Machine & Machine Tool

Types, capabilities, features of construction like working & auxiliary motions in machine tools, parameters defining the working motions of a machine tool, machine tool drives, general requirements of machine tool design, methodology for machine tools design considering quality, quantity of production and economic aspects.

Principle of Machine Tool Design from the point of view of quality, production rate, strength, rigidity, assembly, ergonomics, aesthetics, maintenance and interchangeability (6)

Unit-2

a) Analysis of forces

Forces affecting machine tool elements, determination of motive power for different operating conditions, use of handbooks. (2)

b) Design considerations and selection of standard components

Drive systems with pulleys, belts, ropes and chains; selection of oil seals, gaskets and electric motors from standard catalogues. (3)

Unit-3

Kinematics of Machine Tools

Classification of various driving systems, basic considerations in the design of drives, aims of speed & feed regulation, stepped regulation of speeds, design of gear box, laws of stepped regulations, selection of range ratio, G.P. ratio, break up of speed steps, structural diagram, Ray diagram & speed chart, design of feed box, machine tool drives using multiple speed motors, general recommendations for developing gearing diagram, determining the number of teeth on gears, step less regulation of speed and feed rates.(8)

Unit-4

a) Design of Spindle & Spindle Support

Functions of spindle unit and requirements, materials and construction, spindle ends, spindle support, design calculations, mounting arrangements of spindle bearings, spindle bearing lubrication. (3)

b) Selection of Machine Tool Bearing

Journal, rolling and hydrostatic bearings, basic principles, assembly, mounting and maintenance, procedure for selection of bearings from manufacturer′s catalogue based on load and life considerations (4)

Unit-5

a) Design of Machine Tool Structures

Functions of machine tool structures and their requirements, design criteria, materials, static and dynamic stiffness, profiles of machine tool structures, basic design procedure, design of beds, columns, housings, rams etc, Causes of vibrations in machine tools and methods of elimination.
(4)

b) Design of Guide ways

Functions and types of guide ways, materials, design criteria and calculations of slide-ways based on wear and accuracy, design of anti-friction guide ways, hydrostatic and hydrodynamic lubrication of guide ways.

(4)

Unit-6

a) Product Design and Development

Product design by evolution and innovation, essential factors of product design, analysis of the product, product characteristics, 3 S"s – simplification, standardization and specialization, basic design considerations, functional design practice, product value, design for safety, reliability and environmental conditions, ergonomic design of controls and displays, introduction to rapid prototyping. (3)

b) Intellectual Property Rights (IPR)

Trademarks, copyrights, patents and its procedures. (2)

Term Work:

1) Design of a gear box for speed and feed drive, design of shafts and gears with assembly drawing. 2) Selection of bearings from manufacturer"s catalogue
3) Study of different machine tools from the point of view of types of machine parts.
4) Exercise on design of machine tools from ergonomic aspects suitable in India.
5) One case study on product design and development. (Report to be submitted)
6) Assignment on IPR with case study.

Text Books

1) Basic and Applied Thermodynamics by P.K.Nag (TMH).
2) Thermal Engineering by R.K. Rajput (Laxmi Publications).
3) Thermal Engineering by P.L. Ballaney (Khanna Publishers).
4) Thermal Engineering by B.K. Sarkar (TMH).
5) Thermal Engineering by Kodandaraman (New Age International Publication).

Reference Books

1) Machine tool design by N.K.Mehta (TMH).
2) Principles of machine tools by Gopal Chandra Sen and Amitabh Bhattacharya (New Central Book Agency).

3) Machine Tool Design Handbook, C.M.T.I, Bangalore, (TMH).

4) Design Data Handbook, PSG College of Tech., Coimbatore.

5) Design of Machine Tool, Dr. S. K. Basu (Oxford IBH)

6) Design of Machine Elements, Dobrovalsky.

7) Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publishing Company Ltd.

8) Elements of Machine Design, N. C. Pandya and C. S. Shaha, Charotkar Publishing House

9) Design Data Handbook, K. Mahadevan and Balveera Reddy, C.B.S Publishers & Distributors.

10) Engineering Design, a Materials and Processing Approach, G. Dieter, Tata McGraw- Hill Publishing Company Ltd.

11) Product Design and Manufacturing, (3/e), A. K. Chitale and R. C.Gupta, Prentice Hall of India Pvt. Ltd.

12) Catalogues of Bearing Manufacturers, example, S.K.F, NACHI, TIMKEN, NRB etc.

T. Y. B. Tech (Production Engineering) –Semester VI.

CAM LABORATORY AND CNC WORKSHOP PRACTICE

Course Code: PCC-PE312

Teaching Scheme:

Practical: 4 Hrs. / Week/ Batch

Credits: 2

Examination Scheme:

Term Work: 50

Pre-requisites: Computer Aided Solid Modeling, Advanced machine tools & Processes

Course Learning Objectives: - A Student should be

1) Able to study the Computer Aided Manufacturing Fundamentals and Procedure
2) Able to study advanced features of Computer Aided Manufacturing practices followed in the industry
3) Able to prepare Part Programs

Course Outcomes: The student should have

1) Ability to demonstrate the knowledge of advanced features of Computer Aided Manufacturing practices followed in the industry.
2) Ability to use the techniques, skills, and computer aided tools necessary for advance engineering practice

Contents & Term Work:

1) Selection of cutting parameters including tool specifications for various operations on CNC machines–Turning Center and Machining Center. (2)

2) Study of the features of the controller of the CNC machines (e.g. FANUC, SINUMERIC, MAZAK etc.) including Tool offsets, Wear Compensation etc. (2)

3) CNC Part Programming - Detailed Manual part programming on Turning Center and machining centers using G & M codes for various operations on CNC machines–

a) CNC Part Programming for Turning Center: Stock Removal Cycles: Facing and turning, Finishing Cycles, Drilling cycles.

b) CNC Part Programming for Machining Center: Canned Cycles, Pattern Repeat cycles, Sub programming and sub routines, Rotation of Coordinate System, Polar coordinate system. (12)

4) Generating and simulating CNC part programs from the CAD models (at least two exercises each). Preparing a suitable CAD model for a part to be turned and generating the CNC part program to machine the same on a CNC Turning Center from the given form of raw material using suitable CAM software and a post processor. Simulation of the above programs using any suitable CNC simulation software. (8)

5) Preparing a suitable CAD model for a part to be machined and generating the CNC part program to machine the same on a CNC machining center (vertical/horizontal) from the given form of raw material using suitable CAM software and a post processor. (2 dimensional machining like turning, facing, threading, drilling, face/slot milling etc, and rectangular, circular pockets, cavities) (12)

6) Generating a simple part program using CAM software and executing it on a CNC machine (at least one exercise each) on CNC lathe and CNC machining center. (12)

IMPORTANT NOTES:

1) During CNC practice each student has to perform the machining of at least two parts of the assembly undertaken during the Workshop Practice-V of B.E. (Prod) Sem-5 on CNC Turning Center or CNC machining center.

2) Each student shall perform the CNC programming for a separate component as referred in point 6 above.

3) The external practical examination shall include execution of one assigned job & its operation on CNC Turning Center or CNC machining center followed by an oral examination.

4) The print outs of CAM & CNC programs and relevant reports of the above mentioned laboratory work shall be included in the journal.

Reference Books:

1) Jon Stenerson and Kelly Curran ―Computer Numerical Control‖, Prentice-Hall India Pvt. Ltd. New Delhi, 2008

2) Ibrahim Zeid ―CAD/CAM – Theory and Practice‖ Mc Hill, International edition, 1998

3) P. N. Rao ―CAD/Cam principles and operations‖, Tata McGraw Hill

4) Thomas M. Crandell ―CNC Machining and Programming, Industrial Press ISBN-0-831-3118-7

5) Bedworth, Wolfe and Henderson-Computer aided design and manufacturing, McGraw Hill.

6) A. Ghosh and Malik – ―Manufacturing Science‖ Affiliated East West Press Pvt. Ltd

7) Tilak Raj – ―CNC Technology and Programming‖, Dhanpat Rai Publication Company.

8) Robert Quesada, T. Jeyapoovan ―Computer Numerical Control: Machining and Turning Centers‖, Pearson Education.

9) Programming Manuals of various CNC machines (Lathes and Machining Centers) e.g. FANUC, SINUMERIC, MAZAK etc.

10) Catalogs of Commercial Tool Manufacturers e.g. SANDVIK, KENNAMETAL, ISCAR, TAEGUTECH, MITSUBISHI etc.

11) Manuals of CNC Simulation and CAM Software.

12) Reference Manuals of controllers like FANUC, Siemens, Mazak, etc.

T. Y. B. Tech (Production Engineering) –Semester VI.

RESEARCH SEMINAR

Course Code: PCC-PE314

Teaching and Examination Scheme:

Practical: 2 Hrs. / Week/ Batch Credits : 1 Term Work: 25

Course Learning Objectives: A Student should be -

1) Able to explain different research techniques

2) Able to complete literature review

3) Able to write systematic report.

4) Able to prepare and deliver presentation before a group of peers and faculty

Course Outcomes: A Student should have-

1) Ability to conduct minor research

2) Ability to complete literature review

3) Ability to compile systematic report

4) Ability to prepare and deliver a presentation

Content and Term Work

Before the end of Semester VI each student will deliver a research seminar on a subject related to production engineering. Seminar topic shall be latest and ahead of the scope of curriculum. Preferably topic shall be related to tentative project work (to be finalized in semester VII). Research seminar guide shall help the students in selection of topic.

Student shall systematically prepare and submit at least 30 page report of research seminar work in duplicate, typed on A4 size sheet in a prescribed format and bound. The report shall be verified by seminar guide considering latest research in area selected by student. Major content of the report shall have literature review.

The student shall present the research seminar before the group of peers & faculty. The performance of the student shall be judged by seminar guide along with one more teaching staff on the basis of the contents, literature review, research problem, research objectives, research methodology, result and conclusion.

T. Y. B. Tech (Production Engineering) –Semester VI.

MINI PROJECT

Course Code: PCC-PE315

Teaching Scheme:	**Examination Scheme:**
	Term Work: 25 Marks
Practical: 2Hrs. / Week/ Batch	Credits : 2
	Practical Oral Examination : 25 Marks

Course Learning Objectives: A Student should be -

Able to encourage hands-on working skills by fabricating simple working mechanisms illustrating technical principles.

Term Work:

A group of maximum four students will design and fabricate one simple working mechanism involving mechanical or electromechanical components / sensors. (Mechanisms already proven may also be taken up.) For example : Gear trains, shaft bearing assembly, mechanisms with lower and higher pairs, water level indicator, Screw jack etc.

Assessment scheme: Fabrication of model and Presentation : 15marks

Report (10 – 15 pages, typed on A4 sheets) : 10 marks

Total : 25 marks

Reference Books:

1. Machines and Mechanisms (Mir Publications, Moscow)