PUNJAB TECHNICAL UNIVERSITY
KAPURTHALA

Scheme& Syllabus of
B. Tech. Production Engineering [P.E.]

3rd & 4th Semester effective for Batch 2011

By
Board of Studies Mechanical Engineering/ Production Engineering / Industrial Engineering

Third Semester

Contact Hours: 33 Hrs.

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTPE301	Strength of Materials	3	1	-	40	60	100	4
BTPE302	Machine Drawing	2	-	6	40	60	100	5
BTPE303	Thermal Engineering	3	1	-	40	60	100	4
BTPE304	Theory of Machines	3	1	-	40	60	100	4
BTPE305	Manufacturing Processes – I	4	-	-	40	60	100	4
BTPE306	Strength of Materials Lab.	-	-	2	30	20	50	1
BTPE307	Thermal Engineering Lab	-	-	2	30	20	50	1
BTPE308	Theory of Machines Lab	-	-	2	30	20	50	1
BTPE309	Manufacturing Processes – I Lab	-	-	2	30	20	50	1
Advisory Meeting		-	-	1	-	-	-	-
BTPE 310	Workshop Training*	-	-	-	60	40	100	1
	Total	**15**	**3**	**15**	**380**	**420**	**800**	**26**

*** Workshop Training will be imparted in the Institution at the end of 2nd ssemester for Four (04) weeks duration (Minimum 36 hours per week). Industrial tour will also form part of this training.**

Fourth Semester

Contact Hours: 31 Hrs.

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTPE401	Design of Machine Elements	4	1	-	40	60	100	5
BTPE402	Fluid Mechanics & Fluid Machinery	4	1	-	40	60	100	5
BTPE403	Manufacturing Processes-II	4	-	-	40	60	100	5
BTPE404	Engineering Materials and Metallurgy.	4	-	-	40	60	100	5
BTPE405	Industrial Organization and Management	4			40	60	100	4
BTPE406	Design of Machine Elements Practice	-	-	2	30	20	50	1
BTPE407	Fluid Mechanics & Fluid Machinery Lab.	-	-	2	30	20	50	1
BTPE408	Manufacturing Processes-II Lab.	-	-	2	30	20	50	1
BTPE 409	Engineering Materials and Metallurgy Lab	-	-	2	30	20	50	1
Advisory Meeting		-	-	1	-	-	-	-
General Fitness		-	-	-	100	-	100	-
	Total	**20**	**02**	**09**	**420**	**380**	**800**	**27**

Third Semester

BTPE-301 Strength of Materials

Course Objectives:

- To prepare students to understand the simple stresses strains and deformation in components due to external loads.
- To enable the students to evaluate 2D, 3D and principal stresses (analytically and graphically) for different sections.
- To enable the student to draw the shear forces and bending moments diagram and to calculate bending stresses in structural member of an engineering system.
- Identify the applicable theory, and apply the appropriate equations to calculate the stresses, strains and/or displacements in axial members.
- To assess stresses and deformations through mathematical models of beams, twisting bars, and torque / power transmitter (Shafts).
- To calculate the internal stresses, strains and/or displacements in thin pressure vessels.
- To determine the buckling loads of various types of columns under different conditions

Expected Outcomes: At the end of this course, students should be able to:

- Perform design and analysis of thin-walled pressure vessels.
- Design the structures subjected to wide range of loading conditions, including thermal loads.
- Solve problems involving simple and combined modes, including torsion and bending

Unit I

Simple stresses and strains : Concept of stress and strain; St. Venant's principle, stress and strain diagram, Hooke's law, Young's modulus, Poisson ratio, stress at a point, stress and strains in bars subjected to axial loading. Modulus of elasticity, stress produced in compound bars subject to axial loading. Temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound bars. Compound stress and strains, the two dimensional system; stress at a point on a plane, principal stresses and principal planes; Mohr's circle of stress; ellipse of stress and their applications. Generalized Hook's Law, principal stresses related to principal strains

Unit II

Bending moment and shear force diagrams: S.F and B.M definitions. BM and SF diagrams for cantilevers, simply supported beams with or without overhangs and calculation of maximum BM and SF and the point of contraflexure under the following loads:

i) Concentrated loads

ii) Uniformity distributed loads over the whole span or part of span

iii) Combination of concentrated loads (two or three) and uniformly distributed loads

iv) Uniformity varying loads

v) Application of moments

Relation between rate of loading, shear force and bending moment

Unit III

Theory of bending: stresses in beams due to bending, assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular channel, I and T-sections; Combined direct and bending stresses in aforementioned section, composite / flitched beams.

Unit IV

Torsion : Derivation of torsion equation and its assumptions. Applications of the equation to the hollow and solid circular shafts, torsional rigidity, combined torsion and bending of circular shafts principal stress and maximum shear stresses under combined loading of bending and torsion.

Unit V

Thin cylinders and spheres : Derivation of formulae and calculation of hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume; principal stresses in sphere and change in diameter and internal volume

Unit VI

Columns and struts : Columns and failure of columns : Euler's formulas; Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.

Unit VII

Slope and deflection : Relationship between moment, slope and deflection, Moment area method; method of integration; Macaulay's method: Use of all these methods to calculate slope and deflection for the following :

a. Cantilevers

b. Simply supported beams with or without overhang

c. Under concentrated loads, uniformly distributed loads or combination of concentrated and uniformly distributed loads

Suggested Readings / Books

- Mechanics of Materials-SI Version 2nd Edition by EP Popov, (Prentice Hall India)
- Introduction to Solid Mechanics by D.H Shames, (Prentice Hall Inc.)
- Strength of Materials by Dr.D.S Bedi; (S Chand Publishers)
- Strength of Materials by R.S Lehri and A.S. Lehri, (S.K Kataria and Sons.)
- Strength of Materials by Dr.Sadhu Singh (Khanna Publishers)
- Strength of Materials by R.S Khurmi (S.Chand & Co.)

BTPE-302 Machine Drawing

Course Objectives:

- Understanding the principles and requirements of production drawings and various symbols used in drawing.
- How to assemble and disassemble the various couplings, pipe fittings, boiler mountings, bearing, machine tool parts, screw jack, and drill press.
- To enable students to draw various machine tools and produce their material bills.
- To enable students to draft the various machine tools by computer aided drafting.

Expected Outcomes:

The course studied will enable the students to:

a. Read, draw and interpret the entities being drawn in the course.

b. Increase the drafting skills for various industrial applications

c. Understand the concept of limits, fits and tolerances in various machine parts.

Unit I

Principles of drawing, requirements of production drawings, symbols of standard tolerances, machining symbols, sectioning and conventional representation, dimensioning, welding symbols, various types of screw threads.

1. Assembly and Dis- assembly of the following manually and using computer aided drafting.

a) Couplings: Pin type, flexible coupling, claw coupling, cone friction clutch, single plate friction clutch.

b) Pipe and pipe fittings.

c) IC Engine Parts: Piston, connecting rod, Cross head and eccentric

d) Bearings: Swivel bearing, thrust bearing, Plummer block

e) Machine tool parts: lathe tail stock, tool post.

f) Miscellaneous: Screw jack, drill press vice.

2. Drafting of simple Mechanical components on computer.

NOTE: First angle projection to be used. Drawings should contain bill of materials and should illustrate surface finish. The syllabus given above indicates the broad outlines and the scope of the subject to be covered. It is not necessary to cover all the drawing exercises of the types of machine tools mentioned above.

Suggested Readings / Books:

- Machine Drawing by PS Gill, (Kataria & Sons.)
- Machine Drawing by ND Bhatt, (Charotar)
- Machine Drawing byN. Sidheswar, (Tata McGraw Hill)

BTPE-303 Thermal Engineering

Course Objectives:

This course is designed for Production Engineering students for comprehensive study of steam power plants, its allied components and reciprocating compression machines. The various objectives of this course are as follows:

- To understand and recognize the various components of Heat transfer modes.
- To provide knowledge about different types of steam boilers / generators, boiler mountings and accessories and methods for improving boiler performance.
- To enable the students to understand combustion phenomenon.
- To understand non conventional energy resources.
- To understand the working, design and analysis of various thermal devices viz. steam nozzles, condensers and steam turbines.
- To understand working and performance of refrigeration and air conditioners.

Expected outcomes:

- Student will be able to identify, track and solve various Heat transfer problems.
- Student can recognize and understand the working of devices involved in steam power generation system.
- Student will be able to evaluate theoretically the performance of various components involved in steam power plants and reciprocating compression machines.
- Student will have ability to design some components of steam power plants and reciprocating compression machines.
- Student will be able to suggest and design different types of boilers for different commercial applications.
- Student can apply his knowledge to find out various losses from different thermal systems and can even suggest various preventive measures.

Unit I

Heat Transfer: Modes of Heat Transfer – Conduction, Convection and Radiation. Steady and unsteady heat transfer, Fourier law of conduction and thermal conductivity, Conduction of heat through a slab, through a hollow cylinder and through a hollow sphere, Natural and forced convection, convective heat transfer coefficient, Combined conduction and convective heat transfer, Critical thickness of insulation, Fin and its application, Types of fins, Analysis of heat transfer through a rectangular fin, Introduction to radiation, total emissive power, monochromatic emissive power, emissivity, Absorptivity, reflectivity and transmissivity, Black body, Opeque Body, White

body and Gray body, Stefan Boltzmann's Law, Kirchhoff's law, Plank's law, Wien's displacement law, Intensity of radiation and Lambert's cosine law. Heat Exchangers: Introduction, classification of heat exchanger, Heat exchanger analysis – Logarithmic mean temperature difference (LMTD) for parallel flow and counter flow.

Unit II

I.C Engines & Gas Turbines: Classifications of I.C. engines Working of two and four stroke petrol and diesel engines. Measurement of BHP, IHP, mechanical and thermal efficiency, Specific fuel consumption. Elementary idea of combustion phenomenon in S.I. and C.I. engines. Description of simple carburetor, fuel pump and injector. Magneto and battery ignition system. Simple Brayton Cycle, Description of open cycle Gas turbines, comparison of I.C. Engines and gas turbines and their applications.

Unit III

Refrigeration and Air Conditioning: Description of simple Vapour compression and Vapor absorption cycles, relative merits and demerits, Properties of refrigerants, Elementary idea of ozone friendly refrigerants, Concept of Psychrometry, Definitions of psychometric terms i.e. dry air, moist air and saturated air, absolute humidity, relative humidity ratio or specific humidity, degree of saturation, Dew point temperature, Dry bulb temperature and wet bulb temperature. Psychometric charts.

Unit IV

Boilers: Fire tube and water tube boilers, Description of Lancashire, Cochran, Locomotive, Babcock- Wilcox Boiler, mountings and accessories.

Unit V

Non-Conventional Power Generation: Introduction, advantages of non conventional energy sources, Wind power plants – multiple blade type, savonius type and darrieus type, Wind electric generation power plant – horizontal and vertical axis wind machines. Tidal power plant – classification and operation, single basin and double basin, Solar power plants – flat plate collector, concentrating collector, solar pond, Geothermal power plants. Biogas plants.

Suggested Readings / Books:

- Thermal Engg. by V.P. Vasandani and D.S. Kumar, (Treatise on Heat Engineering Metropolitan)
- Fundamentals of Engg. Thermodynamics by John R.Howell & Richrd O Buckius (McGraw Hill International.)
- Refrigeration & Air Condition by C.P. Arora(Tata McGraw Hill)
- Thermal Engineering by Domkundwar (Dhanpat Rai & Co.)
- Thermal Engineering by R. K. Rajput(S.Chand & Co.)

BTPE-304 Theory of Machines

Course Objectives:-

The subject of theory of machines deals with various aspects of parts of different machines. The course shall enable students to:-

- Understand the principles and fundamentals of static as well as dynamic parts.
- Provide mathematical formulae to ensure the feasibility of various parts of machines and structures.
- Introduction of different types of steering mechanisms.
- Provide technical aspects for the application of different parts in industry.

Expected Outcomes:-

At the end of the course, the student shall be able to:-

- Understand the working of various primitive components of a machine.
- Develop mathematical skills for the computation of industry related problems.
- Determine the various physical parameters of power transmission devices, friction devices and different governing devices.
- Compute the essential parameters like fluctuation of speed and energy in a flywheel of a vehicle, slotting machine etc.
- Understand the parameters involved in the working and application of different types of brakes and clutches of a vehicle.

Unit I

Basic concept of machines: Link, mechanism, kinematic pair and chain, principles of inversion, inversion of a four bar chain, slider- crank-chain, double slider crank chain and their inversions, kinematic pairs and analytical /geometrical methods for finding displacement velocity and acceleration of all basic mechanisms.

Unit II

Flywheels: Turning moment and crank effort diagrams for reciprocating machines Fluctuation of speed, coefficient of fluctuation of speed and energy, Determination of flywheel effect.

Unit III

Belts, Ropes and chains: material types of drives, idler pulley, intermediate or counter shaft pulley, angle drive, quarter turn drive, velocity ratio, crowning of pulleys, loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack sides of belts. HP transmitted by belts including consideration of creep and slip, centrifugal tensions and its effect on HP transmitted. Flat, V-belts and rope materials. Length of belt, rope and chain drives.

Unit IV

Brakes, Dynamometers and Clutches: Types of brakes, principle, function of brakes of various types. Problems to determine braking capacity, types of dynamometer: absorption, transmission and driving. Function of Clutches. Disc and Cone clutches.

Unit V

Cams: Types of cams and followers, definitions of terms connected with cams, displacement, velocity and acceleration diagrams for cam followers, various motions: SHM, uniform acceleration and retardation, analysis of follower motion for circular .concave, tangent cam profiles.

Unit VI

Gears & Gear Trains: Toothed gears and spur gears, types of toothed gears, definitions: pitch circle diameter, pitch surface, pitch point, circular pitch, module, pitch, diametrical pitch, addendum, dedendum, clearance, outside and internal diameters, root diameter, base circle diameter, face and flank of tooth, pressure angle, path of contact, arc of contact, conditions for correct gearing, forms of teeth, involute and its variants, interference and methods of its removal. Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel, helical and spiral gears.

Suggested Readings / Books:

- Theory of Machines by PL Ballaney, (Khanna Publishers)
- Theory of Machines by Shigley, (Mc Graw Hill)
- Theory of Machines by R.S.Khurmi, (S.Chand and Sons)
- Theory of Machines by Thomas Bevan(Pearsons Publishiers)
- Theory of Machines by S.S Ratan (Mc Graw Hill)

BTPE-305 Manufacturing Process –I

Course Objectives: To provide Comprehensive knowledge about:

- Fundamentals of casting and welding processes.
- Essentials components of casting and welding processes.
- Procedure or methodologies for conducting the casting and welding processes.
- Handling of castings and welds.

Expected outcomes:

- The subject will make the students aware of fundamental principles about casting and welding processes so as to apply these principles for studying the processes.
- Student will be able to identify various equipments and accessories required for performing the casting and welding processes.
- Students will be able to demonstrate and guide the technicians for successful conduct of casting and welding processes in industrial applications.

- The subject will create the ability to test the products made by casting and welding processes so as to appreciate their utility in industrial applications.
- Student will suggest a suitable process for manufacturing of components.
- Ability to understand the latest technologies in casting and welding processes will get increased.

Unit –I

Casting: Introduction to metal casting, types of patterns, their materials and allowances. Moulding materials :moulding sand compositions & moulding sand properties, sand testing; types of moulds, moulding Machines. Cores: core sands, types of cores, core baking. Elements of Gating systems and Risers and their design. Cupola and its operation, charge calculations, types of furnaces. Casting processes: sand casting, shell mould casting, investment casting, permanent mould casting, full mould casting, vacuum casting, Die-casting, Centrifugal casting, continuous casting Casting defects, their causes and remedies. Metallurgical considerations in casting, solidification of metals and alloys, directional solidification, segregation, nucleation and grain growth, critical size of nucleus. Casting of non ferrous metals and their alloys viz. aluminum and copper. Cleaning and finishing of castings, Testing and Inspection of castings

Unit –II

Welding Welding: Introduction and classification of welding processes, welding terms (terminology), general principles, welding positions, joint design and filler metals. Gas welding and Gas cutting: Principle, Oxyacetylene welding equipment. Oxy hydrogen welding, Flame cutting. Electric arc welding: Principle, equipments, types-MIG, TIG, submerged arc and others, Welding electrodes, classification and selection of electrodes, welding arc and its characteristics, arc stability, arc blow, mechanism of metal transfer, metallurgical effects of welding, solidification and gas absorption. Thermal effects on weldment. Heat affected zone. Grain size and its control. Resistance welding- principle and their types i.e. spot, seam, projection, upset and flash. Thermit welding, electro slag welding, friction welding, plasma are welding, electron beam welding, laser beam welding, atomic hydrogen welding. Welding Defects, their causes and remedies. Brazing, braze welding, and soldering.

Suggested Readings / Books:

- Principles of Metal Casting by Heine, R.W. C.R. Loperand P.C. Rosenthal, (McGrawHill, New York).
- Welding Technology by R.S. Parmar, (khanna Publishers).
- Workshop Technology Vol.1 by B.S Raghuwanshi (Dhanpat Rai & Co.)
- Welding and Welding Technology by Little (McGraw-Hill Education (India) Pvt Ltd).
- Foundry Technology by O.P Khanna ((Dhanpat Rai & Co.)

BTPE-306 Strength of Materials Lab

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on C.I. and to determine ultimate compressive strength.
3. To perform shear test on different materials and determine ultimate shear strength.
4. To perform any one hardness test (Rockwell, Brinell & Vicker's test) and determine hardness of materials.
5. To perform impact test to determine impact strength.
6. To perform torsion test and to determine various mechanical properties.
7. Study of performance of Fatigue & Creep tests.
8. To perform bending test on beam (wooden or any other material) and to determine the Young's modulus and Modulus of rupture.
9. To perform Torsion test and close coiled helical spring in tension and compression and to determine modulus of rigidity/stiffness.
10. Determination of Bucking loads of long columns with different end conditions.

BTPE-307 Thermal Engineering Lab

1. Determination of coefficient of heat transfer for free/forced convection from the surface of a cylinder / plate when kept along the direction of flow.
2. Determination heat transfer coefficient of radiation and hence find the Stefan Boltzman's constant using two plates/two cylinders of same size by making one of the plates/cylinders as a black body.
3. Trial of single Cylinder, four stroke diesel engine to calculate BHP, IHP, and air fuel ratio thermal efficiency.
4. Morse test on multi cylinder petrol engine.
5. To find C.O.P of domestic refrigerator.
6. To find COP of an Air conditioner.
7. To find COP of water cooler.
8. Study of various types of boilers Models

BTPE-308 Theory of Machines Lab

1. Study of working principles and construction of the different types of link motions and mechanisms.
2. Study of different types of gears and gear trains.
3. Study of different types of brakes and clutches.
4. Study of various types of quick return mechanisms and determination of quick return effects.
5. To study various types of cams and followers and the working, construction of a cylindrical cam for

doing operation.

6. To study the flywheel and draw turning moment and crank effort diagram for a four stroke, single cylinder petrol and diesel engines.
7. Study various types of belts and calculate the length of belt and power transmitted by the flat and V-belts.
8. Study of various types of dynamometers and calculate the forces on a multi cylinder petrol engine.

BTPE-309 Manufacturing Processes-I Lab

Casting

1. To determine clay content and moisture content in a moulding sand sample.
2. To find shatter index of different sand samples and to compare and discuss the results
3. To test tensile, compressive, transverse strength and hardness a moulding sand in dry/wet conditions.
4. Determination of permeability of a moulding sand sample.
5. Measurement of grain fineness number.
6. To conduct a comparative study of various types of modern furnaces used in foundry industry.
7. To make detailed calculations for design of riser and gate for a given component and perform its casting

Welding

1. Specimen preparation and making of lap joint, butt joint. T-joint with Oxyacetylene gas welding.
2. Making of lap, Butt, T-joints etc. with electric arc welding.
3. Study of MIG welding equipment and making a weld joint by this process.
4. Study of TIG welding equipment and making a weld joint by this process.
5. Study of different process parameters in Friction welding and preparing a weld joint by this process.
6. To study various welding equipments namely rectifiers, generators, welding torch etc.
7. To study the resistance welding processes and prepare a spot-welded joint.

Note: It is essential for each student to visit at least one Foundry and one Welding industry and submit a detailed industrial tour report

Fourth Semester

BTPE-401 Design of Machine Elements

Course Objectives:

The main objective of the course is to design concepts of different machine elements. The aim of this course is:-

- Application of scientific principles from various fields of engineering to create new technical feats, which can perform specific functions with maximum economy.
- To help students in identifying various kinds of loading conditions and corresponding stresses in various machine elements.
- To guide the students in designing a product from the conceptual stage to the final finished form in shortest possible time.
- To make them understand the concepts in designing of permanent and temporary fasteners.
- To study design of keys and couplings, brakes and clutches.

Expected Outcomes:

After the completion of this course the students is expected to -

- To understand the design flow chart for existing and new conceptual design.
- Deal with the machine design problems in technical way using design principles and procedures.
- Understand different stresses and strains (loading conditions), and also effect of these stresses and strains on different machine members.
- To deal with problems of designing various types of joints and other important machine elements in a technical way.
- To design shafts, keys and couplings using standard steps taught in subject.
- To design the brakes and clutches.

Unit –I

Scope and meaning of machine design. Sources of design data. Design considerations from economics, manufacturing, aesthetics and ergonomics aspects. Design Process, Selection of Materials.

Unit –II

Screwed Joints: - Design of Bolted joints, Bolted Joints under eccentric Loading. Welded Joints: - Design of Fillet Welded Joints, Butt Joints, Un-symmetric Welded sections, Eccentrically loaded welded joints.

Unit –III

Riveted Joints: - Design of Lap Joints, Butt Joints, Diamond Riveting, Eccentrically loaded riveted joints.

Unit –IV

Design of Cotter and Knuckle Joints

Unit –V

Shafts: - Design of shafts under different types of loading conditions.

Unit –VI

Keys & Couplings: - Design of rectangular and square keys, muff coupling, split muff coupling, flange coupling, bushed-pin flexible coupling.

Unit –VII

Levers: - Design of straight levers, Bell -Crank levers, foot levers, hand levers.

Unit –VIII

Brakes and Clutches: - Design of friction plate and cone clutches, and simple type brakes.

Unit –IX

Introduction to Design for Manufacturing and Assembly

Suggested Readings / Books:

- Mechanical Engineering Design by J.E. Shigley (McGraw-Hill Education (India) Pvt Ltd).
- Machine Design by Dr. Sadhu Singh (Khanna Publishers)
- A text book of machine design by R.S.Khurmi & J.K.Gupta, (S Chand & Co.)
- Machine Design by D.K.Aggarwal & P.C.Sharma (S.K Kataria and Sons)
- Design and Manufacturing by Krishnamurthi, (S.K. Kataria and Sons)

NOTE: Design data book is NOT allowed in the examination.

BTPE-402 Fluid Mechanics & Fluid Machinery

Course objectives: This subject helps in introducing the fluids and their properties to the students. The aim of the course is

- To guide the students in studying kinematics and dynamics involved during fluid flow are studied in this course
- To understand the dimensional analysis this is an important aspect for checking the dimensional homogeneity with the help of different methods
- To enhance the knowledge of the student in developing the skills required for working upon the operating conditions of these turbines and pumps.

Expected outcomes: After the completion of this course the students is Expected to know

- How to solve problems relating to kinematic and dynamics of fluid flow.
- How to analyze the fluid dynamic conditions and in assessing the equations involved on the basis of dimensional homogeneity
- The various problems arising in turbines and pumps.

Unit I

Fluids & Their Properties: Concept of fluid; Ideal & Real fluids; significance of fluid Mechanics; continuity concept of fluid; density, specific weight, viscosity & its dependence on temperature; vapor pressure & cavitations; compressibility & bulk modulus, Newtonian & non Newtonian fluids.

Unit II

Fluid statics, kinematics & dynamics: Concept of pressure, Pascal's Law, Buoyancy & floatation, stability of floating & submerged bodies. Classification of fluid flows; streamline , path line & streakline; continuity equation in Cartesian coordinates. Euler's equation; Bernoulli's Equation & steady flow energy equation, Impulse momentum equation.

Unit III

Dimensional Analysis: Fundamental & derived units & dimensions; dimensional homogeneity; Rayleigh's & Buckingham's Pi method for dimensional Analysis.

Unit IV

Laminar & Turbulent flows & their measurements: -Flow in circular cross section pipes; Turbulent & flow losses in pipes; Darcy Equation. -Manometers; pitot tubes; venturimeter & Orificemeter; rotameter.

Unit V

Fluid machinery concepts: Impulse momentum principle; Jet impingement on stationary & moving flat plates and on stationary or moving vanes with jet striking at center & tangentially at one end of vane, calculations for force exerted, work done & efficiency of jet.

Unit VI

Turbines: Components parts & operation of Pelton, Franics & Kaplan Turbines Draft Tube- Its function & types (No Numerical).

Unit VII

Pumps : Component parts & operation of centrifugal & Reciprocating pumps: Suction, delivery & manometric heads of centrifugal pumps; priming & priming devices. Multistage pumps, series & parallel arrangements.

- Pressure variation due to piston acceleration & acceleration effects.

-Suction /delivery pipes in reciprocating pumps; air vessels.

Suggested Readings / Books:

- Fluid Mechanics & fluid power Engg. By D.S. Kumar (Metropolitan Publishers)
- Fluid Mechanics by R.K.Bansal, (Laxmi Publications)
- Fluid Mechanics by Potter & Wiggert (Cengage Learning)
- Fluid Mechanics by A.K Mohanty (PHI Learning Pvt.Ltd.)
- Fluid Mechanics and Hydraulic Machines by R.K.Rajput (Khanna Publishers)

BTPE-403 Manufacturing Processes-II

Course objectives: This course has been designed for providing basic knowledge of machine tools. The aim of the course is

- To make the students aware of principles and requirements for comprehensive understanding of metal cutting or machining.
- To make students aware of the existing technologies related to this process with the aim of appreciating their industrial applications.

Expected outcomes: After the completion of this course the students is Expected

- To completely understand the machining process
- To understand the various process parameters involved in different processes.
- To apply this knowledge for practical use and application of manufacturing processes in the industries.

Unit I

Lathe Machine & its operations: Lathe & its accessories, Lathe specifications, Lathe cutting tools, speed, feed, depth of cut & machining time, various operations on Lathe (turning, facing, copy turning, boring, counter boring, parting off, chamfering, threading, chamfering etc.), Attachments used on Lathe; Turret & Capstan Lathe, Tool holding devices. Detailed calculations and numerical related to material removal rate, surface finish and tool wear for turning operations

Unit II

Milling Machines & its operations:

Milling machines (Horizontal, Vertical & Universal milling machine), specifications, accessories, standard & Special attachments (Vertical milling attachment, High speed milling attachment, Slotting attachment, Universal dividing head, Angular milling attachment); milling operations; Indexing, Type of indexing (Direct, Simple, Compound, Differential, Angular); milling cutters, size, shape & material of milling cutters; numerical related to cutting speed, feed, depth of cut & machining time.

Unit III

Shapers, Planer and Slotting machine:

Types of Shaper, Planners & Slotters and its operations, specifications; quick return mechanisms (crank & slot, hydraulic) shaper tools; calculations of cutting speed, feed and machining time.

Unit IV

Press Working: Definition, Various types of presses, feeding mechanisms, Various operations (Blanking, Piercing, Perforating, Shearing, Lancing, Drawing, Coining, Embossing, Stamping.

Notching etc.); Various types of dies (Simple, Compound, Combination, Progressive, Transfer, Rubber die).

Unit V

Drilling Machines & Operations: Types of drilling machines, specifications, Drilling operations (drilling, counter sinking, spot facing, reaming, tapping etc); Multi-spindle drilling head, Drills and Reamers; Type, specifications; Numerical problems related to cutting speed, feed, depth of cut and machining time.

Unit VI

Grinding Machines: Definition, Composition of Grinding wheel, Standard marking of Grinding wheel, Shapes of Grinding wheels; Types of Grinding Machines (cylindrical, surface); Dressing and Truing of Grinding wheels; machining time; Centreless grinding, Honing, Lapping, Super finishing.

Unit VII

Boring Machines: Type of boring machines (horizontal, vertical, fine boring machine), Boring tools, deep hole boring, Machining time, Jig boring (description, hole location procedure).

Unit VIII

Broaching Machines: Types of Broaching machines, Broaching tools, Materials for Broach, Cutting action, Chip disposal, applications of broaching, advantages and limitations.

Unit IX

Gear Manufacturing: Methods used in production of spur, bevel and worm gears (Powder metallurgy, Moulding, Forming, Rolling, Gearhobbing and shaping), Gear finishing.

Suggested Readings / Books:

- Manufacturing Processes by Myron L. Begeman (John Wiley & Sons)
- Production Technology by H.M.T.(Tata McGraw-Hill Education)
- Manufacturing processes (Vol. 2.) by Hazra Chowdhary **(**Media Promoters & *Publishers* Pvt. Ltd)
- Manufacturing Processes by S. Kalpakjian (Pearsons)
- Workshop Technology (Vol.2) by B.S Raghuwanshi (Dhanpat Rai & Co.)

BTPE-404 Engineering Materials & Metallurgy

Course objectives: The aim of the course is

- To understand various types of engineering materials and their physical as well as mechanical properties.
- To understand various heat treatment processes on different metals and alloys, phase transformations, various equilibrium diagram.

Expected Outcomes: After the completion of this course the students is Expected to know

- Complete information of metallurgical characteristics (atomic structures, equilibrium diagram, phase transformation) of engineering materials (ferrous and non-ferrous),

- Mechanical behaviors of the materials and application of heat treatments processes in industries.

Unit I

Atomic structure of metals crystal structure, crystal lattice of (1) Body centered cubic (ii) face centered cubic (iii) closed packed hexagonal, crystallographic notation of atomic planes, polymorphism and allotropy, Solidification of crystallization (i) nuclear formation (ii)crystal growth (iii) crystal imperfection. Elementary treatment of theories of plastic deformation, phenomenon of slip. Twinning. Dislocation. Identification of crystallographic possible slip planes and direction in F.C.C. B.C.C. C.P.H., recovery, re-crystallization, preferred orientation causes and effects on the property of metals.

Unit II

Introduction to Engineering materials; their mechanical behavior, testing and manufacturing properties of materials; physical properties of materials; classification of engineering materials.

Unit III

General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of Binary system in which the components form a mechanical mixture of crystals in the solid state and are completely mutually soluble in both liquid state. Equilibrium diagrams of a systems whose components have complete mutual solubility in the liquid state and limited solubility in the solid state and in which the solid state solubility decreases with temperature; Equilibrium diagram of alloys whose components have complete mutual solubility in the liquid state and limited solubility in solid state (Alloy with a peritectic transformation) Equilibrium diagrams of a system whose components are subject to allotropic change. Iron carbon equilibrium diagram, phase transformation in the iron carbon diagram: (i) Formation of Austenite (ii) Transformation of austenite into pearlite (iii) Martensite transformation in steel, time temperature transformation curves.

Unit IV

Principles and applications of heat treatment processes viz annealing, normalizing, hardening, tempering; harden ability & its measurement, surface hardening processes. Defects in heat treatment and their remedies; Effects produced by alloying elements on the structures and properties of steel. Distribution of alloying elements (Si. Mn. Ni. Cr. Mo. TL. AL) in steel.

Suggested Readings / Books:

- Engg. Physical Metallurgy by Y. Lakhtin, (Mir Publishers)
- Heat Treatment of Metals by B. Zakharv (Peace Publishers)
- Engineering Metallurgy by V. Raghavan (PHI Learning Pvt. Ltd)
- Introduction to Physical Metallurgy by Avner (Tata McGraw Hill)
- Material Science & Metallurgy by O.P Khanna (Dhanpat Rai & Co.

BTPE-405 Industrial Organization & Management

Course objectives: The aim of the subject is to make students aware with-

- Types of business organization, organization structure characteristics, departmentalism.
- Concepts of industrial psychology and Management by Objectives.
- Management concepts, Need for Management, Management functions, scientific management.
- Need for planning, characteristics, steps in planning, Principles of Organizing, formal and informal organization, Steps in organizing.
- Principles of directing, Supervision, Activities of Supervisor, Leadership styles, Path goal approach.
- Introduction, Principles and Problems in Co-ordination, Management Information System.

Expected Outcomes: After studying the course the student will be able to-

- Understand types of business organization and concepts of industrial Psychology.
- Act as the supervisor and leader in Industrial Environment.
- Plan and organize the basic Industrial activities.
- Understand the modern management concepts like MBO, Management functions, scientific management

Unit I

Industrial Organization: Types of business organization, organization structure characteristics, departmentalism, authority-span of control- matching a job- division of labor-lateral relationship-delegation-chain of command-types of organization structures: line or sealer, functional, line and staff and functional committee, organization chart- question

Unit II

Industrial Psychology: Introduction-definition-classification-scope-basic concept-role application of industrial psychology Management by Objective: Definition, procedure, advantages and disadvantages of MBO, Problems in approach of MBO in India Management concepts, Need for Management, Management functions, Scientific management, Modern management approaches: Introduction to Japanese management concepts, Systems concept, Organizations as system, Approaches to management of systems.

Unit III

Planning: Need for planning, characteristics, steps in planning, Principles of Organizing, formal and informal organization, Steps in organizing, span of control, organization charts, Types of organization, Authority and Responsibility. Directing: Characteristics, Principles of directing, Supervision, Activities of Supervisor, Leadership styles, Path goal approach, Effective Leadership, Management grid, Leadership continuum.

Unit IV

Communication: Process, Types, Barriers to effective communication. Co-ordination: Introduction, Principles and Problems in Co-ordination. Management Information System: Concept, Characteristics and importance of MIS, Types of Information systems, role of computers in MIS, Operating elements of MIS, Information needs of MIS, Functions of information systems, Management reports, Strategic and project planning for MIS, Objectives and plans of MIS with business plans, Project Planning for MIS.

Suggested Readings / Books:

- Principles of Management by Koontz and donell (Tata McGraw Hill)
- Information Systems for Modern Management by Mudrick.Ross and Clagget (PHI)
- Industrial Organization and Engineering Economics by Sharma and Banga, (Khanna Publishers)

BTPE-406 Design of Machine Elements Practice

1. Select a daily use product and design the conceptual design by applying the design process talking the controlling parameters
2. Make a list of mechanical components and know their materials and suggest some alternative materials for the each on of them.
3. Design a wall bracket, which is being used in real life by actual measurement of load.
    a. Welded joints
    b. Riveted and bolted joints
    c. And justify your findings
4. Find a flange coupling in the college laboratory and justify its design by actual measurements.
5. Design a shaft used in some practical application, by actual working and loading conditions.
6. Select a braking system lever (both hand and foot lever) and justify the design parameters.
7. Justify the design of single plate clutch of a engine assembly
8. Design of software in some high level language or excel sheets for design of a component.

BTPE-407 Fluid Mechanics & Fluid Machinery Lab

1. To study flow through a variable area duct & verify Bernoulli's energy equation.
2. To determine coefficient of discharge for venturimeter.
3. To determine coefficient of discharge for orifice.
4. To study transition from laminar to turbulent flow and to ascertain lower critical Reynolds No.
5. To determine friction coefficients for pipes of different materials.
6. To draw Characteristics of Francis Turbine.
7. To study constructional features of reciprocating pump & to perform test on it for Determination of pump performance.

8. To draw the characteristics of pelton turbine
9. To draw characteristics of centrifugal pump.

BTPE-408 Manufacturing Processes -II Lab

1. Preparation of detailed working sketches describing constructional features of following machines through drawing/ sketches:-
   - **a.** Lathe
   - **b.** Capstan & Turret Lathe
   - **c.** Radial Drilling Machine
   - **d.** Universal Milling Machine
   - **e.** Shaper and Planer
   - **f.** Plastic Moulding Machine
   - **g.** Grinding Machines (Surface, Cylindrical)
   - **h.** Gear Cutting Machines etc.
   - **i.** Hydraulic Press
2. Study of lubrication system in the machine tools.
3. Advanced exercises on Lathe where the students will work within specified tolerances, cutting of V-threads and square threads (internal as well as external).
4. Production of machined surfaces on shaper and planer.
5. Exercises on milling machines; generation of plane surfaces, production of spur gears and helical Involute gears, use of end mill cutters.
6. Grinding of single point cutting tool, cutters and drills.
7. Study of recommended cutting speeds for different tool-work material combinations.
8. Identification of different cutting tool and work materials.

BTPE-409 Engineering Materials & Metallurgy Lab

1. Study of different Engineering materials and their Mechanical properties.
2. To study the microstructures of the following materials
   - (i) Hypo Eutectoid & Hyper Eutectoid steels.
   - (ii) Hypo- Eutectic cast Iron and Hyper Eutectic cast Iron.
   - (iii) Grey and white cant Iron
   - (iv) Nodular and Malleable cast Iron
   - (v) Non-ferrous metals i.e. Al. Mg. Cu. Ni. Son. And their alloys.
3. Study of Iron carbon diagram and its engineering applications.

4. Annealing of steel, Effect of annealing temperatures and time on hardness.
5. Study of microstructure and hardness of steel at different rates of cooling.
6. Hardening of steel, effect of quenching medium and agitation of the medium on hardness.
7. Effect of carbon percentage on the hardness of steel.
8. Harden ability test by Jominy's End quench test.
9. Normalizing, tempering of steel components.
10. To study the case hardening processes i.e. carburizing, Nitriding, cyaniding etc.
11. To study and construct the T-T-T diagram for steels.