



BansilalRamnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to SavitribaiPhule Pune University formerly University of Pune)

Structure & Syllabus of

B.Tech. (Mechanical Engineering)

Pattern 'B-14'

Effective from Academic Year 2016-17

(S.Y. B.Tech.)

Prepared by: - Board of Studies in Mechanical Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Chairman – BOS

Chairman – Academic Board

Vision, Mission and PEOs of B. Tech. Mechanical Engineering

Vision of the Department

To be recognized as one of the preeminent Mechanical Engineering Programs

Mission of the Department

- To prepare students competent to make their careers in Mechanical Engineering
- To provide value education to students to make them responsible citizen
- To strengthen collaborations with Industries, Academia and Research Organizations to enrich learning environment and to enhance Research Culture
- To be recognized as a leading Mechanical Engineering Department in the field of Knowledge, Skill and Research

Program Educational Objectives

To achieve the mission of the program, Mechanical Engineering graduates will be able:

- To work independently as well as in team to formulate, design, execute solutions for engineering problems and also analyze, synthesize technical data for application to product, process, system design & development
- To understand & contribute towards social, environmental issues, following professional ethics and codes of conduct and embrace lifelong learning for continuous improvement
- To develop expertise towards use of modern engineering tools, instruments, programming languages and software's
- To acquire and develop careers in industries, Research organizations, academia and demonstrate entrepreneurial skill

Program Outcomes

Mechanical Engineering

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSO)

Mechanical Engineering

Mechanical Engineering Graduates will be able to:

1. Read & generate 2D & 3D computer based drawings of Mechanical Engineering components & systems and select appropriate materials and manufacturing processes for their production.
2. Conceptually understand Mechanical Engineering components & systems and thereby design & analyze them for enhancement of thermal & mechanical performance.
3. Conduct experiments on mechanical systems to measure different parameters required to evaluate the performance of materials, components & systems and deduce relevant conclusions

S.Y. B.Tech - Mechanical Engineering Structure with effect from Academic Year 2016-17 MODULE 3

Code	Subject	Type	Teaching Scheme			Assessment Scheme						Credits
			L	P	Tut.	ISA					ESA	
						Test 1	Test 2	HA	Tut.	CA	ESE	
ME 20103	Kinematics and Mechanisms	Theory - Core	3	-	1	10	20	5	5	-	60	4
ME 21121	Differential Equations And Vector Analysis	Theory – Core / MD	3	-	1	10	20	5	5	-	60	4
ME20113	Material Science	Theory – Core	3	-	-	15	20	5	-	-	60	3
ME 20111	Thermal Engineering	Theory – Core	3	-	-	15	20	5	-	-	60	3
ME20119	Industrial Engineering	Theory – MD	2	-	-	15	20	5	-	-	60	2
ME 20311	Thermal Engineering	Lab – Core	-	2	-	-	-	-	-	70	30	1
ME20315	Mechanical Engineering Lab	Lab – Core / MD	-	2	-	-	-	-	-	70	30	1
ME 24304	Geometric Modeling	Lab – SD	-	2	-	-	-	-	-	70	30	1
ME 27401	Mini Project	Project	-	4	-	-	-	-	-	70	30	2
ME20405	Comprehensive Viva Voce	Oral	-	-	-	-	-	-	-	-	100	2
TOTAL			14	10	2							23

S.Y. B.Tech -Mechanical Engineering Structure with effect from Academic Year 2016-17 MODULE 4

Code	Subject	Type	Teaching Scheme			Assessment Scheme						Credits
			L	P	Tut.	ISA					ESA	
						Test 1	Test 2	HA	Tut.	CA	ESE	
ME20114	Manufacturing Processes	Theory - Core	3	-	1	10	20	5	5	-	60	4
ME 20102	Strength of Machine Elements	Theory – Core / MD	3	-	1	10	20	5	5	-	60	4
ME21116	Electronics Engineering	Theory – Core	3	-	-	15	20	5	-	-	60	3
ME 20108	Fluid Mechanics	Theory – Core	3	-	-	15	20	5	-	-	60	3
ME21122	Electrical Machines and Switchgear	Theory – MD	2	-	-	15	20	5	-	-	60	2
ME 20308	Fluid Mechanics	Lab – Core	-	2	-	-	-	-	-	70	30	1
ME21320	Electrical & Electronics Engineering	Lab – Core / MD	-	2	-	-	-	-	-	70	30	1
ME24301	Workshop Practice	Lab – SD	-	2	-	-	-	-	-	70	30	1
ME 27402	Mini Project	Project	-	4	-	-	-	-	-	70	30	2
ME20406	Comprehensive Viva Voce	Oral	-	-	-	-	-	-	-	-	100	2
TOTAL			14	10	2							23

S.Y. B.Tech -Mechanical Engineering Structure with effect from Academic Year 2016-17**Semester I – Irrespective of Module**

Code	Subject	Type	Teaching Scheme			Assessment Scheme						Credits
			L	P	Tut.	ISA				ESA		
						Test 1	Test 2	HA	Tut.	CA	ESE	
ME20317	Machine Drawing I	Lab – Core	-	2	-	-	-	-		70	30	1
HS20108	Lab	Technical Writing	-	2	-	-	-	-		70	30	1
TOTAL			-	4	-							2

S.Y. B.Tech -Mechanical Engineering Structure with effect from Academic Year 2016-17**Semester II – Irrespective of Module**

Code	Subject	Type	Teaching Scheme			Assessment Scheme						Credits
			L	P	Tut.	ISA				ESA		
						Test 1	Test 2	HA	Tut.	CA	ESE	
ME20318	Machine Drawing II	Lab – Core	-	2	-	-	-	-		70	30	1
HS20307	Lab	General Seminar-II	-	2	-	-	-	-		70	30	1
TOTAL			-	4	-							2

MODULE -III

ME20103 :: KINEMATICS AND MECHANISMS	
Credits: 03	Teaching Scheme: - Theory 3 Hrs/Week

Unit 1: Terminology, Definitions and Assumptions (8 Hrs)

Part A. Links, kinematic pairs, kinematic constraints, kinematic chains, mechanisms, machine, degree of freedom of pairs and mechanisms, four link chains and their inversions, fourbar, single-slider and double-slider chains. Numericals and Applications. Mechanisms with lower pairs: Universal (Hooke's) Joint, Steering mechanisms – Principle of correct steering, Ackerman steering mechanism, Davis steering mechanism.

Part B. Grubler and Kutzbach criteria, Grashof's Law. Ratchets and Escapement mechanisms, Swinging / Rocking mechanisms, Indexing mechanisms, Approximate and Exact Straight line mechanisms.

Unit 2: Graphical Velocity Analysis of Mechanisms (8Hrs)

Part A. Instantaneous centre of velocity, Aronhold-Kennedy theorem of three centers, velocity analysis using method of instantaneous centers, angular velocity ratio theorem. Definition of velocity, angular velocity of a rigid body, relative velocity, velocity analysis of mechanisms by graphical (Velocity Polygon) method. Friction in turning pairs, Friction circle, Friction axis, Friction in mechanisms.

Part B. Indices of merit (mechanical advantage), centrodes. Rubbing velocity at turning pairs.

Unit 3: Graphical Acceleration Analysis of Mechanisms (8 Hrs)

Part A. Definition of acceleration, angular acceleration of a link, relative acceleration, acceleration polygon, Coriolis component of acceleration, acceleration analysis of mechanisms by graphical (Acceleration Polygon) method. Instantaneous center of acceleration, Klein's construction.

Part B. Equivalent mechanisms, Transmission angle

Unit 4: Analytical Velocity and Acceleration Analysis of Mechanisms (8 Hrs)

Part A. Vector loop closure equations, Velocity and acceleration analysis by vector method, Chace solutions, method of kinematic coefficients. Velocity and acceleration analysis of

mechanisms by complex algebra method. Velocity and acceleration analysis of slider-crank mechanism by analytical method.

Part B. Friction in mechanism, Coupler curves

Unit 5: Inertia Force Analysis

(8 Hrs)

Part A. Radius of gyration of rigid bodies, Theory of Compound Pendulum, Two point mass statically equivalent system, two point mass dynamically equivalent system, and correction couple. Static and Dynamic (Inertia) force analysis of I. C. Engine mechanism, Determination of torque at the crank shaft to overcome the connecting rod inertia (Graphical and Analytical approach).

Part B. Bi-filler and Tri-filler suspension. Inertia of geared systems.

Text Books

1. "Theory of Machines and Mechanisms (Third edition)", John Uicker Jr., Gordon R. Pennock and J. E. Shigley, Oxford University Press.
2. "Theory of Machines", S. S. Rattan, Tata McGraw-Hill Publication
3. "Theory of Machines and Mechanisms", Amitabh Ghosh and A. K. Mallik, Affiliated East-West Press Pvt Ltd.

Reference Books

1. "Theory of Machines", Thomas Bevan, CBS Publications.
2. "Machines and Mechanisms Applied Kinematic Analysis", David H. Myszka, Pearson Education, Asia.
3. "Design of Machinery", R. L. Norton, McGraw-Hill.

Course Objective: Study of fundamentals of kinematics and dynamics of machinery and mechanisms, To make students understand analytical and graphical methods of analysis of mechanisms, To introduce the students to static and dynamic analysis of I. C. Engines, To introduce the students to friction in mechanisms

Course Outcome: Student will be able to determine degree of freedom of mechanisms, draw Velocity diagrams for Mechanisms, draw Acceleration diagrams for Mechanisms, find Analytically Velocity and Acceleration in mechanisms, find Inertia Forces in Mechanisms

ME20203 :: KINEMATICS AND MECHANISMS (TUTORIAL)	
Credits: 01	Teaching Scheme: - Tutorial 1 Hrs/Week

A journal containing the record of the following:

1. Problems on finding radius of gyration of a connecting rod using theory of compound pendulum.
2. Problems on finding radius of gyration of a body by using either the method of Bi-filler or Tri-filler suspension.
3. Assignments on :
 - i. Computer programme for velocity and acceleration analysis of slider-crank mechanism.
 - ii. Computer programme for displacement, velocity analysis of a single Hooke's joint.
 - iii. Problems on Inertia Force Analysis of I. C. Engine mechanism by analytical method.

B. Five (Half Imperial Size) drawing sheets containing graphical solutions as follows :

1. Problems on drawing at least Four (04) typical mechanisms, of which Two (02) must be Straight-Line mechanisms, in different positions (One Sheet).
2. Problems on velocity analysis by the instantaneous center method (One Sheet).
3. Problem on velocity & acceleration analysis (involving Coriolis component of acceleration) by polygon method (Two Sheets).
4. Problem on Klein's construction (One Sheet)
5. Problems on inertia force analysis of an I.C. Engine mechanism by graphical method (One Sheet)

Text Books:

1. "Theory of Machines and Mechanisms (Third edition)", John Uicker Jr., Gordon R. Pennock and J. E. Shigley, Oxford University Press.
2. "Theory of Machines", S. S. Rattan, Tata McGraw-Hill Publicatio

Reference Books .

1. "Theory of Machines", Thomas Bevan, CBS Publications.
2. "Machines and Mechanisms Applied Kinematic Analysis", David H. Myszka, Pearson Education, Asia.
3. "Design of Machinery", R. L. Norton, McGraw-Hill.

4. “Theory of Machines and Mechanisms”, Amitabh Ghosh and A. K. Mallik

Course outcomes

Students will be able to find the CG and radius of gyration of any compound pendulum, find displacement, velocity and acceleration of slider crank mechanism using analytical, graphical and using computer program, find forces on mechanism and hence the Inertia forces.

ME20113 :: MATERIAL SCIENCE	
Credits: 03	Teaching Scheme: - Theory 3 Hrs/Week

Unit I**(08 Hours)****Introduction to material Science**

A.Introduction, (Why study Material science ?, Classification of Materials, Structures and their property co-relationship in relation to engineering materials.) Single Crystal, Polycrystalline materials, Plastic Deformation of single crystals and polycrystalline materials, Dislocations, Theory of work hardening, Numericals based on theory of plastic deformation.

B.Crystal Structure, Space lattice concept, Bravais lattices, Indexing of lattice planes and directions, Crustal Imperfections

Unit II**(08 Hours)****Mechanical Properties and Testing of Materials**

A.Mechanical properties of Materials, Engineering Stress Strain Curve, True stress strain curve, types of engineering stress-strain curves, Hardness test (Brinell, Poldi, Vickers, Rockwell, Rockwell superficial) Toughness Test (Impact- Charpy and Izod)Numericals based on tension test, compression test, cupping test on sheet metal,Non destructive testing (Visual inspection. Magnaflux, Dye penetrant test, Sonic and Ultrasonic test, Radiography and Eddy current test.)

B.Scleroscope, Durometer, Moh's test. Micro hardness and hardness conversions, Examples of selection of NDT and mechanical testing methods for selected components like crankshafts, gears, razor blades etc. Welded joints, steel and C.I. casting, rolled products.

Unit III**(08 Hours)****Phase Diagrams and Phase Transformations**

A.Phase rule, Unary, Binary Phase Diagrams, microstructural changes during cooling, Lever rule, Typical phase diagrams, Invariant reactions, Diffusion in solids, Diffusion processes, Nucleation and growth, Recovery Crystallization and Grain growth

B.Humerothery rule, Fick's law of diffusion, Lever rule numericals, Some special Phase diagrams

Unit IV

(08 Hours)

Fractures and Failures

A. Ductile fracture, Brittle fractures, Ductile to Brittle transition, Fatigue, Creep (mechanism of creep), Oxidation (mechanism), Corrosion (principle), Methods of protection against fractures

B. Methods of Investigation of failures, oxidation resistant materials, protection against corrosion,

Unit IV

(08 Hours)

Properties and applications of some Engineering Materials

A. Steel (Classification and Specifications), cast iron, Ferrous and Non-ferrous metals and alloys, Composite materials, Ceramic materials, Polymers

B. Selection of materials for different engineering applications

Text Books:

V Raghavan; Material Science and Engineering; Prentice Hall of India; New Delhi

2. U.C. Jindal; material Science and Metallurgy; Pearson, Dorling Kindersley India

Reference books:

1. Sydney Avner; Introduction to Physical Metallurgy; Edition No2., McGraw Hill Education (India) Private Limited

2. W F Smith et al; Material Science and Engineering; Edition No5., McGraw Hill Education (India) Private Limited

3. Murthy -Structure and properties engineering materials, Tata McGraw Hill 2003.

Course Outcome

1. Students will be able to write and recognize Miller Indices for the various crystal planes
2. Students will be able to characterize and analyse behavior of metals
3. Students will be able to analyse Binary Phase Diagrams
4. Students will be able to detect losses due to corrosion, suggest remedies against corrosion in different applications
5. Students will be able to calculate the critical resolved shear stress for plastic deformation
Students will be able to select and recommend materials and metals for different applications

ME20315 :: MECHANICAL ENGINEERING LAB	
Credits: 01	Teaching Scheme: - Practical 2 Hrs/Week

List of Practicals:

1. Rockwell Hardness Test, Brinell Hardness Test, Poldy Test
2. Tensile Test
3. Impact Test
4. NDT (Dye penetrant and Magnetic flux test)
5. Preparation of Specimen
6. Microstructure of mild Steel, medium carbon steel
7. Microstructure of Tempered and hardened steel
8. Jominy End Quench Test
9. Experiment on compound pendulum
10. Experiments on Bifillar/ Trifillar suspension systems
11. Experiment on Hookes coupling
12. Moment of Inertia

Text Books :

1. V Raghavan; Material Science and Engineering; Prentice Hall of India; New Delhi
2. U.C. Jindal; material Science and Metallurgy; Pearson , Dorling Kindersly India
3. P.L.Ballney; Theory of Machines and Mechanisms;Khannapublishers;New Delhi

Reference Books :

1. Sydney Avner; Introduction to Physical Metallurgy; Edition No2., McGraw Hill Education (India)Private Limited
2. W F Smith etal; Material Science and Engineering; Edition No5., McGraw Hill Education (India)Private Limited
3. Murthy -Structure and properties engineering materials, Tata McGraw Hill 2003

Course Outcomes:

1. Students will be able to measure surface Hardness properties of different metals with Rockwell and Brinell harness machines.
2. Students will be able to carry out tests on Universal Testing machines
3. Students will be able to carry out tests on Izod and Charpy Impact Testing machines
4. Students will be able to carry out Non Destructive Tests i.e Magnetic flux and Dye penetrant for detecting surface cracks.
5. Students will be able to prepare specimens for studying microstructures under microscope.

ME20111 :: THERMAL ENGINEERING	
Credits: 03	Teaching Scheme: - Theory 3 Hrs/Week

UNIT I: First Law of Thermodynamics(8 Hrs)**Part A:**

Thermodynamic system, surroundings and boundary, thermodynamic properties, thermodynamic processes, Temperature and temperature scale, Macro and microscopic approach, Reversible and Irreversible Processes, Principle of conservation of Mass and Energy, Continuity equation, First law of thermodynamics, Joules experiment, Application of first law to flow and non-flow processes and cycles. Concept of internal energy, Flow energy and enthalpy, Application of steady flow energy equation to nozzles, turbines, pumps, compressors

Part B: Temperature scale problems, Application of steady flow energy equation to heat exchangers

UNIT II: Second Law of Thermodynamics (8 Hrs)

Part A: Limitations of First Law of Thermodynamics, Clausius statement and Kelvin-Planck statement of Second Law of Thermodynamics, Equivalence of Kelvin-Planck statement and Clausius statement, Perpetual Motion Machine II, Carnot theorem, Carnot Cycle for Heat engine, Refrigerator and Heat Pump, Concept of Entropy

Part B: Problems based on entropy

UNIT III: Ideal Gas Properties and Processes (8 Hrs)**Part A:**

Specific Gas constant and Universal Gas constant, Specific heat, Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic and Throttling Processes on P-V and T-S diagrams, heat transfer, work transfer, change in internal energy, enthalpy and entropy during these processes.

Part B:

Ideal Gas definition, Gas Laws

UNIT IV: Properties of Steam and Vapor Processes (8 Hrs)**Part A:**

Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Non-flow and Steady flow vapour processes, change of properties, work and heat transfer, study of P-V, T-S and H-S diagrams for steam, Use of Mollier diagram, Dryness fraction and its determination, introduction to Vapour Power Cycles, Performance of Boiler (equivalent evaporation, boiler

efficiencies, energy balance, boiler draught)

Part B:

Classification, constructional details of low pressure boilers, mountings and accessories Study of steam calorimeters.

UNIT V: Reciprocating Air Compressor

(8 Hrs)

Part A:

Single stage compressor: Computation of work done, isothermal efficiency, volumetric efficiency, free air delivery, theoretical and actual indicator diagram.

multistage compressors: Need of multi- staging, computation of work consumption, volumetric efficiency, condition for maximum efficiency, inters cooling and after cooling, theoretical and actual indicator diagram.

Part B:

Use of compressed air, Classification of compressors, Constructional details of single and multistage compressors

Text Books

1. P. K. Nag; Engineering Thermodynamics; Tata McGraw Hill Publications
2. Kothandaraman and Domkundwar ;Thermodynamics and Heat Engines;
3. Ballaney P. L;Thermal Engineering; Khanna Publishers

Reference Books

1. Y Cengel and Boles; Thermodynamics - An Engineering Approach; Tata McGraw Hill Publications
2. R. K. Rajput ;Thermal Engineering; Laxmi Publications.
3. Rayner Joel ;Engineering Thermodynamics; ELBS Longman

Course Outcomes:

The student will be able to –

- 1) Understand fundamental concepts in thermodynamics and apply First law of thermodynamics to various engineering problems
- 2) Demonstrate limitations of the first law, second law and its application to different energy conversion devices.
- 3) Demonstrate thermodynamic properties and analyze various ideal gas processes and cycle.
- 4) Analyse performance of boiler using steam property charts.
- 5) Evaluate performance of multistage reciprocating air compressor and its applications in engineering industry

ME 20311 : THERMAL ENGINEERING LAB	
Credit : 01	Teaching Scheme: - Practical 2 Hrs/Week

List of Practical

1. Determination of calorific value using gas calorimeter
2. Determination of calorific value using Bomb calorimeter
3. Trial on Flue gas analysis using gas analyzer
4. Trial for performance determination of Refrigerator and Heat pump
5. Trial on reciprocating air compressor
6. Demonstration and study of boiler mountings and accessories
7. Determination of dryness fraction of steam using throttling calorimeter or throttling and separating calorimeter
8. Trial on boiler to determine boiler efficiency, equivalent evaporation
9. Trial for energy balance of any one thermal system
10. Visit to any process/manufacturing industry which uses boiler and report thereof
11. Measurement of alternative fuel properties
12. Study of Package boiler

Text Books

1. P. K. Nag; Engineering Thermodynamics; Tata McGraw Hill Publications
2. Kothandaraman and Domkundwar ;Thermodynamics and Heat Engines;
3. Ballaney P. L;Thermal Engineering; Khanna Publishers

Reference Books

1. Y Cengel and Boles; Thermodynamics - An Engineering Approach; Tata McGraw Hill Publications
2. R. K. Rajput ;Thermal Engineering; Laxmi Publications.

Rayner Joel ;Engineering Thermodynamics; ELBS Longman

Course Outcomes:

The student will be able to –

1. Determine various fuel properties such as calorific value, flash point, fire point
2. Perform experimental analysis of thermal systems and represent the results graphically and draw conclusions.
3. Correlate the Thermal Engineering concepts to the process industrial applications

ME 21121 :: DIFFERENTIAL EQUATIONS AND VECTOR ANALYSIS	
Credits: 03	Teaching Scheme: - Theory 3 Hrs/Week

Unit 1: Linear Differential equations of higher order (08 Hours)

Part A:

Homogeneous Linear differential equations of Second Order, Higher Order Homogeneous & Non Homogeneous Linear Differential Equations with Constant Coefficients, Solutions by undetermined coefficients and Variation of Parameter method , Euler – Cauchy Equation, solution of system of differential equations by Matrix method . conversion of an nth –order differential equation to a system.

Part B:

Coupled Mass spring system

Unit 2: Laplace Transform (08 Hours)

Part A:

Laplace Transform and its properties. Laplace Transform of Unit step function, Delta function and periodic function. Inverse Laplace Transform and its properties. Application of Laplace Transform to Engineering Problems.

Part B:

Coupled Mass spring system by Laplace Transform.

Unit 3: Fourier Analysis (08 Hours)

Part A:

Fourier series of a periodic function, half range Fourier series, complex exponential form for Fourier series, Fourier integrals, Fourier transforms, Fourier cosine and sine transforms, Fourier transform of unit step function, Dirac Delta and Signum function, properties of Fourier transform, Parseval Theorem of Fourier transform

Part B:

Application of Fourier series to physical systems that are governed by linear differential equations and subjected to periodic forcing functions.

Unit 4: Applications of Partial Differential equations (08 Hours)

Part A:

Basic concepts, Classification of Partial Differential Equations. The method of separation of variables, Modelling :vibrating string, the heat equations. The equation of Laplace its solution by Fourier series, Fourier integral and Fourier transform techniques. D’Alembert’s solution Wave equation.

Part B:

Solution of Partial Differential equations by Laplace transform

Unit 5: Vector Calculus**(08 Hours)****Part A:**

Vector and scalar functions & fields, Derivative, Gradient of a scalar field, Directional derivative, Divergence and curl of a vector field, vector identities, Irrotational and solenoidal vectors and potential functions, line and surface integrals, Green's, Stoke's and Gauss theorems.

Part B:

Applications to Fluid dynamics.

Text Books:

1. Erwin Kreyszig ;Advanced Engineering Mathematics; 9th edition, Wiley India
2. B.V. Ramana; Higher Engineering Mathematics; Tata McGraw-Hill publishing co. Ltd.

Reference Books:

1. Michael D. Greenberg;Advanced Engineering Mathematics; Pearson Education Asia
2. Dennis G. Zill, Michael R. Cullen; Advanced Engineering Mathematics; Narosa Publishing House
3. Peter V. O'Neil;Advanced Engineering Mathematics; 5th edition, Thomson Brooks/Cole..
4. Robert A. Gabel, Richard A. Roberts; Signals and linear systems; John Wiley & sons.

Course Outcomes:

The student will be able to –

1. Acquire the knowledge of ordinary linear differential equations, partial differential equations, Laplace transform, Fourier Transform, differentiation and integration of vector functions.
2. Calculate Laplace transform, Fourier series, Fourier transforms, for a variety of functions and to use these to solve mathematical problems as well as ODE and PDE.
3. Recognize the major classification of PDEs and be competent in solving linear ODE, PDEs using various solution methods.
4. Apply concepts of vector differentiation to find tangent and normal components of velocity and acceleration, determine gradient, curl ,divergence and interpret it physically, evaluate line and surface integrals and interpret physically.
5. Translate a physical problem into a mathematical model and find solution of the model by selecting and applying suitable mathematical method.

ME 21221 :: DIFFERENTIAL EQUATIONS AND VECTOR ANALYSIS (TUTORIAL)	
Credits: 01	Teaching Scheme: - Tutorial 1 Hrs/Week

List of Tutorials:

1. Problem solving on Homogeneous Linear differential equations of Second Order, Higher Order Homogeneous & Non Homogeneous Linear Differential Equations with Constant Coefficients
2. Problem solving on LDE by method of undetermined coefficients and Variation of Parameter, Euler – Cauchy Equation.
3. Problem solving on Applications of LDE for mass spring system.
4. Problem solving on Fourier series of a periodic function, half range Fourier series.
5. Problem solving on complex exponential form for Fourier series. Fourier transforms
6. Problem solving on Fourier cosine and sine transforms, Discrete Fourier transforms:
7. Problem solving on Laplace Transform.
8. Problem solving on Inverse Laplace Transform Application of Laplace Transform to Engineering Problems.
9. Problem solving on Partial Differential Equations, The method of separation of variables, The heat & Wave equations. The equation of Laplace.
10. Problem solving on Laplace & Fourier transform techniques for solving Partial Differential Equations.
11. Problem solving on Directional derivative, Divergence and curl of a vector field, vector identities.
12. Problem solving on Greens, Stokes and Gauss theorems.

Text Books: (As per IEEE format)

1. “Advanced Engineering Mathematics” 9th edition by Erwin Kreyszig, Wiley India.
2. “Higher Engineering Mathematics”, B.V. Ramana, Tata McGraw-Hill publishing co. Ltd..

Reference Books: (As per IEEE format)

1. “Advanced Engineering Mathematics” by Michael D. Greenberg, Pearson Education Asia.
2. “Advanced Engineering Mathematics”, Dennis G. Zill and Michael R. Cullen, Narosa Publishing House.
3. “Advanced Engineering Mathematics” 5th edition, by Peter V. O’Neil, Thomson, Brooks/Cole.
4. “Signals and linear systems”, Robert A. Gabel, Richard A. Roberts, John Wiley & sons.

Structure and syllabus of S.Y. B.Tech. Mechanical Engineering. Pattern B-14, A.Y. 2016-17

Course Outcomes:

The student will be able to –

1. acquire the knowledge of ordinary linear differential equations, partial differential equations, Laplace transform, Fourier Transform, differentiation and integration of vector functions.
2. calculate Laplace transform, Fourier series, Fourier transforms, for a variety of functions and to use these to solve mathematical problems as well as ODE and PDE.
3. recognize the major classification of PDEs and be competent in solving linear ODE, PDEs using various solution methods.\
4. apply concepts of vector differentiation to find tangent and normal components of velocity and acceleration, determine gradient, curl ,divergence and interpret it physically, evaluate line and surface integrals and interpret physically.
5. translate a physical problem into a mathematical model and find solution of the model by selecting and applying suitable mathematical method.

ME24304 :GEOMETRIC MODELLING	
Credits: 01	Teaching Scheme: - Practical 2 Hr/Week

List of Practicals / Assignments :

1. Introduction to concepts of Solid Modeling.
2. Drawing, Editing and Modifying shapes and applying constraints using sketcher workbench.
3. Solid modeling using part workbench.
4. Solid modeling involving dress up features, transformation features and Boolean Operations.
5. Surface modeling assignment
6. Assembly modeling
7. Assembly modeling
8. Assembly modeling
9. Drafting Assignment
10. Drafting Assignment
11. Sheet metal component design using generative sheet metal workbench.

For the understanding of the above practical's following theory to be explained during the practical sessions

Unit 1: Solid Modeling

Sketcher: Drawing sketches in sketcher workbench, sketcher tools, Display tools, Editing and modifying sketches, Constraining Sketches and creating base feature, Creating dress up and Hole features, Editing features, Transformation Features.

Unit 2: Surface Modeling

Working with wireframe and Surface Design workbench, Creating surfaces, Operations on the shape geometry, Editing and modifying surfaces

Unit 3: Assembly Modeling

Creating bottom up and top down assemblies, editing assemblies

Unit 4 : Drafting

Drafting workbench. generating drawing views. Hatch patterns and section views Adding Annotations. Generating bill of materials, generating balloons.

Unit 5: Sheet Metal Components

Generative sheet metal workbench, creating extrusions. swept walls, bend. Stamping.

Text Books: (As per IEEE format)

1. Sham Tickoo. "CATIA V5R 17 for Engineers and Designers". Dreamtech Press. 2008
2. Ibrahim Zeid. Mastering CAD/CAM. McGraw-Hill

Reference Books: (As per IEEE format)

1. CATIA Reference Manual

Course Outcomes:

The student will be able to –

- 1 create, read/interpret and modify 3D models, assemblies and 2D draftings of various machine components and assemblies, by 3D modeling softwares like Catia.
- 2 Be productive in making the models and assemblies and make use of all the tools / features of the softwares as fully as possible.
- 3 Provide dimensions, tolerances and other annotations on the drawings of the components
- 4 Design sheet metal components and surface models of machine parts.
- 5 Develop new and utilize existing symbol libraries of standard components

ME27401 :MINI PROJECT	
Credits: 02	Teaching Scheme: - Practical 4 Hr/Week

Guidelines:

1. Mini Project can be an individual or a group activity depending on the depth and scope of the topic.
2. The project work can be any of the form given below :
 - a) Making physical working models, prototypes, scaled models, of a concept machine.
 - b) Making virtual / CAD models of a sufficiently complex machines / concepts.
 - c) Making study, modeling, analysis, programming and simulation of a system / machine / operation / process.
 - d) Making study / teaching modules of a sufficiently complex topic for pedagogy purposes.
3. Group formation, discussion with faculty advisor, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the Semester.
4. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.
5. A complete Assembly and Details drawings of the project should be submitted along with a detailed project report, where applicable.
6. A Detailed Background / field / literature survey, related to the topic must be made and presented in the report.
7. Review – I: during Mid Semester Examination (Compulsory) as per the Academic Calendar.
8. Review – II : The last week of the Semester . (Optional)
9. For poor performing students identified by the examiners, a second review to be taken. Review II optional for other students. For Review II, deduction of 10 marks will take place.

Evaluation Scheme :

1. Attendance during Semester – 10 marks
2. Regularity in project work execution and reporting – 10 marks
3. Relevance of Mini-Project topic – 10 marks
4. Timely Abstract submission – 10 marks
5. Literature review – 10 marks
6. Technical contents /skills / Knowledge – 10 marks
7. Presentation – 25 marks

8. Question & answer Session – 15 marks

100 marks

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Duration of presentation – 10 minutes , Question and answer session – 5 minutes

Course Outcomes:

1. Students will be able to apply basic principles and concepts for development of working model
2. Students will be able to work in groups and participate in group discussions
3. Students will be able to demonstrate and present the working model
4. Student will be able to develop skills of technical report writing and presentation

ME20405 :COMPREHENSIVE VIVA VOCE	
Credits: 02	Teaching Scheme: - Nil

The Comprehensive Viva Voce (CVV) will be conducted at end of semester on basis of following Laboratory courses

- Mechanical Engineering Lab
- Thermal Engineering
- Machine Drawing I / II

Course Outcomes:

1. Students will be able to exhibit the theoretical concept.
2. Students will be able to demonstrate verbal, written and graphical communication skills.
3. Students will be able to undertake technical discussions.

HS20108 :TECHNICAL WRITING	
Credits: 01	Teaching Scheme: Practical 2 Hr/Week

UNIT I (2 + 2 = 4Hrs)

- [A] Definition, Structure and types of reports.
[B] Home Assignments related to the above topics.

UNIT II (4+ 2 = 6 Hrs)

- [A] Importance of references, glossary and bibliography. How to write and insert them in reports
[B] Home Assignments related to the above topics.

UNIT III (3+ 2 = 5 Hrs)

- [A] Use and types of charts and illustrations in report writing
[B] Home Assignments related to the above topics (minimum 25 sentences on each topic).

UNIT IV (3 + 2 = 5 Hrs)

- [A] Various report writing techniques
[B] Home Assignments related to the above topics.

UNIT V (3 + 2 = 5 Hrs)

- [A] A detail study of any report (non technical and technical)
[B] Home Assignments related to the above topics.

Text Books

1. “Techniques of writing memos , reports and business letters “ Courtland L Bovee
2005 Jaico Publishing house Mumbai
- 2.“ Project Report writing “ MK Rampal , SL Gupta 2010 Galgotia Publishing company Delhi

Reference Books

1. “ The effective presentation “ Asha Kaul 2005 Sage Publications Delhi
2. “ Business communication and report writing “ R.C Sharma and KrishnaMohan
2ndedition , 2000 , Tata McGrawhill publishing company

HS20307 :GENERAL SEMINAR	
Credits: 01	Teaching Scheme: Practical 2 Hr/Week

List of Demonstration and Practical Sessions

Sr. No.	Name of Experiment	Mode of Conduct
1	Introductory Session	Student activities in groups: Each student must present any technical topic for 15 min followed by an evaluation by the teacher for 10 min using evaluation criterion. All other non participating must attend and can give suggestions. Each student will give minimum of two presentations per semester.
2	Presentations by 4 – 5 students(1stTopic)	
3	Presentations by 4 – 5 students (1stTopic)	
4	Presentations by 4 – 5 students (1stTopic)	
5	Presentations by 4 – 5 students (1stTopic)	
6	Presentations by 4 – 5 students (1stTopic)	
7	Presentations by 4 – 5 students (1stTopic)	
8	Presentations by 4 – 5 students(2ndTopic)	
9	Presentations by 4 – 5 students (2ndTopic)	
10	Presentations by 4 – 5 students (2ndTopic)	
11	Presentations by 4 – 5 students (2ndTopic)	
12	Presentations by 4 – 5 students (2ndTopic)	

Text Books

- 1.“Developing communication skills “ – Krishna Mohan and Meera Banerji , 2008
McMilan Publishers Delhi
2. “Speaking and writing for effective business communication “Francis Sounderaraj 2009 ,
McMilan Publishers India ltd, delhi
3. “Technical writing and professional communication for non native speakers of English
“ – International edition 1991 –
Thomas N Huckin & Leslie A Olsen 2nd edition Tata McGrawhill publishing company.
4. Technical communications - A practical approach 2007 “ – William Sanborn
Pfeiffer & TVS Padmaja – 6th edition Dorling Kindersley (India) Pvt ltd , Delhi.

Reference Books

- 1.“ Cambridge English for engineering “ Mark Ibbotson , Cambridge university press Delhi
- 2.“ Professional presentations “ Malcolm Goodale , Cambridge university press 2009
- 3.“ Technical Report Writing Today “ – 8th edition (Indian Adaptation 2004
Daniel G Roirdon , Steven E Penley Biztantra publications New Delhi
- 4.“ English for success “ E Sureshkumar , P Srihari , J Savitri –
Cambridge University Press India Pvt ltd , 2010 , Delhi

ME20317 :: MACHINE DRAWING I	
Credits: 01	Teaching Scheme: - Practical 2 Hrs/Week

List of Practicals – Drawing Sheets / Assignments :

Sheet I

IS conventional representation of Various components as per IS-SP 46 standard.
(Including some Free-Hand Drawings)

Sheet II

Threaded Joints : Introduction , nomenclature , Forms of threads, thread series, Threads Designation, Types, Representation of threads , Bolts, Nuts, Set-Screws, Stud, locking arrangements for Nuts, Foundation bolt

Sheet III

Various types of Production Drawings, Part, Assembly & Details drawings, Schematic , Exploded, pictorial and Patent Drawings / representation. Bill of Materials, Process Sheet preparation. ISO system of tolerancing. Tolerance chart, hole and shaft base system of tolerancing, Limits, Basic types of fits (clearance, transition and interference) .Selection and judgement of type of fit from dimensions and specified tolerance and applications. Blue print reading

Sheet IV

Geometrical Dimensioning & Tolerancing (GD &T) and Surface Roughness .Tolerances for Single Features such as Straightness, Flatness, Circularity, Cylindricity. Tolerances for Related Features such as Parallelism, Perpendicularity, Angularity, Concentricity, Tolerance Symbol and Value, Indicating Geometrical Tolerances on drawings. Surface Finish: Introduction, Surface Roughness Number, Machine symbols, Indication of Surface Roughness, Eg.Piston cylinder assembly, IC engine components, Joint & coupling

Sheet V

Auto LISP :Data types, User input and output, Math operators and functions, Trigonometric functions, logical operator, String function, Data conversion functions, List filtering functions, Decision making and looping

Menu Customization in AutoCAD, Introduction to 3D CAD Modeling.

Sheet VI

Auto cad drawings of Assembly showing details drawing of machine component like knuckle joint, coupling with BOM. Isometric drawing, Exploded view, Parametric drawing, (Using of standard parts from libraries)

Text Books: (As per IEEE format)

1. K.L.Narayana, P. Kannaiah and K. VenkataRaddy, “Machine Drawing”, New Age International Ltd.
2. David I. Cooke and Robert N. McDougal, “Engg. Graphics and design with computer applications”,

Holt Sounders International edition.

3. Ajit Singh, "Machine Drawing", Tata Mc Graw Hill Publications.

Reference Books: (As per IEEE format)

1. IS Code "Engineering drawing practice for schools and colleges" : SP46 : 1988.

2. "Machine Tool Design handbook", CMTI, Tata McGraw Hill Publication.

3. "Design Data Book", P.S.G. College of Technology, Coimbtore.

4. "Westermann Tables for metal Trade", Wiley Publication

Course Outcomes:

The student will be able to –

- 1 Read and draw conventional representation of Various components as per standards
- 2 Develop primary knowledge of working drawing , tolerances and fits
- 3 Know and apply dimensioning ,tolerancing on production drawing as per standards
- 4 Read and understand the production drawings of mechanical components and assemblies
- 5 Represent any component pictorially and as production drawing in free hand, with drawing instruments and CAD software

ME20318 :: MACHINE DRAWING II	
Credits: 01	Teaching Scheme: - Practical 2 Hrs/Week

List of Practicals – Drawing Sheets / Assignments :

Sheet I

Welded Joints: Introduction, Welded Joints and symbol, Dimensions, designations.

Riveted Joints: Introduction, Classification of rivet heads, Joints.

Sheet II

Piping Symbols, Piping layout views. Process Chart of a simple component with Tolerances and fits.

Sheet III, IV ,V& VI (III & IV from given drawing, V & VI from actual assembly)

Details and Assembly Drawing with Tolerances, fits and BOM.

Part and Assembly Drawing of lathe tail stock, Gate valve, screw jack, safety valve etc. (Any 3 components).

Any one Sheet should be based on Dismantling, Assembly and Measurement of dimensions of a simple mechanical assembly . General study of measuring instruments used for measuring the dimensions, Dismantling and assembly sequence, Qualitative observation of fits between different mating parts, Application and working of the studied assembly, Use BOM

Sheet VII

AutoCAD drawing of Making of piping symbol library and a piping layout in orthographic and isometric form. Eg. Steam flow piping for process industry like sugar,Hydraulic circuit of press,Lubrication layout of machine tool,Electric component diagram of automat

Text Books: (As per IEEE format)

1. K.L.Narayana, P. Kannaiah and K. VenkataRaddy, “Machine Drawing”, New Age International Ltd.
2. David I. Cooke and Robert N. McDougal, “Engg. Graphics and design with computer applications”, Holt Sounders International edition.
3. Ajit Singh, “Machine Drawing”, Tata Mc Graw Hill Publications.

Reference Books: (As per IEEE format)

1. IS Code "Engineering drawing practice for schools and colleges" : SP46 : 1988.
2. "Machine Tool Design handbook", CMTI, Tata McGraw Hill Publication.
3. "Design Data Book", P.S.G. College of Technology, Coimbtore.
4. "Westermann Tables for metal Trade", Wiley Publication

Course Outcomes:

The student will be able to –

- 1 Create, read/interpret and modify drawings of machine components and assemblies, by free-hand, instruments and 2D CAD – both orthographic and isometric
- 2 Measure dimensions of components and make production drawings for the same.
3. Understand and apply limits, fits, tolerances and surface finish on the existing and new drawings, as per standards.
- 4 Understand and prepare layout and drawings of rivetted, welded and piping joints .
- 5 Use Autocad for preparing and using symbol libraries for various types of components.

ME 20119 : INDUSTRIAL ENGINEERING	
Credits: 02	Teaching Scheme: - Theory 2 Hrs/Week

Unit 1: Productivity and work study**(5 Hours)**

Part A : Productivity

Definition ,Factors affecting Productivity , Productivity Measures , Productivity improvement methods

Work study

Work study techniques, Method study – procedure, recording techniques, Motion economy, Macro motion analysis , Work measurement – Time study , work / activity sampling , motion time standards , Job evaluation and merit rating.

Part B

Concepts and applications of Industrial Engineering

Unit 2: Production Planning and Control**(5 Hours)**

Part A: Production planning

Introduction, Functions, Forecasting Models, Capacity planning, Process planning, Scheduling and Control of production

Part B: Group Technology

Unit 3: Operations Research**(5 Hours)**

Part A:

Concept of Optimization, Methods of Operations research , Linear Programming ,Transportation and Assignment problems , Queuing theory , sensitivity analysis , Dynamic programming

Part B:

Tools of Management science

Unit 4: Project Management**(5 Hours)**

Part A:Network analysis

PERT / CPM , Cost accounting and Control , Depreciation , Break Even Analysis , Standard Costing

Part B: Plant location and Layout

Unit 5: Materials management and Inventory control (5 Hours)

Part A: Materials Management

Procurement techniques and procedures ,Basic EOQ , Inventory models , ABC analysis ,
Materials Planning

Part B: Value analysis

Text Books:

1. O.P.Khanna; Industrial Engineering and Management; 16th Edition, Dhanpat Rai Publications.
2. H.M.Wagner; Principles of Operations Research; 2nd edition, Printice Hall of India Pvt Ltd.
3. P.E.Hicks; Industrial Engineering and Management; 3rd edition, Tata McGraw Hill Education Pvt Ltd.

Reference Books:

1. S.N.Chary; Production and Operations Management; 5th edition, Tata McGraw Hill Education Pvt Ltd.
2. R.Pannerselvam; Production and Operations Management; PHI Learning Pvt Ltd.
3. R.B.Chase , Ravi Shankar , F.R.Jacobs and N.J.Aquilano; Operations and Supply Management; 8th edition, Tata McGraw Hill Education Pvt Ltd.

Course Outcomes:

1. Students will be able to understand productivity improvement techniques.
2. Students will be able to understand facilities management techniques.
3. Students will be able to solve simple optimization problems.
4. Students will be able to perform network analysis for the given problem.
5. Students will be able to understand applications of industrial engineering in context to mechanical engineering.