Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(*An Autonomous Institute affiliated to University of Pune*)

Structure and Syllabus of

B.E. (Mechanical Engineering)

Pattern 'E11'

Effective from Academic Year 2012-13

Prepared by: - Board of Studies in Mechanical Engineering

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

Signed by,

Chairman – BOS **Chairman – Academic Board**

Content

Program Educational Objectives (PEO)

B.E. (Mechanical Engineering)

PEO No.	Description of the Objective
1	Graduates will demonstrate basic knowledge in mathematics, science and engineering.
2	Graduates will demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results.
3	Graduates will demonstrate the ability to design a mechanical system or a thermal system or a process that meets desired specifications and requirements.
4	Graduates will demonstrate the ability to function on engineering and science laboratory teams, as well as on multidisciplinary design teams.
5	Graduates will demonstrate the ability to identify, formulate and solve mechanical engineering problems.
6	Graduates will demonstrate an understanding of their professional and ethical responsibilities.
7	Graduates will be able to communicate effectively in both verbal and written forms.
8	Graduates will have the confidence to apply engineering solutions in global and societal contexts.
9	Graduates should be capable of self-education and clearly understand the value of lifelong learning.
10	Graduates will be broadly educated and will have an understanding of the impact of Engineering on society and demonstrate awareness of contemporary issues.
11	Graduates will be familiar with modern engineering software tools and equipment to analyze mechanical engineering problems.

MODULE III

STRUCTURE MODULE III

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/week)			Credits
			Lect.	Tutorial	Practical	
S1	ME21109	Differential Equations	3	0	0	3
S2	ME20103	Kinematics and Mechanisms	3	0	0	3
S3	ME 20111	Thermal Engineering	3	0	0	3
S4	ME21107	Metallurgy and Material Science	3	0	0	3
S9	HS20108	Technical Writing (Irrespective of Module – in Semester I)	2	0	0	1
T1	ME21209	Differential Equations	0	1	0	1
T2	ME20203	Kinematics and Mechanisms	0	1	0	1
P1	ME20311	Thermal Engineering	0	0	2	1
P2	ME21307	Metallurgy and Material Science	0	0	2	1
MP3	ME27401	Mini project	0	0	2	2
SD3	ME24301	Workshop Practice	0	0	2	1
GP3	HS25301 HS25303	General Proficiency	0	0	2	1
CVV1	ME20401	Comprehensive Viva Voce	-	-	-	1
OE3	ME26101	Institute Elective (Irrespective of Module – in Semester I) Electronics Engineering	2	0	0	2
SM2	HS20307	General Seminar II (Irrespective of Module – in Semester II)	0	0	2	1
		Total	**16/12**	**2**	**10/12**	**24/22**

ME21109 :: Differential Equations

Credits: 03	**Teaching Scheme: -** Theory 3 Hrs/Week, Tutorial 1 Hr/Week

Prerequisites: Nil

OBJECTIVE:

1. Modeling or translating the physical problem into mathematical form.
2. Solving the models using appropriate mathematical methods and interpretation of results

OUT COME: By the end of this module students are expected to demonstrate the Knowledge of

- Linear differential equations for modeling of linear systems and its solutions by classical methods, Matrix method and Transform techniques.
- Fourier series, Complex Fourier series, and frequency spectrum. Fourier Transform and its properties. Solution of Partial differential equation by Fourier Transform.
- Laplace transform. Inverse Laplace transform. Application to solve engineering problem.
- Method of separation of variables for Solving Partial differential equations.
- Differentiation and integration of vector functions, Gradient, divergence and curl and its physical and geometrical interpretations. Gauss Divergence theorem and Stokes Theorem.

Unit I **(8 Hrs)**

Linear Differential equations of higher order

Part A: Homogeneous & Non Homogeneous Linear Differential Equations with Constant Coefficients, Particular integral by general method, undetermined coefficients and method of Variation of Parameter, Euler – Cauchy Equation, Solution of system of ordinary differential equations by Matrix method . Conversion of an nth-order ordinary differential equation to a system.

Part B: Coupled Mass spring system by Matrix method.

Unit II **(8 Hrs)**

Laplace Transform

Part A: Laplace Transform and its properties. Laplace Transform of Unit step function, Delta function, Periodic functions and special functions, Laplace transform of convolution. Inverse Laplace Transform and its properties. Application of Laplace Transform to Engineering Problems.

Part B: Coupled Mass spring system by Laplace Transform

Unit III **(8 Hrs)**

Fourier Analysis

Part A: Fourier series of a periodic function, Properties of Fourier series, Parsevals theorem for Fourier series, half range Fourier series, complex exponential form of Fourier series, Fourier integrals, Fourier transforms, Fourier cosine and sine transforms, Fourier transform of unit step, Dirac delta and Signum function. Properties of Fourier transform. Parsevals theorem for Fourier transforms.

Part B: Application of Fourier series to physical systems that are governed by linear Differential equations and subjected to periodic forcing functions.

Unit IV **(8 Hrs)**

Partial Differential equations

Part A: Basic concepts, Modeling: Vibrating string, wave equation. Solution by separating variables. Use of Fouier series. D'Alembert's solution of wave equation. Heat equation solution by Fourier series and solution by Fourier integral and transform. Modeling: Membrane, Two-dimensional wave equation solution by Fourier series.

Part B: Solution of Partial differential equations by Laplace transform.

Unit V **(8 Hrs)**

Vector Calculus

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 of vector calculus to fluid dynamics.

Text Books

1. "Advanced Engineering Mathematics" 9th Edition, 2012, by Erwin Kreyszig, Wiley-India.
2. "Higher Engineering Mathematics", B.V. Ramana, Tata Mcgraw-Hill Publishing Company Limited, New Delhi .

Reference Books

1. **"**Advanced Engineering Mathematics" by Michael D. Greenberg, Pearson Education Asia.
2. "Advanced Calculus" by Murray R. Spiegel [Schaum's out line series].
3. " Signals and systems", Alan V. Oppenheim and Alan S. Wollsky with S. Hamid Nawab, Second Edition, 1997, Prentice Hall of India private limited, New Delhi.

ME20103 :: KINEMATICS AND MECHANISMS

Credits: 03	**Teaching Scheme: -** Theory 3 Hrs/Week

Prerequisites: Nil

Objectives:

- 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 outcomes

- Students will know the basic terminology used in kinematics
- They will be able to find velocity and acceleration of mechanisms using analytical and graphical methods
- They will be able to find the forces on different points on a element, which will be prerequisite in Design Engineering**.**

Unit I **(8 Hrs)**

Terminology, Definitions and Assumptions

A. Links, kinematic pairs, kinematic constraints, kinematic chains, mechanisms, machine, degree of freedom of pairs and mechanisms, four link chains and their inversions, four-bar, 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.

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

Unit II **(10 Hrs)**

Graphical Velocity Analysis of Mechanisms

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.

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

Unit III **(8 Hrs)**
Graphical Acceleration Analysis of Mechanisms

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.

B. Instantaneous center of acceleration, Klein's construction.

Unit IV **(7Hrs)**
Analytical Velocity and Acceleration Analysis of Mechanisms

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.

B. Graphical Differentiation and Integration

Unit V **(7Hrs)**
Inertia Force Analysis

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).

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.

Additional Reading

1. "Theory of Machines", R.S. Khurmi, Khanna Publications.

ME20111 : THERMAL ENGINEERING

Credits: 03	**Teaching Scheme: -** Theory 3 Hrs/Week

Prerequisites: Nil

Objectives:

- To expose the students to fundamentals of Thermodynamics based on which Thermodynamic systems work/operate.
- Application of the said fundamentals in some of the Thermodynamic systems from the perspective of theoretical development supported by hands on experience.

Outcomes:

- Students will understand first and second law of thermodynamics and their application to real life problems.
- Students will be able to find performance of the boiler, draw the heat balance.
- Students will understand working of various types of compressors and will be in a position to find related performance parameters like FAD various efficiencies of the compressor.

Unit I **(8 Hrs)**

First Law of Thermodynamics

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

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

Unit II **(8 Hrs)**

Second Law of Thermodynamics

A: Limitations of First Law of Thermodynamics, Clausius statement and Kelvin-Plank statement of Second Law of Thermodynamics, Equivalence of Kelvin-Plank statement and Clausius statement, Perpetual Motion Machine II, Carnot theorem, Carnot Cycle for Heat engine, Refrigerator and Heat Pump, Concept of Entropy, Introduction to availability
B: Problems based on entropy and availability

Unit III **(8 Hrs)**
Ideal Gas Properties and Processes

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.
B: Ideal Gas definition, Gas Laws

Unit IV **(8 Hrs)**
Properties of Steam and Vapor Processes

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

Unit V **(8 Hrs)**
Reciprocating Air Compressor

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

Text Books

1. "Engineering Thermodynamics", P. K. Nag, Tata McGraw Hill Publications

1. "Engineering Thermodynamics", Rayner Joel, ELBS Longman
2. "Thermal Engineering" Ballaney P. L., Khanna Publishers

Reference Books

1. "Thermodynamics- An Engineering Approach", Y Cengel and Boles, Tata McGraw Hill Publications
2. "Thermal Engineering", R. K. Rajput, Laxmi Publications.
3. "Thermodynamics and Heat Engines", Kothandaraman and Domkundwar

ME21107 : METALLURGY AND MATERIAL SCIENCE

Credits: 03 **Teaching Scheme: -** Theory 3 Hrs/Week

Prerequisites: Nil

Objectives:

- To study Engineering materials, their properties, applications and Testing.
- Mapping with objectives and outcomes as I(a,c,h,i,), II(b,),III (d),IV (b), V(i,j)

Unit I (08 Hrs)

Introduction to Material Science

A. Classification of Engineering Materials, Structures property relationship, Crystal Geometry, Miller Indices, Crystal Defects, Edge dislocations, Deformation of single crystal , Plastic deformation of Polycrystalline materials, Strain hardening.
B. Stability and metastability**,** Average Number of atoms per unit cell, Atomic packing factor, Density calculations, Point defects.

Unit II (06 Hrs)

Mechanical Properties and Testing

A. Engineering and True stress strain curve, Stress strain curve for different types of materials, Tensile Test, Torsion Test, Hardness and Hardness measurement, Toughness, Impact Test, Fatigue and Fatigue Testing, Creep and Creep testing
B. Mechanical properties, Types of fracture, Compression Test, Bend Test, Durometer

Unit III (08 Hrs)

Phase Diagrams

A. Introduction, Phase Rule, Hume Rothery Rule, Plotting of Equilibrium diagrams, Isomorphous systems, Lever rule, Invariant Reactions, Microstructural changes during cooling,
B. Silver Platinum, Copper-Zinc Phase Diagrams

Unit IV **(10 Hrs)**
Steels and Heat Treatments

A. Iron –Iron carbide Equilibrium Diagram, Critical Temperatures, Equilibrium cooling, Non equilibrium cooling, Transformation products of austenite, Time-temperature-transformation diagrams, Critical cooling rate, Continuous cooling transformation diagrams. Heat treatment of steels, Annealing, Normalizing, Hardening, Retention of austenite, Tempering, Hardenability testing.
B. Classifications and Specifications of Steel, Quenching media, Effects of retained austenite' Elimination of retained austenite, Defects due to heat treatment and remedial measure, Secondary hardening, Temper embrittlement, Quench cracks

Unit V **(06 Hrs)**
Alloy Steels, Cast Iron, and Non-Ferrous Alloys

A. Alloy Steels - Effects of alloying elements, Stainless Steels, Sensitization of stainless steel, weld decay of stainless steel. Tool steels and tool materials, Special purpose steels with applications, Cast irons- Classification, Gray cast iron, White cast iron, Malleable cast iron Copper alloys - Brasses, Bronzes-: Tin, Aluminium, Copper nickel alloys, Aluminium and aluminium alloys. Solders.
B. Applications of cast irons for different components of machine tool, automobiles, pumps etc, Bearing materials and their applications, High Temperature materials such as Nimonics, Super alloys, Ti-alloys etc.

Text Books

1. "Material science and metallurgy for Engineers", Kodgire V. D., Everest Publishing House, Pune.
2. "Engineering Materials", K. G. Bundinski and M. K. Bundinski, Prentice Hall of India Pvt. Ltd, New- Delhi.
3. "An introduction to physical metallurgy", Avner, TMH publication

Reference Books

1. "Metallurgy for Engineers", Rollason E. C., ELBS Publishing.
2. "Physical Metallurgy for Engineers", Clark and Varney W. R., East-West Press Pvt. Ltd., New Delhi.
3. "The science of engineering materials", Donald R. Askeland and Pradeep Phule,Thomson series.

HS20108 :: TECHNICAL WRITING

Credits: 01	**Teaching Scheme: -** Theory 2 Hrs/Week

Prerequisites: Nil

Objectives:

- To enhance reading and writing skills.
- To guide the students with apt expressions in English language (both words and sentence construction) and to develop the students confidence level
- Mapping with PEOs: I, II, III, V : (j, k, n, o, p)

Unit I **(4 + 2 = 6 Hrs)**

[A] Definition, Structure and types of reports.

[B] Home Assignments related to the above topics.

Unit II **(5 + 2 = 7 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 **(5 + 2 = 7 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 **(5 + 2 = 7 Hrs)**

[A] Various report writing techniques

[B] Home Assignments related to the above topics.

Unit V **(5 + 2 = 7 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 Publiishing 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 2nd edition , 2000 , Tata McGrawhill publishing company

ME21209: Differential Equations	
Credits: 01	**Teaching Scheme: -Tutorial 1 Hr/Week**

OUT COME: Upon completion of this module students will be able to

- Model the given Mechanical system.
- Analyze the problem using methods from all the units.

List of Contents

Tutorial No. 1: Solution of Homogeneous Differential equation.

Tutorial No. 2: Solutions of Non-Homogeneous Differential equation by Variation of Parameter method and by undetermined coefficients Method.

Tutorial No. 3: Solution of system of ordinary differential equations by Matrix method

Tutorial No. 4: Summary of properties of Laplace Transform and problem solving.

Tutorial No. 5: Summary of properties of Inverse Laplace Transform and problem Solving.

Tutorial No. 6: Problem solving on Application of Laplace transform to linear Differential Equations.

Tutorial No. 7: Summary of Fourier series of a periodic function and problem solving.

Tutorial No. 8: Summary of Fourier Transform and problem solving.

Tutorial No. 9: Summary of Method of separating variable to solve Wave equation by Using Fourier series.

Tutorial No.10: Summary of Method of separating variable to solve Heat equation by using Fourier series.

Tutorial No.11: Summary of vector differentiation, problems on tangential and normal component of velocity and acceleration, directional derivative, vector identities.

Tutorial No.12: Summary of vector integration, problems on work done, Stoke's and divergence theorem.

Text Books

1. "Advanced Engineering Mathematics" 9th Edition, 2012, by Erwin Kreyszig, Wiley-India.
2. "Higher Engineering Mathematics", B.V. Ramana, Tata Mcgraw-Hill Publishing Company Limited, New Delhi .

ME20203 : KINEMATICS AND MECHANISMS	
Credits: 01	**Teaching Scheme:** Tutorial 1 Hr/Week

Prerequisites: Nil

Objectives:

- To make the student understand the fundamentals of kinematics and dynamics of machines and mechanisms and various methods of mechanism analysis.
- To introduce the student to various mechanisms commonly used in mechanical systems and their working and analysis.

Course outcomes

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

A journal containing the record of the following:

1. An Problem on finding radius of gyration of a connecting rod using theory of compound pendulum.
2. An Problem 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.
iv. Problems on Friction

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. Problems on acceleration analysis (involving Coriolis component of acceleration) by acceleration polygon method (Two Sheets).
4. 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

ME20311: Thermal Engineering (LAB)	
Credits: 01	**Teaching Scheme: -** Laboratory 2 Hrs/Week

Prerequisites: Nil

Objectives:

• To expose the students to fundamentals of Thermodynamics based on which Thermodynamic systems work/operate.

• Application of the said fundamentals in some of the Thermodynamic systems from the perspective of theoretical development supported by hands on experience**.**

Outcomes:

• Students will be in a position to perform simple experiments based on fundamental laws in thermodynamics.

• Students can apply thermodynamic principles to real life problem, perform the experiment and draw useful conclusions.

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

Text Books

1. "Engineering Thermodynamics", P. K. Nag, Tata McGraw Hill Publications
2. "Engineering Thermodynamics", Rayner Joel, ELBS Longman

3. "Thermal Engineering" Ballaney P. L., Khanna Publishers

Reference Books

1. "Thermodynamics- An Engineering Approach", Y Cengel and Boles, Tata McGraw Hill Publications
2. "Thermal Engineering", R. K. Rajput, Laxmi Publications.
3. "Thermodynamics and Heat Engines", Kothandaraman and Domkundwar

ME21307: METALLURGY AND MATERIAL SCIENCE (LAB)

Credits: 01	**Teaching Scheme: -** Laboratory 2 Hrs/Week

Prerequisites: Nil

Objectives:

- To study Engineering materials, their properties, applications and Testing.
- Mapping with objectives and outcomes as I(a,c,h,i,), II(b,),III (d),IV (b), V(i,j)

List of Practical

1. Rockwell Hardness Test
2. Brinell hardness Test
3. Poldi Hrdness measurement
4. Tension test
5. Impact Test
6. NDT (Dye penetrant and Magnetic flux test)
7. Specimen preparation for micro examination.
8. . Study and drawing of microstructures of mild steel, medium carbon steel, eutectoid steel and hypereutectoid steel.
9. Study and drawing of microstructures of white, malleable, grey and nodular cast iron.
10. Study and drawing of microstructures of alpha brass, alpha-beta brass, aluminum bronze, tin bronze and bearing metal.
11. Study and drawing of microstructures of hardened steel, tempered steel.
12. Hardening of steel- study of effect of carbon on hardness of hardened steel.
13. Study of change in microstructure on annealing and normalizing of tempered steel.
14. Jominy Hardenability test on steel sample.

Text Books

1. "Material science and metallurgy for Engineers", Kodgire V. D., Everest Publishing House, Pune.
2. "Engineering Materials", K. G. Bundinski and M. K. Bundinski, Prentice Hall of

India Pvt. Ltd, New- Delhi.

1. "An introduction to physical metallurgy", Avner, TMH publication

Reference Books

1. "Metallurgy for Engineers", Rollason E. C., ELBS Publishing.
2. "Physical Metallurgy for Engineers", Clark and Varney W. R., East-West Press Pvt. Ltd., New Delhi.
3. "The science of engineering materials", Donald R. Askeland and Pradeep Phule, Thomson series.

ME27401 :: Mini Project	
Credits: 01	**Teaching Scheme:** - Practical 2 Hrs/Week

Prerequisite : Nil

Objectives:

- To train the students to apply their engineering knowledge to real life problem solving.

ME24301 :: WORKSHOP PRACTICE

Credits: 01	**Teaching Scheme: -** Laboratory 2 Hrs/Week

Prerequisites: : Nil

Objectives:

- To give 'hands on experience' of crafts-man ship, machining, and assembly.
- To make students familiar with different Work Trades.
- To develop quality and safety consciousness amongst the students.
- To develop respect towards labour work amongst the student.

List of Practical

Turning

Introduction and demonstrations of different lathe operations such as knurling, grooving, drilling, boring, reaming, threading, etc., safety precautions.
Practical: One composite job involving the above mentioned operations.

Foundry

Introduction, uses of different foundry tools, sand preparation, mould preparation, metal pouring, safety precautions, etc.
Practical: One job of casting.

Demonstrations

CNC machining: Demonstration on a CNC lathe machine
Machine Part Assembly: Demonstration and exercise on assembly of machine parts in a group of students.

Note: - Students should wear safety apron and safety shoes during the practical.

Text Books

1. "Workshop Technology Vol. I, II", H. S. Bawa, Tata McGraw-Hill, New Delhi
2. "Principles of Foundry Technology", P. L. Jain, Tata McGraw-Hill New Delhi, 5th Edition 1995

Reference Books

1. "Production Technology", HMT, Tata McGraw Hill, New Delhi, 1st Edition 1987
2. "Maintenance Engineering Handbook", Lindley R. Higgins, McGraw-Hill Inc.1995

HS25301 / HS25303 :: General Proficiency	
Credits: 01	**Teaching Scheme: -** Practical 2 Hrs/Week

This course will be conducted by BOS, DESH

ME20401 :: Comprehensive Viva Voce	
Credits: 01	**Teaching Scheme:** - --

The CVV will be conducted on the basis of Lab Courses.

ME26103 :: ELECTRONICS ENGINEERING

Credits: 02	**Teaching Scheme: -** Theory 2 Hrs/Week

Objectives:

- To Study the basic components like diode, BJT, Op-Amps and their applications
- To Study the basic working of active components and their implementation in electronic circuits.

Course outcomes:

Students will understand following concepts :-

- Concepts of semiconductor theory.
- Semiconductor devices and their working.
- Semiconductor circuits

Unit I DIODES (5+1 Hrs)

A. Overview of semiconductor theory: Intrinsic, Extrinsic, doping. Formation of P-N Junction, working Principle, characteristics, Zener Diode working Principle, characteristics, Application as a voltage regulator. Rectifier: - Half wave rectifier, analyze these rectifiers w. r. t. ripple factor, efficiency, clipper and clamper
B. Full wave rectifier, Bridge rectifier and analyze these rectifiers w. r. t ripple factor, efficiency.

Unit II Bipolar Junction Transistor (5+1 Hrs)

A. Introduction to BJT, BJT configuration, Characteristics of CE, Overview of Biasing, Fixed Bias, Collector to Base Bias, Self Bias, Stability factor for self bias, Applications of transistors:-Transistor as a switch and amplifier.
B. Thermal Runaway, Bias Compensation.

Unit III Operational Amplifiers (5+1 Hrs)

A. Block Diagram of an OP-Amp, Direct Coupled Differential Amplifier Circuit, Level Shifter and the Output Stage. Op-Amp Parameters: - offset voltage; input bias current CMRR, slew rate, PSRR, gain bandwidth product, Definitions, Significance.
B. Typical parameter values of Op-Amp (IC-μA741).

Unit IV OpAmp Applications (5+1 Hrs)

A. Adder, Precision Rectifier, Zero Crossing Detector, Schmitt Trigger, Waveform Generator (triangular), Integrator, Instrumentation Amplifier, Current to Voltage Circuits.

B. Subtractor, Differentiator, and Voltage to Current Circuits.

Unit V Power Devices and Power Supplies (5+1 Hrs)

A. Power Devices: - Characteristics and Principle of Operation of SCR, Applications: Half-wave and Full-wave Controlled rectifiers, Fan Regulator, UJT as relaxation oscillator. Power supplies: - Introduction to SMPS, types of SMPS: Buck, Boost, Buck-Boost SMPS, online UPS, off line UPS, Line interactive UPS..
B. SCR Applications: Half-wave wave Controlled rectifiers, Introduction to DIAC and TRIAC.

Text Books

1. "Integrated Electronics Analog and Digital Circuits and Systems", J. Millman, C. Halkias, McGraw Hill, 1988, ISBN 0 – 07 – Y85493 –9, 2nd Edition.
2. "Op-Amp and Linear Integrated Circuits", R. Gaikwad, Prentice Hall of India, 2002, ISBN 81 – 203 – 2058 – 1, 4th Edition.

Reference Books

1. Electronic Devices", Floyd, Pearson Education, 2001, ISBN 81– 7808–355-8, 5th Edition.
2. "Electronic Devices and Circuit Theory", R. Boylstad, L. Nashelsky, Pearson Education, ISBN 81 – 7808 – 590 – 9, 2002, 8th Edition.

Additional Reading

2. "Microwave Devices and Circuits", Liao, Prentice Hall of India, ISBN 81 – 203 – 0699 – 6, 3rd Edition.
3. **"**Integrated Circuits and Semiconductor Devices", G. Deboo, C. Burrous, Theory and Applications", McGraw Hill, 1987, ISBN 0 – 07 – 016246 – 8, 2nd Edition.

HS20307 :: GENERAL SEMINAR II

Credits: 01	**Teaching Scheme: -** Theory 2 Hrs/Week

Prerequisites: Nil

Objectives:

- To improve pronunciation.
- To improve oral communication.
- To guide the students with apt expressions in English language (both words and sentence construction).
- To improve reading, writing and listening skills.
- To make the students confident and impressive in front of a group.
- Mapping with PEOs: I, II, III, V : (j, k, n, o, p)

List of Demonstration and Practical Sessions

Sr. No.	Name of the 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 **(1st Topic)**	
3.	Presentations by 4 – 5 students **(1st Topic)**	
4.	Presentations by 4 – 5 students **(1st Topic)**	
5.	Presentations by 4 – 5 students **(1st Topic)**	
6.	Presentations by 4 – 5 students **(1st Topic)**	
7.	Presentations by 4 – 5 students **(1st Topic)**	
8.	Presentations by 4 – 5 students **(2nd Topic)**	
9.	Presentations by 4 – 5 students **(2nd Topic)**	
10.	Presentations by 4 – 5 students **(2nd Topic)**	
11.	Presentations by 4 – 5 students **(2nd Topic)**	
12.	Presentations by 4 – 5 students **(2nd Topic)**	

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