PRODUCTION ENGINEERING

S.Y. B. Tech.
Effective from A. Y. 2012-13

INDEX

Item **Page No.**

List of Abbreviations

Sr. No.	Abbreviation	Stands for:
1	BSC	Basic Science Course
2	PSC	Professional Science Course
3	PCC	Program Core Course
4	LC	Laboratory Course
5	HSSC	Humanities and Social Science Course
6	MLC	Mandatory Learning Course
8	LLC	Liberal Learning Course

CURRICULUM STRUCTURE OF S. Y.-B.TECH (PRODUCTION S/W)

Effective from A. Y. 2012-2013

I-Semester:

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	BSC/MA201	Engineering Mathematics-III	3	1	-	4
02	PCC/CE 203	Strength of Materials	2	1	-	3
03	PCC/MT213	Material Science and Technology	4	-	-	4
04	PCC/ME209	Theory of Machines	3	-	-	3
05	PCC/PE201	Production Processes	3	-	-	3
06	LC/MT214	Material Science and Technology Laboratory	-	-	2	1
07	LC/ME209	Theory of Machines Laboratory	-	-	2	1
08	LC/PE201	Production Processes Laboratory	-	-	2	1
09	LC/PE293	Product and System Graphics Laboratory	-	-	4	2
10	HSSC/AS207	Professional Communication	2	-	-	2
11	LLC/	Foreign Language	1	-	-	2
		Total	**18**	**2**	**10**	**25**

II-Semester:

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	BSC/AS204	Applied Biology	3	-	-	3
02	PCC/EE217	Industrial Electronics and Electrical Drive Systems	3	-	-	3
03	PCC/ME208	Engineering Thermodynamics and Heat Transfer	3	-	-	3
04	PCC/ME210	Fluid Power	3	-	-	3
05	PCC/ME211	Design of Machine Elements	3	-	-	3
06	PCC/PE202	Machining Science and Technology	3	-	-	3
07	LC/ET212	Industrial Electronics and Electrical Drive Systems Laboratory	-	-	2	1
08	LC/ET213	Engineering Thermodynamics and Heat Transfer Laboratory	-	-	2	1
09	LC/ET214	Fluid Power Laboratory	-	-	2	1
10	MLC/	Environmental Studies	2			2
		Total	**20**	**-**	**06**	**23**

CURRICULUM STRUCTURE OF S. Y.-B.TECH (PRODUCTION S/W)-Direct Admitted Diploma Students- Effective from A. Y. 2012-2013

I-Semester:

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	BSC/MA203	Foundation of Mathematics-I	3	1	-	4
02	BSC/AS205	Foundation of Physics	3	-	-	3
03	PCC/CE217	Strength of Materials	2	1	-	3
04	PCC/MT217	Material Science and Technology	4	-	-	4
05	PCC/ME209	Theory of Machines	3	-	-	3
06	PCC/PE201	Production Processes	3	-	-	3
07	LC/MT219	Material Science and Technology Laboratory	-	-	2	1
08	LC/ME211	Theory of Machines Laboratory	-	-	2	1
09	LC/PE203	Production Processes Laboratory	-	-	2	1
10	LC/PE205	Product and System Graphics Laboratory	-	-	4	2
11	HSSC/AS201	Professional Communication	2	-	-	2
12	LLC/LL201	Liberal Learning Course	1	-	-	1
		Total	**21**	**2**	**10**	**28**

II-Semester:

Sr. No	Course Type/ code	Subject Title	Contact hours L	T	P	Credits
01	BSC/MA204	Foundation of Mathematics-II	3	1	-	4
02	BSC/AS202	Applied Biology	3	-	-	3
03	PCC/EE216	Industrial Electronics and Electrical Drive Systems	3	-	-	3
04	PCC/ME212	Engineering Thermodynamics and Heat Transfer	3	-	-	3
05	PCC/ME214	Fluid Power	3	-	-	3
06	PCC/ME216	Design of Machine Elements	3	-	-	3
07	PCC/PE202	Machining Science and Technology	3	-	-	3
08	LC/EE218	Industrial Electronics and Electrical Drive Systems Laboratory	-	-	2	1
09	LC/ME218	Engineering Thermodynamics and Heat Transfer Laboratory	-	-	2	1
10	LC/ME220	Fluid Power Laboratory	-	-	2	1
11	MLC/ML202	Environmental Studies	2	-	-	2
		Total	**23**	**1**	**06**	**27**

MA 201 Engineering Mathematics III

Teaching Scheme:
Lectures : 3 hrs/week
Tutorial: 1 hr/week

Examination Scheme
100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks, End Sem Exam- 60 marks

Unit 1 **(4 hrs)**

Gradient, Divergence and Curl: Vector and Scalar functions and Fields, Derivatives, Gradient of a Scalar field, Directional derivatives, Divergence and Curl of a Vector field.

Unit 2 **(6 hrs)**

Vector Integral Calculus: Line Integrals, Line integrals independent of path, Green's theorem in plane, surface integral, Divergence theorem and Stoke's theorem.

Unit 3 **(6hrs)**

Fourier Series: Periodic functions, trigonometric series, Fourier series, half range series.

Unit 4 **(6 hrs)**

Partial Differential Equations: Basic concepts, method of separation of variables. One and Two dimensional wave equation, one dimensional heat equation.

Unit 5 **(10 hrs)**

Laplace Transforms: Laplace Transform, Inverse Laplace Transform, linearity, shifting, transforms of derivatives and integrals, differential equations, differentiation and integration of transforms, convolution

Unit 6 **(8 hrs)**

Statistics: Random Variables, Probability Distributions, Mean and Variance of a distribution, binomial and normal distributions, testing of hypothesis.

Text Books:

- Erwin Kreyszig ,"Advanced Engineering Mathematics", Wiley Eastern Ltd. (8th Student Edition)
- Maurice D. Weir, Joel Hass, Frank R. Giordano, "Thomas' Calculus", Pearson Education, Delhi(11^{th} Edition),

Reference Books:

- P.N. Wartikar, J. N. Wartikar, " Engineering Mathematics Vol I, II, III" Pune Vidyarthi Gruha Prakashan.

- C.R. Wylie , "Advanced Engineering Mathematics", McGraw Hill Publications, New Delhi.
- Peter V. O' Neil ,"Advanced Engineering Mathematics", Thomson. Brooks / Cole, Singapore(5^{th} edition) .
- B. V. Ramana , "Higher Engineering Mathematics", Tata McGraw Hill Publications.

Outcomes:

- acquire the knowledge of mathematical methodologies, theorems & models
- use mathematical skills in different application areas of engineering
- use vector Integral calculus, Fourier series, Partial derivatives and Laplace transforms in various applications
- enhance analytical and thinking power.

CE 203 STRENGTH OF MATERIALS

Teaching Scheme	**Examination Scheme**
Lectures : 2 hrs/week	100 marks: Continuous evaluation-
Tutorial : 1 hr/week	Assignments /Quiz- 40 Marks, End Sem Exam- 60 marks

Unit 1 **(7 hrs)**

Simple stresses and strains

a) Concept of stress and strain (linear, lateral, shear and volumetric) Hooks law. Elastic constants and their relationship. Generalized Hook's law.

b) Axial force diagram, stresses, strains and deformation in determinate and indeterminate homogeneous and composite bars under concentrated loads, self weight and temperature changes.

Unit 2 **(7 hrs)**

a) Shear force and bending moment diagrams

Concept and definition of shear force and Bending Moment in beams due to concentrated load, UDL, uniformly varying loads and couples in determinate beams. Relation between SF, BM and intensity of loading, SF, and BM diagrams for cantilevers, simple compound beams and bend.

b) Stresses due to bending

Theory of simple bending, concept and assumptions, Derivation of Flexure formula. Bending stress distribution diagram. Moment of resistance and section modules calculations.

Unit 3 **(7 hrs)**

a) Shear stress distribution in beams

Shear stresses concept, derivation of shear stress distribution formulae, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress, shear connection between Flange and web. Bending of curved bars beams, stresses in ring, chain link, and crane hooks.

b) Torsion of circular shaft

Theory of torsion of shafts of circular, cross section. Assumptions, Derivation of torsion formulae, stresses strains and deformation in determinate and indeterminate shafts of hollow, solid, homogeneous and composite circular cross section subjected to twisting moments, stresses due to combine torsion, bending and axial force on shafts.

Unit 4 **(7 hrs)**

a) Principal stresses and principal strain

Normal and shear stresses on any oblique planes and concept of principal planes and principal planes by analytical and graphical methods (Mohr's circle of stress 2-D).

b) Pressure Vessels.
Stresses, strains and deformation in thin walled seamless cylindrical and spherical vessels due to internal fluid pressure. Change in volume, effects of additional fluid injected under pressure.

Unit 5 **(7 hrs)**

a) Axially loaded columns.
Concept of critical load and buckling, derivation of Euler's formulae for buckling load with hinged ends, concept of equivalent length for various end conditions. Rankine's formulae, safe load on column, Limitations of Euler's formulae.

b) Strain energy and impact.
Concept of strain energy, derivation and use of expressions for deformation of axially loaded members under gradual sudden and impact loads.

Unit 6 **(7 hrs)**

Slope and Deflection of Determinate Beams.
a) Concept and definition, relation between B.M., slope and deflection slope and deflection by double integration method (McCauley's method).
b) Slope and Deflection in determinate beams by Moment Area method

References

1. "Mechanics of Structure" (Vol. I) By Junnarkar and Advi, Charotar publication
2. "Mechanics of Materials" by Gere and Timoshenko, CBS publishers
3. "Introduction to Mechanics of Solids" by J.B. Popov, Prentice – Hall publication
4. "Mechanics of Materials" by James M.Gere (5th Edition) Brooks/Cole Thomson Learning.
5. "Strength of Material" by F. L. Singer and Pytel, Harper and Row publication.
6. "Mechanics of Material" by Beer and Johnston, Mc Graw Hill publication.
7. "Mechanics of Materials" by Andrew Pytel, Jaan Kiusalaas, Thomson Learning, 511, Forest Lodge Road, Pacific Grove, USA.

Outcomes:
- understand properties of engineering material , their behavior and applications.
- understand the types of stresses and the effects of stresses in engineering applications
- gain the knowledge of critical loads, buckling of beams and strain energy concept
- Implement the information in designing of structures and pressure vessels.

MT 213 MATERIAL SCIENCE AND TECHNOLOGY

Teaching Scheme
Lectures : 4 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End Sem Exam- 60 marks

Unit 1 **(6 hrs)**

Engineering Steels:

Iron - Iron carbide equilibrium diagram, critical temperatures. Allotropy, cooling curve and volume changes of pure iron. Microstructures of slowly cooled steels, estimation of carbon from Microstructures, non-equilibrium cooling of steels. Widmanstatten structures, Structures - property relationship.

Unit 2 **(6 hrs)**

Alloy Steels

Classification and applications of steels, specifications of some commonly used steels for engineering applications (e.g. En, DIN, IS etc. with examples). Effects of alloying elements. Classification of alloying elements. Examples of alloy steels. Stainless steels. Tool steels and tool materials.

Unit 3 **(11hrs)**

Heat Treatment of Steels:

Transformation products of austenite, Time temperature Transformation diagrams, Critical cooling rate, continuous cooling transformation diagrams. Heat treatment of steels, Cooling media. Annealing, normalizing, hardening. Tempering, Carburising, nitriding, carbonitriding, Flame and Induction hardening. Commercial heat treatment practice of gears of different sizes, tools, lathe beds, springs, etc.

Unit 4 **(5 hrs)**

Cast Irons:

Classification of Cast irons Gray cast irons, nodular cast irons, white cast irons, malleable cast irons, chilled. Effect of various parameters on structure and properties of cast irons. Applications of cast irons for different components of machine tools, automobiles, pumps, etc.

Unit 5 **(8 hrs)**

Mechanical Testing:

Tension test - Engineering and true stress strain curves, Evaluation of properties. Types of engineering stress-strain curves. Cupping test on sheet metal. Hardness test Brinell, Poldi, Vickers, Rockwell. Durometers, Microhardness. Hardness conversions. Impact test Charpy and Izod. Fatigue test. Creep test.

Unit 6 **(8 hrs)**

Non Destructive Testing:

Magnaflux, dye penetrant, ultrasonic tests, radiography and eddy current testing.

Pyrometry: Principle, operation and uses of various pyrometers. Thermocouples, thermocouple materials. Resistance pyrometer. Disappearing filament pyrometer, total radiation pyrometer.

Powder Metallurgy: Concept, Basic Procedure, Application, Merits & Demerits

Text Books

- S.H. Avner: Physical Metallurgy, Tata McGraw Hill.
- Askland & Phule, Material science & Engineering of materials

Reference Books

- V. Raghvan, Materials Science & Engineering, PHI 5th Edition, 2003.

- Baldev Raj, T. Jayakumar and M. Thavasimuthu : Practica Non-destructive Testing, Narosa Publishing House, Delhi.
- W. Callister, Materials Science & Engineering, Wiley.
- Clark D. S. and Varney W. R. Physical Metallurgy for Engineers, Affiliated East-West Press, New Dehli.

Outcomes:

- select an appropriate material for the components to be designed as per design considerations
- make the student conversant with various tool materials that play an important role in designing diverse manufacturing processes
- understand the concept of equilibrium diagrams, TTT and CCT curves which will enable them to select suitable heat treatment to achieve desired properties for various service applications in varied industries
- the area of microstructure interpretation of different ferrous and non ferrous materials which is important for engineers to establish correlation between properties and applications
- various testing methods to evaluate different mechanical properties

ME 209 THEORY OF MACHINES

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks,
End Sem Exam- 60 marks

Unit 1 **(7 hrs)**

Fundamentals of Kinematics and mechanisms.

Kinematic Link, Kinematic Pair, Kinematic chain, Structure, mechanism, machine, Types of Constrained Motions, Degrees of Freedom, Grubler's Criterion for Plane Mechanisms, Equivalent linkage Mechanism, Inversions of Four Bar Chain, Single Slider Crank Chain ,Double Slider Crank Chain Difference between Spatial and Planner Mechanism. Pantograph, Straight Line Motion mechanisms. Hooke's Joint / Universal Joint.

Unit 2 **(7 hrs)**

Velocity and Acceleration Analysis in Mechanisms.

Relative Velocity (Velocity polygon) for Kinematic link. Acceleration Diagram for a Link. Corioli's component of Acceleration. Velocity and acceleration in a Slider Crank Mechanism by Klein's construction. Instantaneous Centre of Rotation (ICR).

Angular Velocity Ratio Theorem, Methods of Locating ICR in a Mechanism .Velocity analysis of a Kinematic Link by ICR Method, Body and Space Centrode.

Unit 3 **(7 hrs)**

Static and Dynamic Force Analysis

Introduction, Static Equilibrium, Equilibrium of Two Force and Three-Force Members, Resultant effect forces acting on a rigid body, D'Alembert's Principle, Equivalent Dynamic System, Compound Pendulum, Bifilar and Trifilar suspension methods. Static and Dynamic

Analysis of inertia forces of Slider-Crank Mechanism by analytical and graphical method.

Unit 4 **(7 hrs)**

Friction and Lubrication

Introduction, Types of Friction, Limiting Friction, Laws of Friction, Coefficient of Friction, Limiting Angle of Friction, Screw Friction, Screw Jack, Torque required to lift and lower the load by a Screw Jack, Efficiency of a Screw Jack, Over Hauling and Self Locking Screws, Efficiency of Self Locking Screws, Rolling Friction, Film Friction, Principles of Thick and Thin Film Lubrication, principles of hydrostatic and hydrodynamic lubrication.

Unit 5 **(7 hrs)**

Belt and Chain Drives

Introduction, Selection of a Belt Drive, Flat and V Belt Drives, Open and cross Belt Drive. Materials used for Belts, Velocity Ratio of Belt Drive, Limiting tension ratio, Slip of Belt, Creep of Belt, Length of Flat Belts, Angle of Contact, Power Transmitted by a Belt, Maximum Power Transmitted by a Belt, Centrifugal Tension and its effect on power transmission. Initial Tension in the Belt, Design of Belt Dimensions, Chain Drive, Advantages and disadvantages of Chain drives, Terms used in Chain Drive, Angular Velocity of the Sprocket.

Unit 6 **(7 hrs)**

Introduction to Gears

Classification, Terminology, Gear Characteristics, Gear Calculations, Gear Tooth Systems, Gear Tooth Profiles, Gear Materials, Law of Gearing, , Gear trains and its types, Calculation of velocity ratio for different gear trains, Gear Trains with bevel gears: Differential Gear Box.

Governors

Introduction, Types of governors, Terms used in Governor, Sensitiveness, Stability and Hunting of Governor, Isochronous Governor, Governor effort and Governor power.

References :

- Ulicker Jr., J.J., Penock, G.R. and Shigley, J.E. "Theory of Machines and Mechanisms", Tata McGraw Hill.
- John Hannah and Stephens, R.C. "Mechanics of Machines: Advance Theory and Examples" Edward Arnold London.
- Ramamurthy, V. "Mechanics of Machines", Narosa Publishing House.
- Thomas Beven, "Theory of Machines", Person Education Ltd.
- R. S. Khurmi and J. K. Gupta: A Text Book of Theory of Machines: S. Chand and Company Ltd.
- S.S. Ratan: Theory of Machines, Tata McGraw Hill.

Outcomes:

- Well conversant with fundamentals of mechanisms, machines and commonly used mechanisms for industrial applications.
- competent enough in drawing velocity and acceleration diagrams for various simple and complex mechanisms using various graphical methods
- able to gain knowledge for solving problems in static and dynamic force analysis using graphical and analytical methods
- well conversant with basic concepts and theory regarding friction, lubrication, belt, rope and chain drives

- competent enough in conducting laboratory experiment for finding moment of inertia of rigid bodies, verification of displacement relation for Hook's joint and kinematic analysis of planer mechanisms

PE 201 PRODUCTION PROCESSES

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1 **(7 hrs)**

Casting Processes

Expendable Mould Casting Processes

Sand Casting, types of pattern materials, pattern making allowances, core prints, moulding sand-properties and testing, hand and machine moulding, core, core boxes, melting and pouring, study of furnaces – cupola, fuel fired, electric arc, induction furnaces. Investment casting, shell moulding. Casting techniques of cast iron, steels and nonferrous metals of alloys; solidification; design of casting, gating and risering Cleaning, finishing and heat treatment of castings, defects in casting,

Permanent Mould Casting Processes

Die casting, low-pressure permanent mould casting – hot and cold chamber processes, centrifugal casting, semi-centrifugal casting, centrifuging, continuous casting.

Unit 2 **(6 hrs)**

Turning, Boring, Related Processes

Fundamentals of turning and boring, lathe – construction, accessories, operations. Thread cutting – single and multistart threading, Different tools, tool materials, tool geometry. Concept of speed, feed, depth of cut. Capstan and Turret Lathe- Construction, Working and Applications. Introduction to boring machines – general arrangement and nature of work done.

Unit 3 **(7 hrs)**

Drilling and Milling Machines

Drilling

Fundamentals of drilling process, twist drill geometry, tool holders. Types of drilling machines, operations performed on drilling machines. Types of drills. Reaming process, reamers types, geometry.

Milling Machines

Fundamentals of milling process, cutters - types and geometry. Operations performed on milling machines. Dividing head, methods of indexing. Gear train calculations for helical and cam milling.

Shaper, Planer and Slotting Machines

Construction, working of quick return mechanism, operations performed.

Unit 4 **(7 hrs)**

Abrasive Machining Processes

Abrasive machining, abrasives - types, size and geometry. Grinding wheels, wheel marking, wheel selection, wheel mountings. Types of grinding machines. Honing, Lapping, Super Finishing, Buffing

Surface treatment processes

Honing, lapping, buffing, polishing, Honing tools, lapping materials. Abrasive, buffing, polishing wheels and burnishing processes.. Electroplating, Electroless plating, plasma coating, phosphating, galvanizing, metal spraying, anodizing, rubbling and tumbling

Unit 5 **(7 hrs)**

Hot and cold working of metals

Principles of rolling, forging, drop, press, upset, roll forging, extrusion, drawing, spinning, effects of hot working. Cold working processes, Cold rolling, swaging, forging, extrusion- forward, backward and impact roll forming, tube drawing, wire drawing, spinning, shot penning, high energy rate forming.

Unit 6 **(7 hrs)**

Joining Processes

Welding Processes: Theory, control and applications, Arc Welding – SMAW, GTAW, GMAW, FCAW, Submerged arc welding, etc.

Resistance welding – theory, Spot, Seam, Projection welding processes etc., Gas welding. Friction welding, Ultrasonic welding, Thermit welding, Electron beam and Laser welding. Defects in welding, their cause and remedy, weldability, welding of dissimilar metals. NDT and other methods of testing welded joints. Soldering and Brazing applications. Use of adhesives for joining. Classification of adhesives, types of adhesives and their applications, surface preparation and various joints.

Text Books :

- S.K. Hajra Choudhary and S.K. Bose, Elements of workshop Technology, Volume I, II, Asia Publishing House, 10th Edition 2000.
- P.N. Rao, Manufacturing Technology, Tata McGraw-Hill Publishing Limited, II Edition, 2002.

References :

- Chapman W.A.J, Workshop Technology, Volume I, II, III, CBS Publishers and distributors. 5th Edition 2002
- Degarmo, Black and Kohser, Materials and processes in Manufacturing, Prentice Hall of India. 2nd Edition 1998
- Milton Shaw, Metal Cutting Principles, Oxford University Press, 4th Edition 2001
- O.P. Khanna and M. Lal, Production Technology, Vol. I,II, Dhanpatrai Publication, 5th Edition, 1999.
- B.S. Raghuwanshi, Workshop Technology, Dhanpat Rai Publication, 9th Edition, 1999

Outcomes:

- Gain an understanding and appreciation of the breadth and depth of the field of Manufacturing Engineering.
- Understand the various basic Production Processes and Machine Tools.
- Learn how to select a particular production process for the given component from the available conventional as well as non conventional manufacturing processes.
- learn development and application of advanced technologies and components & processes for Manufacturing

MT 214 MATERIAL SCIENCE AND TECHNOLOGY LABORATORY

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Term work- 50 marks
Practical/Oral- 50 marks

Termwork

1. Tensile test on mild steel and aluminium test specimens.
2. Hardness test on samples of steel, cast iron, brass, aluminum, etc. by Brinell and Rockwell methods.
3. Impact tests.
4. Non-Destructive tests: Magnaflux testing, Dye penetrant testing and Ultrasonic testing.
5. Study and drawing of microstructures of mild steel, medium carbon steel, eutectoid steel and hypereutectoid steel.
6. Study and drawing of microstructures of brass. Tin bronze, Al-bronze, Babbit metal.
7. Study and drawing of microstructures of white malleable, gray and nodular cast irons.
8. Study and drawing of microstructures of hardened steel, tempered steel.

Outcomes:

- Carrying out Tensile test to evaluate characteristics of mild Steel and Aluminium
- Carrying out hardness test by Brinell and Rockwell methods for samples of ferrous & nonferrous materials
- Carrying out Impact tests on various materials
- Non-Destructive tests like Magnaflux testing, Dye penetrant testing and Ultrasonic testing
- microstructure interpretation of different ferrous and non ferrous materials which is important for engineers to establish correlation between properties and applications

ME 213 THEORY OF MACHINES LABORATORY

Teaching Scheme
Practical : 2 hrs/week

Examination Scheme
Term Work: 50 marks
Pract/Oral Exam- 50 marks

Term Work consists of following Experiments and Sheets:

A) List of Experiments: (Any 3 experiments from the given list)

1) Determination of Moment of Inertia of rigid bodies by bifilar or trifilar suspension method
2) Compound Pendulum
3) Experimental Verification of displacement relation for different shaft angles for single Hook's Joint
4) Developing a computer program for velocity and acceleration of slider crank mechanism.

B) List of drawing Sheets:

1) Graphical solution of problems on velocity & acceleration in mechanisms by Relative velocity & relative acceleration method including problem with Corioli's component of acceleration.
2) Graphical solution of problems on velocity in mechanisms by ICR method.
3) Klein's constructions for slider crank mechanism.
4) Inertia force analysis with graphical methods.
5) Straight line motion mechanisms.

Outcomes:

- Determining Moment of Inertia of rigid bodies by bifilar or trifilar suspension method
- Verifying displacement relation for different shaft angles for single Hook's Joint
- Developing a computer program for velocity and acceleration of slider crank mechanism Non-destructive tests like Magnaflux testing, Dye penetrant testing and Ultrasonic testing
- Graphical solution to problems on velocity & acceleration in mechanisms by Relative velocity & relative acceleration method including problem with Corioli's component of acceleration
- Analyzing Inertia force with graphical methods

PE 291 PRODUCTION PROCESSES LABOROTARY

Teaching Scheme	**Examination Scheme**
Practical : 2 hrs/week	Term work: 50 marks
	Pract/Oral Exam: 50 marks

Termwork:

Each candidate shall be required to complete and submit the following term work:

I) Jobs:

Plain and Taper turning – one job
Forging and grinding of lathe tool with one knife and other end vee – one job
Making a simple solid pattern involving wood turning – one job
Welding (gas or arc) – one job
Sand Casting – one job

Journal & Demonstration:

Assignments on machine tools will be in the form of a journal based on demonstrations on machine tools. This should include sketches and relevant descriptions as given below:

1) Block Diagrams (Any Two)
   a) Lathe
   b) Universal milling machine
   c) Radial drilling machine
   d) Cylindrical grinder.

2) Mechanisms (Any Two)

a) All geared headstock of a center lathe.
b) Spindle arbor (assembly) drive of milling machine
c) Crank and slotted lever quick return drive of shaping machine.
d) Spindle assembly in a drilling machine.

3) Accessories (Any Two)

a) Taper turning attachment for a center lathe.
b) Universal dividing head.
c) Milling cutters.

Outcomes:

- Understand machine tools, mechanism and accessories used in various production processes
- Make the job of turning & tapper turning operation using lathe
- Perform Forging and grinding of lathe tool with one knife and other end vee
- Prepare simple solid pattern involving wood turning
- Perform Welding using gas/arc welding process
- Understand Sand Casting process

PE 293 PRODUCT AND SYSTEM GRAPHICS LABORATORY

Teaching Scheme	**Examination Scheme**
Practical : 4 hrs/week	Term work: 50 marks
	Pract/Oral Exam: 50 marks

Objective:

To understand the principles of drawing, dimensioning, representation of the standard components.

Unit 1 **(8 hrs)**

Dimension Techniques

Methods of indicating dimensions for chords, arcs, angles, radii, spheres, cylinders, squares, equidistant features.

Arrangement of dimensions: Chain dimensioning, parallel dimensioning. Running dimensioning, co-ordinate dimensioning. Geometric Tolerances: Conventional representation on parts drawings

(8 hrs)

Unit 2

Conventional Representation of Machine Components

[As Per Is Code-Sp-46]

Screw threads, tapped holes, holes on circular pitch, bearing, knurling, splined shafts, springs, gears, tapers, chamfers, countersunk and counter bores, keys, welded joints, structural sections and their designations

Unit 3 **(8 hrs)**

Screwed Fasteners
Thread forms and their proportions - standard tables of ISO Metric threads. Thread designations, single and multi start threads, right and left hand threads.
Types of screws and bolts and nuts, types of nut locking arrangements.

(6 hrs)

Unit 4
Types of Pipe Joints
Expansion joints, stuffing box and gland, piping layouts. conventional representation of pipe fittings, valves, joints etc.

Unit 5 **(8 hrs)**
Limits, Fits and Tolerances, Surface Roughness
ISO system of tolerancing. Tolerance chart. Hole base and shaft base system of tolerancing. Types of fits with symbols and applications.
Surface texture, Machining symbols, roughness values (Ra) and roughness grade numbers, conventional representation on part drawings.

Unit 6 **(10 hrs)**
Basic Characteristic of Production Drawings
Assembly and part drawings. Blue print reading. Bill of materials.

Unit 7 **(10 hrs)**
Solid Modeling Package
Basic commands, Drawing basic entities, Sketcher, Solid Modeling, Surfaces, Assembly, Drafting, etc.

Termwork:
Four A4 size sheets (using drafting package) containing different I.S. conventional representation for machine elements. Welded joints, screwed fasteners, tapers, piping layouts, method of dimensioning. I.S. conventions for method of tolerancing, fits, geometric tolerances, surface finish.
One imperial size sheet of drawing consisting of assembly & detail part drawings of mechanical assemblies like valves, boiler mountings, couplings, vices, pumps, engine sub assemblies, jigs & fixtures, lathe tailstock, tool posts, gear boxes, pulley blocks, revolving center etc.
A sketchbook containing the sketches of above parts.
Computer Aided Drafting exercises: Using any Solid Modelling package.
Working drawing, details & assembly of any one machine component such as cotter joint, knuckle joint, flange joint, rigid & flexible coupling etc. with geometric & dimensional tolerances, surface finish etc.

Text Book:
1. Engineering Drawing Practice for Schools and Colleges, SP46-2003, Bureau of Indian Standards, New Delhi

Reference Books:

1. "Fundamentals of Machine Drawing", Sadhu Singh, and P.L. Sah, Prentice-Hall of India, First Edition, 2008.
2. "Machine Drawing", N.D. Bhatt and V.M. Panchal, Charotar Publishing House, Anand, 40th Edition, 2005
3. "Machine Drawing", N. Siddheshwar, P. Kannaian, and V.V.S. Sastry, Tata McGraw-Hill, India, New Delhi.
4. "Machine Drawing", K.L. Narayana, P. Kannaian, and V. Venkat Reddy, New Age International Publication, Second Edition, 2006
5. "Production Drawing", K.L. Narayana, P. Kannaian, and V. Venkat Reddy, New Age International Publication, First Edition, 2006
6. "Machine Drawing", R.B. Gupta, Satya Prakashan, New Delhi, Sixth Edition.

Outcomes:

- do dimensioning to the engineering drawings
- represent machine components conventionally
- select the fits and tolerances for the designed components
- draw the 2D and 3D views using software packages like AutoCAD and Catia
- carryout part drawing and assembly of systems along with preparation of Bill of Material.

AS 207 – PROFESSIONAL COMMUNICATION

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks, End - Sem Exam – 60 Marks

OBJECTIVES

- *To encourage the all round development of students by focusing on soft skills.*
- *To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.*
- *To develop and nurture the soft skills of the students through individual and group activities.*
- *To expose students to right attitudinal and behavioral aspects, and to build the same through activities.*

The coverage of soft skills that help develop a student as a team member, leader, all round professional in the long run have been identified and listed here for reference. As the time allotment for the soft kills laboratory is small and the fact that these skills are nurtured over years, students are encouraged to follow up on these skills as self-study and self driven process.

Unit 1 [8 hrs]

Verbal and Nonverbal Spoken Communications

Public speaking, Group discussions, Oral Presentation skills, Perfect interview, listening and Observation skills, Body language, Use of presentation graphics, Use of presentation aids, study of Communication barriers.

Unit 2 [8 hrs]

Written Communications

Technical writing: technical reports, project proposals, brochures, newsletters, technical articles, technical manuals.

Official / business correspondence: Business Letters, Memos, Progress Reports, Minutes of Meeting, Event Reporting. Use of: Style, Grammar and Vocabulary for effective Technical Writing. Use of: Tools, Guidelines for Technical Writing, Publishing.

Unit 3 [8 hrs]

Leadership Skills and Interpersonal Communications

Leaders: their skills, roles, and responsibilities. Vision, Empowering and delegation, motivating others, organizational skills, Problem solving and conflict management, team building, interpersonal skills. Organizing and conducting meetings, decision making, giving support, Exposure to work environment and culture in today's job places, improving personal memory, Study skills that include Rapid Reading, Notes Taking, Self learning, Complex problem solving and creativity.

Business Ethics, Etiquettes in social as well as office settings, E-Mail Etiquettes, Telephone Etiquettes, Engineering Ethics and Ethics as an IT Professional, Civic Sense

Reference Books

- Raman, Sharma, "Technical Communications", OXFORD.
- Sharon Gerson, Steven Gerson", Technical Writing process and product", Pearson education Asia, LPE Third Edition.
- Thomas Huckin, Leslie Olsen "Technical writing and Professional Communications for Nonnative speakers of English", McGraw Hill.
- Newstrom, Keith Davis, "Organizational Behavior", Tata McGraw Hill.

List of Possible Assignments

1. Write a Personal essay and or resume or statement of purpose which may include:
    a. Who am I (family background, past achievements, past activities of significance).
    b. Strengths and weaknesses (how to tackle them) (SWOT analysis).
    c. Personal short-term goals, long-term goals and action plan to achieve them.
    d. Self assessment on soft skills.
2. Students could review and present to a group from following ideas:
    a. Presentation of a technical report.
    b. Biographical sketch.
    c. Any topic such as an inspirational story/personal values/beliefs/current topic.
    d. Ethics and etiquettes and social responsibilities as a professional.

    Students will present to a group from following ideas:
    e. Multimedia based oral presentation on any topic of choice (Business/Technical).
    f. Public speaking exercise in form of debate or elocution on any topic of choice
3. Students will undergo two activities related to verbal/nonverbal skills from following:
    a. Appearing for mock personal interviews.
    b. Participating in group discussions on current affairs/social issues/ethics and etiquettes.
    c. Participating in Games, role playing exercises to highlight nonverbal skills.
4. Students will submit one written technical documents from following:
    a. Project proposal.

b. Technical report writing

5. Students will submit one written business documents from following:
    a. A representative Official correspondence.
    b. Minutes of meeting.
    c.Work progress report.
    d. Purchase order checklist for event management etc.
6. Students will participate in one or two activities from following:
    a. Team games for team building.
    b. Situational games for role playing as leaders, members.
    c. Organizing mock events.
    d. Conducting meetings.

Outcomes:

- The coverage of soft skills that help develop a student as a team member, leader, all round professional in the long run have been identified and listed here for reference.
- As the time allotment for the soft kills laboratory is small and the fact that these skills are nurtured over years
- Students are encouraged to follow up on these skills as self-study and self driven process.

SEMESTER IV

AS204 BSC - Applied Biology

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End Sem Exam- 60 marks

Unit 1 **(6 hrs)**

Origin of life. Molecules of life- biomolecules. Cell as the unit of life.
Development of cell theory. Cell types : prokaryotes and. eukaryotes; cell organelles, single cell to multi-cellular organism, tissue and organ level organization, organ systems

Structure of the cell membrane. Fluid mosaic model. Functions of plasma membrane; diffusion, osmosis, membrane transport through plasma membrane, ion channels and electrical properties.

Unit 2 **(6 hrs)**

Energy Transduction and Bioenergetics. Mitochondria, ATP, Chemiosmosis, ATPase,Cell to cell junction-gap junctions. Ultra structure of Chloroplast, photosynthetic electron transport, Calvin cycle
Cell architecture, cyto-skeletal components, microtubules and microfilaments,
motility and motor motions, actomyosin complex
Genomics and proteomics

Unit 3 **(6 hrs)**

Evolution of biological machines- Optimization of biological machines at different levels- molecular, cellular, organismal and populational; principles of generating diverse body plans and design in nature
Biomaterials. Applications of nanotechnology in biology. Biosensors & their application

Unit 4 **(6 hrs)**

Bioengineering- genetic engineering, protein engineering, tissue engineering and biochemical engineering.
Computational biology and bioinformatics

Unit 5 **(6 hrs)**

Biomechanics - fluid mechanics , examples in living world, aerodynamic, hydrodynamic and locomotion, mechanism of motion, friction and fracture.
Application of biomechanics and biomaterials- Human body motion, use of prosthetics, rehabilitation application

Unit 6 **(6 hrs)**

Instrumentation in biology- spectroscopic methods, bioimaging using various techniques eg. MRI, CT scan ect.
Green environment- use of biotechnology in environmental engineering

(Entire course should be taught at introductory level)

References :

- Molecul;ar Biology of Cell by Alberts.
- Biochemistry of Cell by Lehninger
- Plant Physiology by N.K.Sinha & Pandye
- Genes 8 by Benjamin Lewin
- A Text Book of Environmental Engineering by P. Venugopal Rao
- Animal Tissue Culture by Ian Freshlly

Outcomes:

- Understand basic biology regarding origin of life, cell structures, bio-molecules, membrane transport & so on.
- Gain knowledge about latest studies in biology like genetic & tissue engineering, stem cells, biomechanics, bioimaging, bio-nanotechnology etc.
- make them think what an engineer's role in life sciences is.

EE 217 INDUSTRIAL ELECTRONICS AND ELECTRICAL DRIVE SYSTEMS

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks, End - Sem Exam – 60 Marks

Objective :

- To study various electronics devices such as power control devices, integrated circuits and its industrial applications.
- To study various electrical machines and their applications in Production Engineering

Industrial Electronics

Unit 1 **(8 hrs)**

Study of Power Control Devices

SCR, Triac, Power MOSFET, IGBT, characteristics and simple applications like controlled rectifiers. Triggering circuits using Diac/UJT and digital logic: Power supply protection circuits (over voltage, thermal shutdown and current limiting). Study of UPS (only block diagram), light dimmers, fan regulators.

Unit 2 **(10 hrs)**

Integrated Circuits and Applications

Amplifiers:Review of Op-amp IC 741, Audio Power Op-Amp ICs like TBA 810, LM 380, Schmidt trigger and its applications, Op-Amp as wave form generator (square and ramp), case study of

waveform generator IC such as 8038 or XR 2206.
IC 555 as mono-stable and a stable multi vibrator and its applications in Mechanical Engineering. Cascading of Timers, sequential timers.
Binary and BCD adder, subtractor. Shift registers, counters, applications of digital circuits such as staircase, traffic light, lift controller, sequential controllers, mechanical system, opto isolators and opto couplers.

Unit 3 **(10 hrs)**

Industrial Applications

Resistance welding, RF heating energy storage welding, ultrasonic method of testing of materials, principles of LASER and applications. DC drives, separately excited and series motors, speed control of AC motors. Use of CR0 as a display device for industrial application.
Smoke, temperature, pressure, vibrations, displacement, flow, level detectors. Controllers using these sensors annunciator circuits, electronic weighing systems, electronic ignition systems, proximity switches.
Analog to Digital and digital to analog converters. Introduction to PLC, concept to distributed control systems, concept of computerised numerical controllers.

Electrical Drive Systems

Unit 4 **(8 hrs)**

D. C. Machines
Construction, generating action, e.m.f. equations, types - shunt, series, compound generators (elementary treatment) Motoring action, types - shunt, series, compound motors. Significance of back e.m.f., torque-speed equations, torque- armature current speed-armature current, torque-speed characteristics, different methods of speed control, braking, starters of D.C. motors, applications.

Unit 5 **(7 hrs)**

Induction Motors

Three Phase Induction Motors: Types, principle of operation slip torque equation, condition for maximum torque, torque slip characteristics, various methods of speed control, breaking. Relation between slip, mechanical power developed and copper loss. Efficiency of motor. Different types of starters, applications.
Single Phase Motors: Principle of working, construction and applications (descriptive treatment only) of

a) Single phase induction motors: resistance split phase, capacitor split phase and shaded pole motors.

b) Special purpose motors: stepper motors, servomotors, hysteresis motors, and reluctance motors. A.C. series motors. Universal motors.

Unit 6 **(13 hrs)**

Synchronous Machines & Electrical Drives

Alternators**: Constructional features, salient pole and cylindrical type rotors, synchronous speed, frequency of induced e.m.f., e.m.f. equations, winding factors, regulation of an alternator (synchrohous impedance method).**
Synchronous motors**: Concept of rotating magnetic field, principle of working, phasor diagram, effect of variation of load and excitation, hunting, methods of starting,, general applications, application as synchronous condensers.**
Selection And Applications Of Electrical Drives**:**

a) Selection: Factors to be considered, classes of insulation, review of speed/torque

characteristics. Selection of power rating for drive motors based on Thermal limits; over load and load variation factors.

b) Industrial Applications: Selection of motors for rolling mills. Cranes, winches, traction, shear press, mechanical press, power mills, textile industry, coal and mining industry.

c) Maintenance of electrical equipment.

References :

Industrial Electronics:

- Chute & Chute: Electronics in Industry, Tata McGraw Hill.
- R.P. Jain: Modern Digital Electronics, Tata McGraw Hill.
- Ramamoorthy: Thyrister and Power Electronics Applications, Prentice Hall of India.
- Harish C. Rai: Industrial and Power Electronics (Umesh Publication, Delhi).
- C. S. Rangan, Sharma, Mahi: Instrumentation, devices and system (WIE).
- Curtis Johnson: Process Instrumentation, Prentice Hall of India.

Electrical Drive Systems:

- B.L.Therja: Electrical technology, Vol. II
- Pillai S. K.: First course in Electrical Drives – Wiley Eastern.
- Kuo B. C.: Automation control systems – Prentice Hall of India.
- H. Cotton: Electrical Technology.
- Stefan Chapman: Fundamental of Electrical Machinery.

Outcomes:

- Learn all speed control methods of separately excited and self excited DC motors and AC motor and with solid state control so these can be used as DC drive and AC drives.
- Understand power control devices like, Triac, SCR, IGBT MOSFET and their triggering methods and design fan regulator and light dimmer circuit.
- Study and select proper OPAMP mechanical or production application like wave form generators IC555 as a timer ,cascading of timers and sequential timer.
- Use logic gates and study registers and counters and applications like staircase, traffic light, lift controllers, sequential controllers.
- Learn all types of welding methods like resistance, RF heating energy storage welding, principles of Laser and applications

ME 208 ENGINEERING THERMODYNAMICS AND HEAT TRANSFER

Teaching Scheme

Lectures : 3 hrs/week

Examination Scheme

100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks, End - Sem Exam – 60 Marks

Objective :

- To understand use of steam for power generation and process heating. To apply fundamentals of Thermodynamics to various power producing and power absorbing devices.
- To understand basic modes of heat transfer & to evaluate performance of heat exchangers.

Unit 1 **(7 hrs)**

Elementary Thermodynamics
Basics of Thermodynamics, First Law of Thermodynamics, Steady Flow Energy Equation, Second Law of Thermodynamics, Ideal Gas Laws, Application of Gas laws to vapour processes.

Unit 2 **(7 hrs)**
Vapour power cycles
Steam Generation and its properties, Measurement of dryness fraction, Carnot Cycle, Ideal Rankine Cycle, Calculation of Thermal Efficiency, Specific Steam Consumption, Work ratio.
Steam Turbines
Types, construction, working, compounding, velocity diagram, & diagram efficiency.

Unit 3 **(7 hrs)**
Fuels and combustion
Solid, Liquid and gaseous fuels, Combustion equations, theoretical air, excess air, analysis of product of combustion, gravimetric and volumetric analysis.

Unit 4 **(7 hrs)**
I. C. Engines
Air standard Otto, Diesel cycles, classifications of systems of I.C. engines such as fuel supply system for SI & CI engines, ignition system, cooling system, lubrication system, Performance of IC Engine – Indicated power, Brake power, Thermal efficiency, Specific fuel consumption,

Unit 5 **(7 hrs)**
Energy Systems
Utilization of Nuclear energy and nuclear power plants; principles of direct energy conversion; Fuel cells, MHD generators; solar energy conversion systems; bio-energy conversion systems; Wind, Tidal, Geothermal and Ocean Thermal energy conversion systems
Gas Turbines: Classification, Brayton cycle, thermal efficiency and its improvement

Unit 6 **(7 hrs)**
Heat Transfer
Modes & laws of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann's law, elementary problems on conduction, convection & radiation, insulating materials, use of shields, heat exchangers-overall Heat Transfer coefficient, LMTD for parallel & counter flow heat exchanger.

Text Book:

- R.K. Rajput: Thermal Engineering, Laxmi Publications.
- R. S. Khurmi and Gupta: Thermal Engineering, S. Chand.

References :

- S.P. Sukhatme: Heat Transfer, Orient Longman.
- Y.A. Cengel: Thermodynamics – an Engineering approach, Tata McGraw Hill.
- Eastop, A. Mc'conkey: Applied Thermodynamics, Pearson Publishers.
- Holman J.P.: Heat Transfer, Tata McGraw Hill

Outcomes:
- Understand use of steam for power generation and process heating.
- Use the laws of Thermodynamics to various power producing and power absorbing

devices.
- Analyze I.C. engines and their Performance evaluation
- understand principles of direct energy conversion
- understand basic modes of heat transfer & to evaluate performance of heat exchangers.

ME 210 FLUID POWER

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End Sem Exam- 60 marks

Unit 1 **(10 hrs)**

Introduction

Historical background and merits and applications of hydraulic and applications of hydraulics and pneumatic power in Industry.

Properties of fluids, Flow of Fluid – Stream lined and turbulent, flow of compressible and incompressible fluid through pipes. Friction of loss of head, Bernauli's theorem, Cavitation. Loss of head through tube irregularities such as bend etc. Work done by fluid under pressure. Hydraulic and pneumatic symbols.

Unit 2 **(7 hrs)**

Pumps and Compressors

Positive displacement pumps, rotary pumps such as different types of gear pumps, vane pumps, variable displacement pumps, reciprocating pumps. Pump construction characteristics and application, power and capacity.

Various types of compressors, their construction, operating characteristics, power and capacity, accessories.

Concept of vacuum and terminology. Vacuum pumps- construction characteristics and power requirements.

Treatment of pumps, compressors, accumulators to be restricted only to these used in hydraulic and pneumatic power control.

Unit 3 **(6 hrs)**

Hydraulic Valves

Pressure control valves, relief valves, counter balance valves, pressure sequence and pressure reducing valves, construction, working and maintenance.

Flow control valves, direction control valves, multiple, multi-position and multi stage valves, Cartridge valves.

Valve sizes, selection, construction, series and parallel connections, stacking of valves.

Unit 4 **(7 hrs)**

Actuators

Hydraulic and pneumatic cylinders, motors and other types of actuators. Single and double

directional operation. Construction selection and operation of actuators.
Accessories: Air and oil hoses, pipe fittings, filters, pressure switches, temperature switches, accumulators, seals and sealing devices for hydraulic, pneumatic and vacuum applications.

Unit 5 **(6 hrs)**

Electrical Control for hydraulic circuits

Electrical components used in hydraulic circuits for purpose of control of motion, speed and force, pressure and limit switches, Dual cylinder sequence circuits, Use of control circuits for operations like box sorting, electrical control of regenerative circuits, counting, timing and reciprocation of hydraulic cylinder.

Unit 6 **(6 hrs)**

Design of hydraulic systems:

Design of hydraulic circuits, Understanding system operations and Identification of requirement of hydraulic components, selection of parameters, selection of pumps, valves, actuators and accessories. Design of simple circuits for operation of Machine tools, Hydraulic presses, Hammers, Material handling devices etc. Representing the circuit using standard symbols.

References :

- Modi, P.N. and Seth, S.M.: Hydraulic and Fluid Mechanics, Standard Book House, New Delhi.
- Dr. R.K. Bansal: A Textbook of Fluid Mechanics and Hydraulic Machines
- Pippenger and Hich: Industrial Hydraulics, McGraw Hill, 1980.
- Vickers: Industrial Hydraulics Manual.
- A.B. Goodwin: Power Hydraulics.

Outcomes:

- To understand properties of fluid.
- To understand different types of pumps and compressors, actuators, hydraulic valves and its applications in industry.

ME 211 DESIGN OF MACHINE ELEMENTS

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	100 marks: Continuous evaluation- Assignments /Quiz- 40 Marks, End - Sem Exam – 60 Marks

Unit 1 **(6 hrs)**

Fundamentals and Design concepts

Design concept, Phases of design, types of design, factor of safety, Standardization and preferred series, materials and process selection.

(6 hrs)

Unit 2

Loads and Stress in Machine Elements

Types of loads, static, shock, impact and fluctuating loads, types of stresses, tensile, compressive, direct and torsional shear, bending stresses, combined effect of direct, bending and torsional stresses, theories of failure.

Unit 3 **(5 hrs)**
Design of Simple Machine parts

Design of cotter joint, knuckle joint, Stresses in eccentrically loaded machine parts.

Unit 4 **(7 hrs)**
Design of shaft, keys and couplings
Design of shaft based on torsional and lateral rigidity, combined loadings.
Design of keys, keyways and splines, Design of Coupling.

Unit 5 **(10 hrs)**
Design of Screws, Fasteners and welded Joints
Standard threads, Design of bolted joints, Design of power screws, Re-circulating ball screws. Types of welded joints, Eccentrically loaded welded joints.

Unit 6 **(5 hrs)**
Design of Springs

Spring configurations, materials, design of helical compression, Extension and Torsion springs. Design of leaf springs. Nipping of Spring.

References :

1. V. B. Bhandari: Design of Machine Elements, Tata McGraw Hill Publication.
2. J.E. Shigley and CR. Mischke: Mechanical Engineering Design, 5th Edition, McGraw Hill Publication.
3. M.F. Spotts: Design of Machine Elements, Prentice Hall Publication.
4. Hall and Helowenko: Machine Design, Schaum Series.
5. Phela: Fundamentals of Machine Design, McGraw Hill Publication.
6. Design data compiled by Faculty of Mech. Engg., PSG College of Tech., Coimbatore.

Outcomes:
- Well conversant with the importance of Design of machine elements in their curriculum and carrier.
- Well conversant with fundamentals of machine design through learning general procedure of Design.
- Able to understand different types of loads and stresses acting on machine components.
- Competent enough to design simple machine components like shaft, keys, couplings, springs, etc.
- Gaining knowledge about designing of power screws, fasteners, bolted and welded joints.

PE 202 MACHINING SCIENCE AND TECHNOLOGY

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Unit 1 **(14 hrs)**

Theory of Metal Cutting

Cutting tools, tool geometry, Concept of speed, feed, depth of cut and cutting action and effect of these on cutting forces. Types of Chips. Merchant's circle of forces. Mechanics of metal cutting, Theories of shear angle.

Estimation of cutting forces. Empirical Relations, Tool Force dynamometers., Measurement of cutting forces and power required. Heat Generation in Metal Cutting, Cutting Fluids.

Cutting Tool Materials. Heat Treatment of Tools and alloys.
Machinability, Tool Life and Tool Wear, New technology in metal cutting for higher productivity. Compliance test

Unit 2 **(08 hrs)**

Design of Cutting tools

Design Principles of cutting tools and tool holders. Single point tools, Tip tools, Drills, Reamers, Broaches, Milling cutters, Thread cutting tools, Gear cutting tools, Grinding Wheels, Form Tools. Mechanics of drilling, milling and grinding.
Broaching
Types of broaching machines-Horizontal, vertical pull up, pull down broaching machines. Parts of the machine and their function. Components machined on broaching machine.

Unit 3 **(6 hrs)**

Gear Manufacturing

Gear cutting process forming and generation. Gear cutting on milling. Gear hobbing. Gear shaping. Gear shaving, Lapping and Grinding. Various machines used for gear manufacturing.

Unit 4 **(8 hrs)**

Thread Manufacturing

Thread cutting internal and external, chasers, dies, thread milling, rolling, lapping and grinding.

Unit 5 **(14 hrs)**

Non conventional Machining Processes
Introduction, principle, set up, operation and applications - Chemical machining, Electrochemical machining, Electric discharge machining, Electron Beam machining, Ion Beam machining, Plasma Arc machining, Laser machining, Abrasive Jet machining, Ultrasonic Machining.

Unit 6 **(6 hrs)**
Testing of Manufacturing Equipments
Introduction testing measuring equipments for testing, machine tool alignment tests.

Text Books:
- Manufacturing Technology, P.N. Rao, Tata McGraw-Hill Publishing Limited, II Edition, 2002.
- Non Conventional Machining, P.K.Mishra, Narosa Publishing House (January 15, 2001), ISBN: 978-81-7319-138-1, Reprint 2008.

Reference Books:
- Donaldson, Lecain and Goold: Tool Design, Donaldson, Lecain and Goold, Tata McGraw Hill, Edition:III
- Advanced Machining Processes, Vijay K. Jain Allied Publishers Pvt. Ltd., Edition I 2007
- Cutting Tools, Prakash Joshi, Wheeler Publishing, ISBN 81-85814-53-8, Edition I 1996
- Metal Cutting Theory and Practice, David A Stephenson, John S Agapiou, CRC Press Edition II.

Outcomes:
- Present various theories of metal cutting and various tools used in the metal cutting
- understand broaching machines and tools used in the process
- suggest various gear and thread manufacturing processes
- learn and use various non-conventional machining processes
- perform testing of Manufacturing Equipments

EE 218 INDUSTRIAL ELECTRONICS AND ELECTRICAL DRIVE SYSTEMS LABORATORY

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Term work: 50 marks
Practical/Oral Exam: 50 marks

Termwork:
Industrial Electronics
Termwork shall consist of record of any five experiments out of the following:
1. Study of CRO and its applications-measurement of frequency, phase difference, voltage, vibration signals, temperature measurement using

thermocouple etc.
Instruments: 20 MHz dual trace CRO, Function-generator.

2. Study of UPS systems Instruments: UPS kit, CRO, DMM.
   Or Controlled rectifiers using SCR with UJT triggering for Lamp load.
   Instruments : Power-Scope, DMM.
3. Applications of Op-Amp using 741 (Any two)
   Square wave generators/ramp generator
   Instrumentation Amplifier
   Op-Amp as comparator and Schmidt trigger
   Instruments : Dual trace CRO, Dual Power supply. Function Generator.
4. Sequential timer using IC555 and square wave generator
   Instruments : Power supply, Dual trace CRO, stop-watch.
5. Application of logic gates (One bit Comparator) and combinational circuits, e.g. traffic lights, combinational lock lift, control, code conversion.
6. PLC Programming.
7. Shift register IC7495 and its application as a sequence generator.
   Or
   Programmable counter (frequency and time measurement)
   Instruments for digital experiments : Power supply, dual trace CRO, Pulse generator, DMM.
8. Minimum two circuits of level detector, proximity detector, electronic weighing machine, non- contact type, Tacho meter Annunciator.
   Or
   Study and demonstration of resistance welding, R.F.Heating.
9. a) Speed control of an A.C. motor.

   b) Speed control of an D.C. motor.
10. Experiment on CNC programming. (To be conducted in workshop)

Electrical Drive Systems

The term work shall consist of record of any four experiments out of the following:

1. Speed control of D.C. shunt motor by armature voltage and flux control methods and study of D.C. shunt motor starters.
2. Load test on D.C. shunt motor
3. Load test on D.C. series motor
4. Study of three phase induction motor starters.
5. Load test on three-phase induction motor.
6. Regulation of alternator by synchronous impedance method
7. Study of various single phase motors

Outcomes:

- Perform basic Electrical Machines experiments and evaluate their suitability for a specified job from their electrical and mechanical characteristics
- Get hands-on experience in using op amps and timer circuits in industrial electronics experiments
- Predict, analyze, and test the performance of sensors of various kinds, including strain gages, thermocouples, tachometers, displacement

transducers, dynamometers, pressure gages and transducers, Flow meters etc. Understand working of fully controlled half wave rectifier and circuits using triacs.

- Develop good communication skills.

ME 212 ENGINEERING THERMODYNAMICS AND HEAT TRANSFER LABORATORY

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Term work: 50 marks
Practical/Oral Exam: 50 marks

Term work:

Term work consists of following experiments (Any Eight)
Determination of dryness fraction of steam.
Trial on bomb calorimeter.
Study of MPFI and Bosh fuel injection pump
Study of High Pressure Boilers.
Test on Diesel/Petrol engine to determine BP, bsfc, Brake thermal efficiency.
Trial on reciprocating air compressor.
Determination of thermal conductivity of insulating meterial.
Test on parallel & counter flow heat exchanger.
Determination of Emissivity of a Test Plate.

Outcomes:

- Use basic concepts of Engineering Thermodynamics to a particular requirement
- Use the method of Determination of dryness fraction of steam & carryout test on bomb calorimeter
- Test Diesel/Petrol engine to determine BP, bsfc, Brake thermal efficiency
- Test reciprocating air compressor and heat exchanger
- Determine thermal conductivity of insulating material & Emissivity of a Test Plate.

ME 214 FLUID POWER LABORATORY

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Term Work-50 marks
Practical/Oral -50 marks

Termwork:
The Term work shall consists of following:
1. Verification of Bernoulli's theorem and finding coefficient of discharge for the

venturimeter
2. Measurement of viscosity by using Redwood viscometer
3. Calculation of major and minor losses for flow through pipes
4. Study of different types of actuators, valves and pumps
5. Study of pressure regulator circuits for machine tools.
6. Study of speed regulation using meter-in, meter-out and head-off
7. Study of hydraulic press circuit.
8. Use of hydraulic trainer to develop hydraulic circuit for a given operation

Outcomes:

- understand basics of fluid power and application to a particular requirement
- Measure of viscosity by using Redwood viscometer and also calculate losses of flow
- Study and understand functioning of different types of actuators, valves and pumps, pressure regulations
- know speed regulations and use of hydraulic trainer kit to develop hydraulic circuit for a given operation

MLC- ENVIRONMENTAL SCIENCES

Teaching Scheme

Lectures : 2 hrs/week

Examination Scheme

Mid-Sem – 30,
Assignments, Quiz -20
End Sem Exam- 50

Unit 1 **(4 hrs)**

Multidisciplinary nature of environmental studies: Definition, scope and importance, need for public awareness.

Unit 2 **(6 hrs)**

Natural Resources :
Renewable and non-renewable resources: Natural resources and associated problems.
Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Unit 3 **(4 hrs)**

Biodiversity and its conservation: Introduction – Definition : genetic, species and ecosystem diversity, Biogeographically classification of India, Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.

Unit 4 **(6 hrs)**

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management.

Unit 5 **(6 hrs)**

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns.

Text Books

1. Environmental studies from crisis to cue R Rajgopalan , III edn. OUP ISBN no. 0-19-537393-X
2. Environmental Science, S C Santra**,** New Cental Book Agency PVT LTD London ISBN no. 81-7381-404-X
3. Environmental Chemistry by De A.K., Wiley Eastern Ltd.

Reference Books

1. The Biodiversity of India by Bharucha Erach, Mapin Publishing Pvt. Ltd., Ahmedabad –380 013, India, Email:mapin@icenet.net
2. Handbook of Environmental Laws by Trivedi R.K.,Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media.

Outcomes:

- conversant with environmental science,
- able to understand about Renewable and non-renewable natural resources
- aware about means of Pollution
- knowing techniques of Solid waste management and Disaster management
- aware about Social issues and the environment