For Batches 2015 & Onwards

Academic Autonomous Institute (No. F22-1/2014 (AC)

BEANT COLLEGE OF ENGINEERING AND TECHNOLOGY GURDASPUR-143521 (PUNJAB)

SCHEME & SYLLABUS

(Modified as per Minutes of 3rd meeting of Academic Council)

B.Tech. Mechanical Engineering

Batch-2015 Onwards

By

Department of Academics

BEANT COLLEGE OF ENGINEERING & TECHNOLOGY

GURDASPUR

3rd Semester-B.Tech. Mechanical Engineering								
Code	**Title of the course**	**L**	**T**	**P**	**Maximum Marks**		**Total Marks**	**Credits**
					Internal	**External**		
BTME-301	Strength of Materials-I	3	1	-	40	60	100	4
BTME-302	Theory of Machines-I	3	1	-	40	60	100	4
BTME-303	Machine Drawing	1	-	4	40	60	100	3
BTME-304	Applied Thermodynamics-I	3	1	-	40	60	100	4
BTME-305	Manufacturing Processes-I	4	-	-	40	60	100	4
BTME-306	Engineering Materials and Metallurgy	3	-	-	40	60	100	3
BTME-307	Engineering Materials and Metallurgy Lab	-	-	2	30	20	50	1
BTME-308	Strength of Materials Lab	-	-	2	30	20	50	1
BTME-309	Applied Thermodynamics Lab	-	-	2	30	20	50	1
BTME-310	Workshop Training*	-	-	-	60	40	100	1
	Advisory meeting**	-	-	-	-	-	-	-
	Total	**17**	**3**	**10**	**390**	**460**	**850**	**26**

Total Contact Hours Per Week = 30

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

****Advisory meeting for one hour per week.**

4th Semester-B.Tech. Mechanical Engineering								
Code	**Title of the course**	**L**	**T**	**P**	**Maximum Marks**		**Total Marks**	**Credits**
					Internal	**External**		
BTME-401	Strength of Materials-II	4	1	-	40	60	100	5
BTME-402	Theory of Machines-II	4	1	-	40	60	100	5
BTME-403	Fluid Mechanics	4	1	-	40	60	100	5
BTME-404	Applied Thermodynamics-II	4	1	-	40	60	100	5
BTME-405	Manufacturing Processes-II	3	-	-	40	60	100	3
BTME-406	Fluid Mechanics Lab	-	-	2	30	20	50	1
BTME-407	Manufacturing Processes Lab	-	-	2	30	20	50	1
BTME-408	Theory of Machines Lab	-	-	2	30	20	50	1
BTGF-400	General Fitness	-	-	-	100	-	100	1
	Advisory meeting*	-	-	-	-	-	-	
	Total	**19**	**4**	**6**	**390**	**360**	**750**	**27**

Total Contact Hours Per Week = 29

***Advisory meeting for one hour per week**

NOTE:-There shall be industrial/institutional training of six (06) weeks duration (Minimum 36 hours per week) at the end of 4th semester. The marks for the same will be included in the 5th semester.

5th Semester-B.Tech. Mechanical Engineering								
Code	**Title of the course**	**L**	**T**	**P**	**Maximum Marks**		**Total Marks**	**Credits**
					Internal	**External**		
BTAM-500	Mathematics-III	3	1	-	40	60	100	4
BTME-501	Design of Machine Elements-I	4	2	-	40	60	100	6
BTME-502	Computer aided Design and Manufacturing	3	-	-	40	60	100	3
BTME-503	Mechanical Measurement and Metrology	3	-	-	40	60	100	3
BTME-504	Fluid Machinery	3	1	-	40	60	100	4
BTME-	Open Elective-I	3	-	-	40	60	100	3
BTME-505	Computer aided Design and Manufacturing Lab	-	-	2	30	20	50	1
BTME-506	Mechanical Measurement and Metrology Lab	-	-	2	30	20	50	1
BTME-507	Fluid Machinery Lab	-	-	2	30	20	50	1
BTME-508	Industrial Training*	-	-	-	60	40	100	1
	Advisory meeting**	-	-	-	-	-	-	
	Total	**19**	**4**	**6**	**390**	**460**	**850**	**27**

Total Contact Hours Per Week = 29

*** The marks of Industrial/Institutional Training imparted at the end of 4th Semester will be included here.**
**** Advisory meeting for one hour per week.**

6th Semester-B.Tech. Mechanical Engineering								
Code	**Title of the course**	**L**	**T**	**P**	**Maximum Marks**		**Total Marks**	**Credits**
					Internal	**External**		
BTME-601	Design of Machine Elements-II	4	2	-	40	60	100	6
BTME-602	Industrial Automation and Robotics	4	-	-	40	60	100	4
BTME-603	Statistical and Numerical Methods in Engineering	3	1	-	40	60	100	4
BTME-604	Automobile Engineering	3	-	-	40	60	100	3
BTME-	Departmental Elective-I	3	-	-	40	60	100	3
BTME-	Open Elective-II	3	-	-	40	60	100	3
BTME-605	Industrial Automation and Robotics Lab	-	-	2	30	20	50	1
BTME-606	Automobile Engineering Lab	-	-	2	30	20	50	1
BTME-607	Minor Project*	-	-	2	30	20	50	1
BTGF-600	General Fitness	-	-	-	100	-	100	1
	Advisory meeting**	-	-	-	-	-	-	-
	Total	**20**	**3**	**6**	**430**	**420**	**850**	**27**

Total Contact Hours Per Week = 29
***The project work will be carried out in parts as minor project in 6th semester and major project in 7th semester. The literature survey, problem formulation, assessment for viability of the project, objectives and methodology for the project shall be decided in 6th semester. The same project problem is to be extended as major project in 7th semester. The minor project may be carried out by a group of students (2 to 4).**
****Advisory meeting for one hour per week.**

7th Semester-B.Tech. Mechanical Engineering								
Code	**Title of the course**	**L**	**T**	**P**	**Maximum Marks**		**Total Marks**	**Credits**
					Internal	**External**		
BTME-801	Industrial Engineering	3	1	-	40	60	100	4
BTME-802	Heat Transfer	3	1	-	40	60	100	4
BTME-803	Refrigeration & Air Conditioning	3	1	-	40	60	100	4
BTME-804	Mechanical Vibrations	3	1	-	40	60	100	4
BTME-	Department Elective-II	3	-	-	40	60	100	3
BTME-805	Heat Transfer Lab	-	-	2	30	20	50	1
BTME-806	Refrigeration & Air Conditioning Lab	-	-	2	30	20	50	1
BTME-807	Mechanical Vibration lab	-	-	2	30	20	50	1
BTME-808	Major Project*	-	-	6	100	50	150	3
BTGF-800	General Fitness	-	-	-	100	-	100	1
	Advisory meeting**	-	-	-	-	-	-	-
	Total	**15**	**4**	**12**	**490**	**410**	**900**	**26**

Total Contact Hours Per Week = 31

***The problem formulated in the minor project during 6th Semester is to be extended and executed as major project by the same group of students. The design/construction/fabrication/computer modeling/experimentation etc. is to be carried out. The results and analysis followed by discussion regarding suitability/non-suitability of the project or any positive gain in the project made with conclusions and recommendations for future extension of the project must be covered.**

****Advisory meeting for one hour per week.**

8th Semester-B.Tech. Mechanical Engineering				
Code	**Title of the course**	**Maximum Marks**		**Total Marks**	**Credits**
		Internal	**External**		
BTME-701	Industrial Training	450	300	750	24

Total Contact Hours per Week = 36 (minimum)

Note: Students have to undergo Industrial Training in reputed industries for complete one semester.

Department Electives:

Departmental Elective-I

BTME-911	I.C. Engines
BTME-912	Non-Conventional Energy resources
BTME-913	Operations Research
BTME-914	Product Design and Development
BTME-915	Finite Element Method
BTME-916	Cryogenic Technology
BTME-917	Total Quality Management

Departmental Elective-II

BTME-931	Non-Traditional Machining
BTME-932	Power Plant Engineering
BTME-933	Non-Destructive Testing
BTME-934	Industrial Tribology
BTME-935	Mechatronics
BTME-936	Modeling and Simulation
BTME-937	Maintenance and Reliability Engineering
BTME-938	Machine Tool Design

Open Electives:

Open Elective-I

BTME-951	Industrial Safety and Environment
BTME-952	Energy Conservation and Management

Open Elective-II

BTME-961	Entrepreneurship
BTME-962	Management Information System
BTME-963	Material Management

Note: Open Elective subjects offered by Department of Mechanical Engineering are only for the students of other departments of the college. Students of B. Tech. Mechanical Engineering will study the Open Elective subjects offered by other departments of the college. Minimum ten (10) students are required to offer Department Elective and Open Elective subjects.

Beant College of Engineering & Technology, Gurdaspur

Third Semester

BTME-301 Strength of Materials-I

L T P
3 1 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Course Objective/s and Expected Outcome/s: The course is designed to understand the basic concepts of stress, strain and their variations due to different type of loading. The concept of Mechanical properties, Poisson's ratio, bulk modulus, elastic modulus, modulus of rigidity, combined stress and strain, principal stress, principal plane, bending moment and shear force in beam under various loading conditions, Understanding of torsional shear stress in solid and hollow shaft; principal and maximum shear stress in a circular shaft subjected to combined stresses, stresses in struts and columns subjected to axial load; bending stress, slope and deflection under different loading and supporting conditions. After the study of this course, a student is expected to analyze different stresses, strains and deflection for designing a simple mechanical element under various loading conditions.

1. Simple, Compound Stresses and Strains

Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar due to without and with self-weight, bar of uniform strength, stress in a bar, elastic constants and their significance, relation between elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus. Temperature stress and strain calculation due to axial load and variation of temperature in single and compound bars. Two dimensional stress 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. (10)

2. Bending Moment (B.M.) and Shear Force (S.F.) Diagrams

S.F. and B.M. definitions; relation between load, shear force and bending moment; B.M. and S.F. diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M. and S.F. and the point of contra flexure under the following loads:

a) Concentrated loads
b) Uniformity distributed loads over the whole span or part of span
c) Combination of concentrated and uniformly distributed load
d) Uniformly varying loads
e) Application of moments (8)

3. Bending Stresses in Beams

Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular, circular and channel, I and T- sections. Combined direct and bending stresses in afore-mentioned sections, composite / flitched beams. (5)

4. Torsion

Derivation of torsion equation and its assumptions and its application 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. (5)

5. Columns and Struts

Introduction, failure of columns, Euler's formula, Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.

6. Slope and Deflection

Relationship between moment, slope and deflection; method of integration, Macaulay's method, moment area method and use of 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 & uniformly distributed loads. (8)

Suggested Books:

1. D.S. Bedi, Strength of Materials, Khanna Book Publishing Company.
2. E.P. Popov, Mechanics of Materials-(SI Version), Prentice Hall India.
3. R.S Lehri and A.S. Lehri, Strength of Materials, Kataria and Sons.
4. S.S.Rattan, Strength of Materials, Tata McGraw Hill.
5. Timoshenko and Young, Elements of Strength of Materials, East West Press (EWP).
6. James M Gere and Barry J. Goodno, Strength of Materials, Cengage Learning.
7. James M Gere, Mechanics of Materials, Thomson Brooks/Cole/Pearson, 2006.
8. R.C. Hibbeler, Mechanics of Materials, 6th Edition, Pearson Education, 2007.

BTME-302: Theory of Machines-I

L T P
3 1 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Course Objective/s & Expected Outcome/s: The course under Theory of Machine-I has been designed to cover the basic concepts of kinematic aspects of mechanical machines and major parts used in running of the machines. The students will understand the basic concepts of machines and able to understand constructional and working features of important machine elements. The students should be able to understand various parts involved in kinematics of machines for different applications. The students shall also be able to understand requirements of basic machine parts which would help them to understand the design aspects of the machine parts. (4)

1. Basic concept of machines

Link, Mechanism, Kinematic Pair and Kinematic Chain, Principles of Inversion, Inversion of a Four Bar Chain, Slider-Crank-Chain and Double Slider-Crank-Chain. Graphical and Analytical methods for finding: Displacement, Velocity, and Acceleration of mechanisms (including Coriolis components). (8)

2. Lower and higher Pairs

Universal Joint, Calculation of maximum Torque, Steering Mechanisms including Ackerman and Davis approximate steering mechanism, Engine Indicator, Pentograph, Straight Line Mechanisms, Introduction to Higher Pairs With Examples (4)

3. Belts, Ropes and Chains

Material & Types of belt, Flat and V-belts, Rope & Chain Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Angle and Right Angle Drive, Quarter Turn Drive, Velocity Ratio, Crowning of Pulley, Loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack side of belts, Length of belt, Power transmitted by belts including consideration of Creep and Slip, Centrifugal Tensions and its effect on power transmission. (8)

4. Cams

Types of cams and follower, definitions of terms connected with cams. Displacement, velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform velocity, uniform acceleration and retardation, cycloidal Motion). Analysis of follower motion for circular, convex and tangent cam profiles. (6)

5. Friction Devices

Concepts of friction and wear related to bearing and clutches. Types of brakes function of brakes. Braking of front and rear tyres of a vehicle. Determination of braking capacity, Types of dynamometers, (absorption, and transmission (6)

6. Flywheels

Turning moment and crank effort diagrams for reciprocating machines' Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of mass and dimensions of flywheel used for engines and punching machines. (4)

7. Governors

Function, types and characteristics of governors. Watt, Porter and Proell governors. Hartnell and Willson-Hartnell spring loaded governors. Numerical problems related to these governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power, controlling force curve, effect of sleeve friction. (4)

Suggested Books:

1. S. S. Rattan, Theory of Machines, Tata McGraw Hill.
2. Jagdish Lal, Theory of Mechanisms & Machines, Metropolitan Book Co.
3. Thomas Beven, Theory of Machines, Longman's Green & Co.
4. W. G. Green, Theory of Machines, Blackie & Sons.
5. V.P. Singh, Theory of Machines Dhanpat Rai.

BTME-303: Machine Drawing

L T P
1 0 4

Internal Marks: 40
External Marks: 60
Total Marks: 100

Course Objective/s and Expected Outcome/s: The objective of this course is to make students understand the principles and requirements of production drawings and learning how to assemble and disassemble important parts used in major mechanical engineering applications. After going through this course, the student shall be able to understand the drawings of mechanical components and their assemblies along with their utility for design of components.

Note:

1. Drawing Practice is to be done as per code IS: 296.
2. First angle projection to be used. Drawings should contain bill of materials and should illustrate surface finish.
3. The syllabus given below 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.
4. The end term paper shall be having following structure / weight age:
5. Short/objective type questions based upon whole syllabus - 30%
6. Free Hand sketching of machine parts etc. - 20%
7. Assembly drawing of machine parts with at least two views - 50%

1. Introduction

Principles of Drawing, Requirements of production drawing, Sectioning and conventional representation, Dimensioning, symbols of standard tolerances, Machining Symbols, introduction and Familiarization of Code IS: 296. (2)

2. Fasteners

Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints. (2)

3. Assembly and Disassembly

a) **Couplings:** Solid or Rigid Coupling, Protected Type Flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.
b) **Knuckle and Cotter Joints**
c) **Pipe and Pipe Fittings:** flanged joints, spigot an socket joint, union joint, hydraulic an expansion joint.
d) **IC Engine Parts:** Piston, connecting rod.
e) **Boiler Mountings:** Steam stop valve, feed check valve, safety valve, blow off cock.
f) **Bearings:** Swivel bearing, thrust bearing, Plummer block, angular plumber block.
g) **Miscellaneous:** Screw Jack, Drill Press Vice, Crane hook, Tool Post, Tail Stock, Drilling Jig.10)

Suggested Books:

- Ajit Singh, Machine Drawing (including Auto CAD), Tata McGraw Hill.
- N.D. Bhatt, Machine Drawing, Charotar publications.
- N. Sidheshwar, Machine Drawing, Tata McGraw Hill.
- P.S. Gill, Machine Drawing, BD Kataria and Sons.
- V. Lakshmi Narayanan and Mathur, Text-book of Machine Drawing.

BTME-304 Applied Thermodynamics-I

L T P
3 1 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Course Objective/s and Outcome/s: This course is designed for comprehensive study of combustion and thermal aspects in internal combustion engines, steam power plants and its allied components. This will enable the students to understand combustion phenomenon and thermal analysis of steam power plant components. The students will be able to identify, track and solve various combustion problems and evaluate theoretically the performance of various components involved in steam power plants and internal combustion engines

1. Introduction to IC Engines

Introduction to gas power cycles (otto cycle, diesel cycle, dual cycle and its comparison) Actual Engine Indicator diagrams and valve-timing diagrams for two stroke and four stroke S.I. and C.I. Engines; Construction and Working Principle of Wankel rotary engine; Principle of simple carburetor, Injection systems in Diesel and Petrol Engines(Direct Injection, MPFI in SI and CI Engines, respectively). Essential requirements for Petrol and Diesel Fuels. Theory of combustion in SI and CI Engines; Various stages of combustion; Pressure time/crank-Angle diagrams; Various phenomenon such as turbulence, squish and swirl, dissociation, pre-ignition/auto- ignition, and after burning etc.; Theory of knocking (ie,. detonation) in SI and CI Engines; Effect of engine variables on the Delay Period in SI and CI engines; Effect of various parameters on knock in SI and CI Engines; Methods employed to reduce knock in SI and CI Engines; Octane and Cetane rating of fuels; Knockmeter; Dopes and inhibitors; Performance curves/maps of SI and CI Engines; Effect of knocking on engine performance; Effect of compression ratio and air-fuel ratio on power and efficiency of engine; Variation of engine power with altitude; Supercharging and turbo charging of SI and CI Engines; Advantages and applications of supercharging; Emissions from SI and CI Engines and methods to reduce/control them. (8)

2. Properties of Steam and Steam Generators

Pure substance, Steam and its formation at constant pressure: wet, dry, saturated and super-heated steam; Sensible heat(enthalpy), latent heat and total heat (enthalpy) of steam; dryness fraction and its determination; degree of superheat and degree of sub-cool; Entropy and internal energy of steam; Use of Steam Tables and Mollier Chart; Basic thermodynamic processes with steam (isochoric, isobaric, isothermal, isentropic and adiabatic process) and their representation on T-S Chart and Mollier Charts(h-s diagrams). Significance of Mollier Charts. Combustion Equations (Stoichiometric and non- Stoichiometric) Classification and Applications of Steam Generators; Working and constructional details of fire-tube and water-tube boilers: (Cochran, Lancashire, Babcock and Wilcox boilers); Merits and demerits of fire-tube and water-tube boilers; Modern high pressure boilers (Benson boiler, La Mont boiler) and Super critical boilers (Once through boilers-Tower type); Advantages of forced circulation; Boiler performance: equivalent evaporation, boiler efficiency, boiler trial and heat balance; Types of draught and Calculation of chimney height. (9)

3. Vapour Power Cycle

Carnot Cycle and its limitations; Rankine steam power cycle, Ideal and actual; Mean temperature of heat addition; Effect of pressure, temperature and vacuum on Rankine Efficiency; Rankine Cycle Efficiency and methods of improving Rankine efficiency: Reheat cycle, Bleeding (feed-water-heating), Regenerative Cycle, Combined reheat-regenerative cycle; Ideal working fluid; Binary vapour cycle, Combined power and heating cycles. (7)

4. Steam Nozzles

Definition, types and utility of nozzles; Flow of steam through nozzles; Condition for maximum discharge through nozzle; Critical pressure ratio, its significance and its effect on discharge; Area of throat and at exit for maximum discharge; Effect of friction; Nozzle efficiency; Convergent and convergent-divergent nozzles; Calculation of Nozzle dimensions (length and diameters of throat and exit); Supersaturated (or metastable) flow through nozzle. (4)

5. Steam Turbines

Classification; Simple Impulse v/s Reaction turbine, De Laval Turbine: Compounding of impulse turbine, pressure and velocity variation, Velocity diagrams/triangles; Combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, maximum work and maximum efficiency, effect of blade friction on velocity diagram, effect of speed ratio on blade efficiency, Multistaging of Impulse turbine, condition for axial discharge; relative efficiency Impulse-Reaction Turbine: Pressure and velocity variation, velocity diagrams/triangles, Degree of reaction, combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency, maximum work and maximum efficiency; Calculations of blade height; Multistaging: Overall efficiency and relative efficiency; Reheating, Reheat factor and condition curve; Losses in steam turbines; Back pressure and extraction turbines; Co-generation; Economic assessment; Governing of steam turbines. (8)

6. Steam Condensers

Function; Elements of condensing unit; Types of condensers; Dalton's law of partial pressures applied to the condenser problems; Condenser and vacuum efficiencies; Cooling water calculations; Effect of air leakage; Method to check and prevent air infiltration; Description of air pump and calculation of its capacity; Cooling towers: function, types and their operation. (4)

Suggested Books:

1.R. Yadav, Sanjay and Rajay, Applied Thermodynamics, Central Publishing House.
2.J.S. Rajadurai, Thermodynamics and Thermal Engineering, New Age Int. (P) Ltd.
3.D.S. Kumar and V.P. Vasandani, Heat Engineering, Metropolitan Book Co. Pvt. Ltd.
4.K. Soman, Thermal Engineering, PHI Learning Pvt. Ltd.
5.G. Rogers and Y. Mayhew, Engineering Thermodynamics, Pearson.
6.W.A.J. Keartan, Steam Turbine: Theory and Practice, ELBS Series.
7.Heywood, Fundamentals of IC Engines, McGraw Hill.
8.Ganeshan, Internal Combustion Engines, Tata McGRaw Hill.

BTME-305 Manufacturing Processes-I

L T P
4 0 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Course Objective/s and Outcome/s: This course is designed to provide students with an overview of a wide variety of manufacturing processes for processing of engineering materials. The students will learn principles, operations and capabilities of various metal casting and metal joining processes. They will also learn about the defects, their causes and remedies in these processes. Upon completion of the course, the students should have the ability to understand the importance of the manufacturing processes and to select a suitable metal casting and metal joining processes to fabricate an engineering product.

1. Introduction

Classification of manufacturing processes, selection criteria for manufacturing processes, general trends in manufacturing**.** (4)

2. Casting Processes

Introduction to metal casting. patterns: types, materials and allowances. Moulding materials: moulding sand compositions and properties, sand testing, types of moulds, moulding machines. Cores: function, types, core making process, core-prints, chaplets. Elements of gating system and risers and their design. Design considerations of castings. Melting furnaces, cupola furnace, charge calculations, induction furnaces. Casting processes: sand casting, shell mould casting, investment casting, permanent mould casting, full mould casting, vacuum casting, die casting, centrifugal casting, and continuous casting. Metallurgical considerations in casting, Solidification of metals and alloys, directional solidification, segregation, nucleation and grain growth, critical size of nucleus. Cleaning and finishing of castings. (17)

3. Welding Processes

Introduction and classification of welding processes, weldability, welding terminology, general principles, welding positions, and filler metals. Gas welding: principle and practice, oxy-acetylene welding equipment, oxy-hydrogen welding. Flame cutting. Electric arc welding: principle, equipment, relative merits of AC & DC arc welding. Welding processes: manual metal arc welding, MIG welding, TIG welding, plasma arc welding, submerged arc welding. Welding arc and its characteristics, arc stability, and arc blow, metal transfer in arc welding. Thermal effects on weldment: heat affected zone, grain size and its control. Electrodes: types, selection, electrode coating ingredients and their function. Resistance welding: principle and their types i.e. spot, seam, projection, up-set and flash. Spot welding machine. Advanced welding processes: friction welding, friction stir welding, ultrasonic welding, laser beam welding, plasma arc welding, electron beam welding, atomic hydrogen welding, explosive welding, thermit welding, and electro slag welding. Considerations in weld joint design. Other joining processes: soldering, brazing, braze welding. (17)

4. Inspection and Testing

Casting defects, their causes and remedies. Welding defects, their causes and remedies. Destructive and non destructive testing: visual inspection, x-ray radiography, magnetic particle inspection, dye penetrate test, ultrasonic inspection, eddy current testing, hardness testing, and micro hardness testing. (10)

Suggested Books:

1. A. Manna, A Textbook of Manufacturing Science and Technology, PHI Publishers.
2. H.S. Shan, Manufacturing Processes, Vol.I. , Pearson Publishers.
3. P. N. Rao, Manufacturing Technology, Foundry, Forming & Welding, Tata McGraw Hill.
4. R.S. Parmar ,Welding Engineering & Technology, Khanna Publishers.
5. Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Publishers.
6. Mikell P. Groover Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 5th Edition.
7. W.A.J. Chapman, Workshop Technology (Part-1,2,3), CBS Publishers & Distributors.

BTME-306 Engineering Materials & Metallurgy

L T P
3 0 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Course Objective/s and Outcome/s: This course is designed to develop fundamental concepts of crystallography, phase transformation and heat treatment processes. The students will learn the atomic structure of metals, imperfections, diffusion mechanisms and theories of plastic deformation. They will also understand equilibrium diagrams, time-temperature transformation curves and heat treatment processes. Upon completion of the course, the students will be able to understand the concepts of crystal structure, microstructure, phase diagrams and deformation. They will also be able to understand the materials and their applications which are useful for design and control of heat treating processes

1. Crystallography
Atomic structure of metals, atomic bonding in solids, crystal structures, crystal lattice of body centered cubic, face centered cubic, closed packed hexagonal; crystalline and non crystalline materials; crystallographic notation of atomic planes; polymorphism and allotropy; imperfection in solids: point defects, line defects and dislocations, interfacial defects, bulk or volume defects. Solidification of crystalline materials: Nuclei formation , critical radius, Grain growth. Diffusion: diffusion mechanisms, steady-state and nonsteady-state diffusion, factors affecting diffusion. Theories of plastic deformation, Slip and Twinning, recovery, re-crystallization. (10)

2. Phase Transformation
General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of Binary systems: Gibbs Phase rule, Lever rule, Eutectic and Eutectiod system, Peritectic and Pertectiod system. Transformations Iron carbon equilibrium diagram and various phase transformations. Time temperature transformation curves (TTT curves): fundamentals, construction and applications. (12)

3. Heat Treatment
Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels: Principles of induction and oxyacetylene flame hardening. Procedure for carburising, nitriding and cyaniding. Harden-ability: determination of harden-ability. Jominy end-quench test. Defects due to heat treatment and their remedies; effects produced by alloying elements. (14)

4. Materials

Ferrous Metals and their Alloys, effect of alloying elements (Si, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel. Nomenclature of steels and Aluminum alloy. Introduction to Bio-materials and Nano-materials. (4)

Suggested Books:
1. William D. Callister, Materials Science And Engineering: An Introduction, John Wiley & Sons.
2. Sidney H Avner, Introduction to Physical Metallurgy, Tata Mcgraw-Hill.
3. Raghavan, Physical Metallurgy: Principles and Practice, PHI Learning.
4. L Krishna Reddy, Principles of Engineering Metallurgy, New Age International.

BTME-307 Engineering Materials & Metallurgy Lab

L T P
0 0 2

Internal Marks: 30
External Marks: 20
Total Marks: 50

1. Preparation of models/charts related to atomic/crystal structure of metals.
2. Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.
3. Hardening the steel specimen and study the effect of quenching medium on hardness of steel.
4. Practice of specimen preparation (cutting, mounting, polishing ,etching) of mild steel, aluminum and hardened steel specimens.
5. Study of the microstructure of prepared specimens of mild steel, Aluminum and hardened steel.
6. Identification of ferrite and pearlite constituents in given specimen of mild steel.
7. Determination of hardenabilty of steel by Jominy End Quench Test.

BTME-308 Strength of Materials Lab

L T P
0 0 2

Internal Marks: 30
External Marks: 20
Total Marks: 50

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 Cast Iron.
3. To perform any one hardness tests (Rockwell, Brinell & Vicker's test).
4. To perform impact test to determine impact strength.
5. To perform torsion test and to determine various mechanical properties.
6. To perform Fatigue test on circular test piece.
7. To perform bending test on beam and to determine the Young's modulus and modulus of rupture.
8. Determination of Bucking loads of long columns with different end conditions.
9. To determine the deflection of beams of different types.

BTME-309 Applied Thermodynamics Lab

L T P
0 0 2

Internal Marks: 30
External Marks: 20
Total Marks: 50

1.Study of construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines using actual engines or models.
2.Study of working, construction, mountings and accessories of various types of boilers.
3.To perform a boiler trial to estimate equivalent evaporation and efficiency of a fire tube/ water tube boiler.
4.Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of an impulse steam turbine and to plot a Willian's line.
5.Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).
6.Performance testing of a diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the smoke density. Draw/obtain power consumption and exhaust emission curves. Also make the heat balance sheet.
7.Performance testing of a petrol engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emissions. Also draw/obtain power consumption and exhaust emission curves.
8.Study of working, construction and operation of a Multi Stage Reciprocating Compressor.

Beant College of Engineering & Technology, Gurdaspur

Fourth Semester

BTME-401 Strength of Materials-II

L T P
4 1 0

Internal Marks: 60
External Marks: 40
Total Marks: 100

Course Objective/s and Outcome/s: The course is designed to understand the concepts of strain energy, resilience, stress under impact loading; shear stress distribution in a beam of various cross sections; stress in curved cross sections; stresses in helical, spiral and leaf springs; stress and strain analysis of thin, thick cylinder and spheres subjected to internal pressure; and various failure theories. The outcome of the course is to enhance deep and vigorous understanding of stress analysis in various machine elements, so that a student can properly analyze and design a mechanical member from the strength point of view under various conditions.

1. Strain Energy
Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied loads. Castigliano's and Maxwell's theorem of reciprocal deflection. (8)

2. Theories of Failure
Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Coulomb-Mohr theory. Graphical representation and derivation of equation for these theories and their application to problems related to two dimensional stress systems. (5)

3. Springs
Open and closed coiled helical springs under the action of axial load and/or couple. Flat spiral springs-derivation of formula for strain energy, maximum stress and rotation. Leaf spring deflection and bending stresses. (7)

4. Thin Cylinders and Spheres
Calculation of Hoop stress, longitudinal stress in a cylinder, , change in diameter, length and internal volume, effects of joints. Principal stresses in sphere, change in diameter and internal volume. (4)

5. Thick Cylinders
Derivation of Lame's equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts, shrinkage allowance and shrinkage stress. (7)

6. Bending of Curved Beams
Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section, and chain links with straight sides. (6)

7. Shear stresses in Beams
Shear stress distribution in rectangular, circular, I, T and channel section; built up beams. Shear centre and its importance. (6)

8. Rotational Discs

Stresses in rotating discs and rims of uniform thickness; disc of uniform strength. (5)

Suggested Books:

1. D.S. Bedi, Strength of materials, Khanna book publishing company.
2. G.H. Ryder, Strength of materials, Macmillan India Ltd.
3. R.S Lehri and A.S. Lehri, Strength of materials, vol. 2, S. K. Kataria and Sons.
4. S.S.Rattan, Strength of materials, Tata McGraw Hills.
5. Timoshenko and Gere, Mechanics of materials, CBS publishers.
6. James M Gere, Mechanics of Materials, Thomson Brooks/Cole/Pearson, 2006.
7. R.C. Hibbeler, Mechanics of Materials, 6th Edition, Pearson Education, 2007.

BTME-402 Theory of Machines-II

L T P
4 1 0

Internal Marks: 60
External Marks: 40
Total Marks: 100

Objective/s & Outcome/s: The students will understand the basic concepts of inertia forces & couples applied to reciprocating parts of a machine. Students should be able to understand balancing of masses and design of gears & gear trains. They will also gain knowledge of kinematic synthesis and different applications of gyroscopic effect.

1. Static Force Analysis
Concept of force and couple, free body diagram, condition of equilibrium, static equilibrium of mechanism, methods of static force analysis of simple mechanisms. Power transmission elements, considerations of frictional forces. (8)

2. Dynamic Force Analysis
Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism, torque required to overcome inertia and gravitational force of a four bar linkage. (8)

3. Balancing
Necessity of balancing, static and dynamic balancing, balancing of single and multiple rotating masses, partial unbalanced primary force in an engine, balancing of reciprocating masses, and condition of balance in multi cylinder in line V-engines , concept of direct and reverse crank, balancing of machines, rotors, reversible rotors. (6)

4. Gears
Toothed gears, types of toothed gears and its terminology. Path of contact, arc of contact, conditions for correct gearing, forms of teeth, involutes and its variants, interference and methods of its removal. Calculation of minimum number of teeth on pinion/wheel for involute rack, helical, spiral, bevel and worm gears. Center distance for spiral gears and efficiency of spiral gears. (8)

5. Gear Trains
Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel. (4)

6. Gyroscopic Motion and Couples
Effect on supporting and holding structures of machines. stabilization of ships and planes, Gyroscopic effect on two and four wheeled vehicles and stone crusher. (4)

7. Kinematic Synthesis of Mechanism
Freudenstien equation, Function generation errors in synthesis, two and three point synthesis, Transmission angles, least square techniques. (4)

Suggested Books:

1. S.S. Rattan, Theory of Machines, Tata Mc. Graw Hill.
2. John, Gordon, and Joseph, Theory of Machines and Mechanisms, Oxford Uni. Press.
3. Hams Crone and Roggers, Theory of Machines.
4. Shigley, Theory of Machines, Mc Graw Hill.
5. V.P. Singh, Theory of Machines, Dhanpat Rai and Sons

BTME-403 Fluid Mechanics

L T P
4 1 0

Internal Marks: 60
External Marks: 40
Total Marks: 100

Course Objective/s and Outcome/s: This course is designed for the undergraduate mechanical engineering students to develop an understanding of the behaviour of fluids at rest or in motion and the subsequent effects of the fluids on the boundaries as the mechanical engineers has to deal with fluids in various applications. This course will also develop analytical abilities related to fluid flow. It is expected that students will be able to have conceptual understanding of fluids and their properties, apply the analytical tools to solve different types of problems related to fluid flow in pipes, design the experiments effectively and do the prototype studies of different types of machines and phenomenon.

1. Fundamentals of Fluid Mechanics
Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties: Density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), Vapor pressure, compressibility, bulk modulus, Mach number, surface tension and capillarity; Newtonian and non-Newtonian fluids. (4)

2. Fluid Statics
Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane submerged surface (horizontal, vertical and inclined): resultant force and centre of pressure; Force on a curved surface due to hydrostatic Pressure; Buoyancy and flotation; Stability of floating and submerged bodies; Metacentric height and its determination; Periodic time of oscillation; Pressure distribution in a liquid subjected to: (i) constant acceleration along horizontal, vertical and inclined direction (linear motion), (ii) constant rotation. (8)

3. Fluid Kinematics
Classification of fluid flows; Lagrangian and Euler flow descriptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; Flow rate and discharge mean velocity; One dimensional continuity equation; Continuity equation in Cartesian (x,y,z), polar (r,θ) and cylindrical (r,θ,z) coordinates; Derivation of continuity equation using the Lagrangian method in Cartesian coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net. (8)

4. Fluid Dynamics
Derivation of Euler's equation of motion in Cartesian coordinates, and along a streamline; Derivation of Bernoulli's equation (using principle of conservation of energy and equation of motion) and its applications to steady state ideal and real fluid flows; Representation of energy changes in fluid system (hydraulic and energy gradient lines); Impulse momentum equation; Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions. (8)

5. Dimensional Analysis and Similitude
Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - method for dimensional analysis; Dimensionless

numbers (Reynolds, Froudes, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws. (8)

6. Internal Flows

Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen-Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart. (8)

7. Pressure and Flow Measurement

Manometers; Pitot tubes; various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters. (4)

Suggested Books:

1. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, S.K. Kataria and Sons Publishers.
2. S.K. Som, G. Biswas and S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill.
3. C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Fluid Mechanics and Machinery, Oxford University Press.
4. 4.Y.A. Cengel and J.M. Cimbala, Fluid Mechanics - Fundamentals and Applications, Tata McGraw Hill.
5. 5.B.R. Munson, D.F. Young, T.H. Okiishi and W.W. Huebsch, Fundamentals of Fluid Mechanics, John Wiley and Sons.
6. J.F. Douglas and J.M. Gasiorek, J.A. Swaffield and L.B. Jack, Fluid Mechanics, Pearson.
7. 2.V.L. Streeter, E.B. Wylie and K.W. Bedford, Fluid Mechanics, Tata McGraw Hill.

BTME-404 Applied Thermodynamics-II

L T P
4 1 0

Internal Marks: 60
External Marks: 40
Total Marks: 100

Course Objectives and Expected Outcomes: This course is designed for providing comprehensive understanding and thermodynamic analysis of positive displacement air compressors and thermal turbo machines used in power generation, aircraft, spacecraft and rocket propulsion. The students will be able to understand the thermodynamic working as well as performance of thermal turbo power machinery. They will also be able to select various thermal devices required for aforesaid applications.

1. Air Compressors-Introduction
Classification of Air Compressors; Application of compressors and use of compressed air in industry and other places; Complete representation of compression process on P-v and T-s coordinates with detailed description of areas representing total work done and polytropic work done; Areas representing energy lost in internal friction, energy carried away by cooling water and additional flow work being done for un-cooled and cooled compression on T-S coordinates; Best value of index of compression; Isentropic, polytropic and isothermal efficiencies and their representation in terms of ratio of areas representing various energy transfers on T-s coordinates. (4)

2. Reciprocating Air Compressors
Single stage single acting reciprocating compressor (with and without clearance volume): construction, operation, work input and best value of index of compression, heat rejected to cooling medium, isothermal, overall thermal, isentropic, polytropic, mechanical efficiency, Clearance Volumetric efficiency, Overall volumetric efficiency, effect of various parameters on volumetric efficiency, free air delivery; Multistage compressors: purpose and advantages, construction and operation, work input, heat rejected in intercoolers, minimum work input, optimum pressure ratio; isothermal, overall thermal, isentropic, polytropic and mechanical efficiencies; Performance curves.(4)

3. Positive Displacement Rotary Compressors Introduction
Comparison of rotary positive displacement compressors with reciprocating compressors; Classification of rotary compressors; Construction, operation, work input and efficiency of positive displacement type of rotary compressors like Roots blower, Lysholm compressor and Vane type Blower. (4)

4. Thermodynamics of Dynamic Rotary Compressors
Applications of Steady Flow Energy Equation and thermodynamics of dynamic (i.e., centrifugal and axial flow m/c's) compressors; Stagnation and static values of pressure, Temperature and enthalpy etc. for flow through dynamic rotary machines; Complete representation of compression process on T-S coordinates with detailed description of areas representing total work done, polytropic work done; ideal work required for compression process, areas representing energy lost in internal friction, energy carried away by cooling water on TS coordinates for an uncooled and cooled compression; isentropic,

polytropic, and isothermal efficiencies as ratios of the areas representing various energy transfers on T-S coordinates. (6)

5. Centrifugal Compressors

Complete thermodynamic analysis of centrifugal compressor stage; Polytropic, isentropic and isothermal efficiencies; Complete representation of compression process in the centrifugal compressor starting from ambient air flow through the suction pipe, Impeller, Diffuser and finally to delivery pipe on T-S coordinates; Pre-guide vanes and pre-whirl; Slip factor; Power input factor; Various modes of energy transfer in the impeller and diffuser; Degree of Reaction and its derivation; Energy transfer in backward, forward and radial vanes; Pressure coefficient as a function of slip factor; Efficiency and out-coming velocity profile from the impeller; Derivation of non-dimensional parameters for plotting compressor characteristics; Centrifugal compressor characteristic curves; Surging and choking in centrifugal compressors. (6)

6. Axial Flow Compressors

Different components of axial flow compressor and their arrangement; Discussion on flow passages and simple theory of aerofoil blading; Angle of attack; coefficients of lift and drag; Turbine versus compressor blades; Velocity vector; Vector diagrams; Thermodynamic analysis; Work done on the compressor and power calculations; Modes of energy transfer in rotor and stator blade flow passages; Detailed discussion on work done factor, degree of reaction, blade efficiency and their derivations; Isentropic, polytropic and isothermal efficiencies; Surging, Choking and Stalling in axial flow compressors; Characteristic curves for axial flow compressor; flow parameters of axial flow compressor like Pressure Coefficient, Flow Coefficient, Work Coefficient, Temperature-rise Coefficient and Specific Speed; Comparison of axial flow compressor with centrifugal compressor and reaction turbine; Field of application of axial flow compressors. (6)

7. Gas Turbines

Classification and comparison of the Open and Closed cycles; Classification on the basis of combustion (at constant volume or constant pressure); Comparison of gas turbine with a steam turbine and IC engine; Fields of application of gas turbines; Position of gas turbine in power industry; Thermodynamics of constant pressure gas turbine cycle (Brayton cycle); Calculation of net output, work ratio and thermal efficiency of ideal and actual cycles; Cycle air rate, temperature ratio; Effect of changes in specific heat and that of mass of fuel on power and efficiency; Operating variables and their effects on thermal efficiency and work ratio; Thermal refinements like regeneration, inter-cooling and re-heating and their different combinations in the gas turbine cycle and their effects on gas turbine cycle i.e. gas turbine cycle. Multistage compression and expansion; Dual Turbine system; Series and parallel arrangements; Closed and Semi-closed gas turbine cycle; Requirements of a gas turbine combustion chamber; Blade materials and selection criteria for these materials and requirements of blade materials; Gas turbine fuels. (8)

8. Jet Propulsion

Principle of jet propulsion; Description of different types of jet propulsion systems like rockets and thermal jet engines, like (i) Athodyds (ramjet and pulsejet), (ii) Turbojet engine, and (iii) Turboprop engine. Thermodynamics of turbojet engine components; Development of thrust and methods for its boosting/augmentation; Thrust work and thrust power; Propulsion energy, Propulsion and thermal

(internal) efficiencies; Overall thermal efficiency; Specific fuel consumption; Rocket propulsion, its thrust and thrust power; Propulsion and overall thermal efficiency; Types of rocket motors (e.g. solid propellant and liquid propellant systems); Various common propellant combinations (i.e. fuels) used in rocket motors; Cooling of rockets; Advantages and disadvantages of jet propulsion over other propulsion systems; Brief introduction to performance characteristics of different propulsion systems; Fields of application of various propulsion units. (8)

Suggested Books:

1.R. Yadav, Sanjay and Rajay, Applied Thermodynamics, Central Publishing House.
2.J.S. Rajadurai, Thermodynamics and Thermal Engineering New Age Int. (P) Ltd. Publishers.
3.D.S. Kumar and V.P. Vasandani, Heat Engineering, Metropolitan Book Co. Pvt. Ltd.
4.K. Soman, Thermal Engineering, PHI Learning Pvt. Ltd.
5.G. Rogers and Y. Mayhew, Engineering Thermodynamics, Pearson.
6.D.G. Shephered, Principles of Turbo machinery Macmillan.
7.H. Cohen, G.F.C. Rogers and M. Sarvan, Gas Turbine Theory, Longmans.

BTME-405 Manufacturing Processes-II

L T P
3 0 0

Internal Marks: 60
External Marks: 40
Total Marks: 100

Course Objective/s and Outcome/s: This course is designed to make students learn principles, operations and capabilities of various metal machining and metal forming processes. They will understand the importance of process variables controlling these processes. They will also recognize the inter-relationships between material properties and manufacturing processes. Upon completion of the course, the students should have the ability to select different types of the metal machining and forming processes needed for the manufacturing of various geometrical shapes of products.

1. Machine Tools

Classification, description and operations, kinematic scheme of lathe, and lathe attachments. Shaping and planing machine: classification, description and operations, drive mechanisms. Milling machine: classification, description and operations, indexing devices, up milling and down milling. Drilling machine: classification, description and operations. Boring machine: classification, description and operations. Grinding machines: classification, description and operations, wheel selection, grinding wheel composition and nomenclature of grinding wheels, dressing and truing of grinding wheels. Broaching machine: classification, description and operations. Speed, feed and machining time calculations of all the above machines. (12)

2. Metal Cutting

Introduction to machining processes, classification, Mechanics of chip formation process, concept of shear angle, chip contraction and cutting forces in metal cutting, Merchant theory, tool wear, tool life, machinability. Numerical problems based on above mentioned topics, Fundamentals of measurement of cutting forces and chip tool interface temperature. Cutting tools: types, geometry of single point cutting tool, twist drill and milling cutter, tool signature. Cutting tool materials: high carbon steels, alloy carbon steels, high speed steel, cast alloys, cemented carbides, ceramics and diamonds, and CBN. Selection of machining parameters. Coolants and lubricants: classification, purpose, function and properties. (12)

3. Metal Forming

Introduction and classification. Rolling process: introduction, classification, rolling mills, products of rolling, rolling defects and remedies. Forging: open and closed die forging, forging operations, hammer forging, press forging and drop forging, forging defects, their causes and remedies. Extrusion: classification, equipment, defects and remedies. Drawing: drawing of rods, wires and tubes, draw benches, drawing defects and remedies. Sheet metal forming operations: piercing, blanking, embossing, squeezing, coining, bending, drawing and deep drawing, and spinning. Punch and die set up. Press working: press types, operations, press tools, progressive and combination dies. Process variables and simple numerical problems related to load calculation in Rolling, Forging, Extrusion, Drawing and Sheet metal forming. High velocity forming of metals: introduction, electro-hydraulic

forming, mechanical high velocity forming, magnetic pulse forming and explosive forming. Powder Metallurgy: Introduction, advantages, limitations, and applications methods of producing metal powders, briquetting and sintering. (16)

Suggested Books:

1. W.A.J. Chapman, Workshop Technology (Part -1,2,3), CBS Publishers & Distributors.
2. M. P. Groover, Fundamentals of Modern manufacturing, Wiley
3. Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Publishers.
4. B. L. Juneja and G. S. Sekhon, Fundamentals of Metal Cutting & Machine Tools, New Age International (P) Ltd.
5. H.S. Shan, Manufacturing Processes, Vol. I&II, , Pearson Publishers
6. PC Sharma, A Text Book of Production Technology, S. Chand & Company Ltd.

BTME-406 Fluid Mechanics Lab

L T P
0 0 2

Internal Marks: 30
External Marks: 20
Total Marks: 50

1.To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2.To study the flow through a variable area duct and verify Bernoulli's energy equation.
3.To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter)
4.To determine the discharge coefficient for a V- notch or rectangular notch.
5.To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6.To determine the hydraulic coefficients for flow through an orifice.
7.To determine the friction coefficients for pipes of different diameters.
8.To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
9.To determine the velocity distribution for pipeline flow with a pitot static probe.
10. Experimental evaluation of free and forced vortex flow.

BTME-407 Manufacturing Processes Lab

L T P
0 0 2

Internal Marks: 30
External Marks: 20
Total Marks: 50

Casting

1.To determine clay content, moisture content, hardness of a moulding sand sample.
2.To determine shatter index of a moulding sand sample.
3.To test tensile, compressive, transverse strength of moulding sand in green condition.
4.To determine permeability and grain fineness number of a moulding sand sample.

Welding

1. To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes.
2. To study MIG, TIG and Spot welding equipment and make weld joints by these processes.

Machining and Forming

1.To study constructional features of following machines through drawings/ sketches:
a. Grinding machines (Surface, Cylindrical)
b. Hydraulic Press
c. Draw Bench
d. Drawing and Extrusion Dies
e. Rolling Mills
2.To grind single point and multipoint cutting tools on tool and cutter grinder.
3.To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads.
4.To prepare job on shaper involving plane surface.
5.Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
6.To determine cutting forces with dynamometer for turning, drilling and milling operations.

Note: At least one industrial visit must be arranged for the students for the live demonstration of Casting, Welding, Forming and Machining processes.

BTME-408 Theory of Machines Lab

L T P
0 0 2

Internal Marks: 30
External Marks: 20
Total Marks: 50

1.To draw displacement, velocity & acceleration diagram of slider-crank and four bar mechanism at any instant.
2.To study the various inversions of kinematic chains.
3.Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor.
4.Determination of gyroscopic couple (graphical method).
5.Balancing of rotating masses (graphical method).
6.Cam profile analysis (graphical method)
7.Determination of gear- train value of compound gear trains and epicyclic gear trains.
8.To draw circumferential and axial pressure profile in a full journal bearing.
9.To determine coefficient of friction for a belt-pulley material combination.
10. Determination of moment of inertia of flywheel.