Curriculum Structure & Syllabi

of

B.Tech

In

Mechanical Engineering

Effective from 2021-22

Vision
Mission
Program Educational Objectives
Program Outcomes
Program Specific Outcomes
Overall Credit Structure
Curriculum
Syllabus

Offered By

DEPARTMENT OF MECHANICAL ENGINEERING
M. M. M. UNIVERSITY OF TECHNOLOGY,
GORAKHPUR-273010, UP
August 2021

CURRICULA & SYLLABI

B. Tech. Mechanical Engineering

Vision:

To become an Internationally Acclaimed Department of Higher Learning, Research, Innovation and Incubation in Mechanical Engineering by2035.

Mission:

1. To provide quality education to the students in order to make them globally competitive Mechanical Engineers.
2. To enhance the skills of students using modern engineering tools and experimental techniques to solve real life mechanical engineering problems.
3. To make them work in groups with high level of societal, environmental and professional ethics with the self learning attitude.
4. To establish linkages with the Industries, R&D organizations and educational institutions in India and abroad for excellence in teaching, research and innovation..

Programme Educational Objectives (PEO)

PEO-1. To prepare students in the area of mechanical engineering for successful careers in industries, academia and research organizations through state of the art education

PEO-2. To provide students with a sound foundation in science and engineering fundamentals necessary to formulate, analyze and solve mechanical engineering problems and to prepare them for research activities.

PEO-3. To develop ability in the field of machine design, thermal engineering, manufacturing and industrial engineering so as to design and create novel products, processes and solutions for the real life problems.

PEO-4. To inculcate in students professional and ethical attitude, effective communication & teamwork skills and ability to apply multidisciplinary knowledge to relate mechanical engineering problems to broader environmental and social context.

PEO-5. To engage students in professional development through the self-learning and keep abreast with the state-of-the-art technology needed for a successful professional career.

Programme Outcome (POs)

PO-1. Apply knowledge of mathematics, science and mechanical engineering fundamentals to solve real life problems.

PO-2. Identify, formulate, apply engineering knowledge, and conduct research to solve real life mechanical engineering problems.

PO-3. Ability to design a system, component or process by applying the knowledge of Machine Design, Thermal Engineering, Manufacturing to meet desired needs within realistic constraints such as economic, environment, cultural, societal, health and safety and sustainability.

PO-4. Ability to design and conduct experiments, as well as to analyze and interpret data and synthesis of information to reach out to solutions.

PO-5. Select, create and apply modern engineering and IT tools, including CAD, CAM to solve complex engineering problems.

PO-6. Apply reasoning to assess the impact of engineering solutions and practices in a global, societal, health, safety, legal and cultural context.

PO-7. Understand the impact of engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO-8. Apply ethical principle, inculcate moral values and commit to professional ethics, responsibility and norms of engineering practice.

PO-9. Function effectively as member or leader in diverse teams and in multi-disciplinary settings.

PO-10. Communicate effectively on complex engineering activities with engineering fraternity and society at large such as being able to understand and write effective reports, documents, presentations and give and take instructions clearly.

PO-11. Apply knowledge and understanding of industrial engineering and management principles and function in multidisciplinary teams as a member or leader to manage projects.

PO-12. Recognition of the need for and an ability to engage in life-long self-learning in state of art technology.

PO-13. Ability to apply engineering fundamentals to design mechanical systems, thermal systems and manufacturing processes that leads to efficient production.

Programme Specific Outcome (PSOs)

PSO 1. Graduate will be able to identify, analyze and solve engineering problems relating to mechanical systems together with allied engineering streams.

PSO 2. Graduates will learn managerial skills and interdisciplinary technologies to work effectively in a team and in a society by following ethical and environmental practices.

MECHANICAL ENGINEERING DEPARTMENT
MADAN MOHAN MALAVIYA UNIVERSITY OF TECHNOLOGY
GORAKHPUR-273010
PROPOSED CURRICULUM FOR B.TECH. (MECH) EFFECTIVE FROM 2021-22

First Year, Semester I

S. N.	Category	Paper Code/Deptt	Subject	L	T	P	Credit
1.	BSM	BSM-102	Ordinary and Partial Differential Equations	3	1	0	4
2.	EF	BME-102	Engineering Mechanics	3	1	2	5
3.	HSS*	BHM-101	Professional Communication	2	0	0	2
4.	PS	BME-101	Technical Art	0	0	4	2
5.	EF	BCS-105	Basic Computer Programming	3	0	2	4
6.	PLBSE	BME-103	Material Science and Engineering	3	0	2	4
7.	HSSE**	BHM-104	Human Values & Professional Ethics	2	0	0	2
			Total	**16**	**3**	**8**	**23**
1.	ECA-I		Induction Program	**-**	**-**	**-**	**0**

***This can be taught either in first semester or in second semester as per the departmental decision.*

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First Year, Semester II

S. N.	Category	Paper Code/Deptt	Subject	L	T	P	Credit
1.	BSM	BSM-153	Complex Analysis and Integral Tranforms	3	1	0	4
2.	EF	BEE-153	Basic Electrical Engineering	3	0	2	4
3.	BSM	BSM-180	Physics of Applied Materials	3	1	0	4
4.	PS	BME-152	AutoCAD & Refrigeration and Air Conditioning	0	0	4	2
5.	EF	BCE151	Engineering Graphics	0	0	4	2
6.	PLBSE	BME-153	Engineering Thermodynamics	3	1	0	4
			Total	**12**	**3**	**10**	**20**
1.	ECA-II		Induction Program	**-**	**-**	**-**	**0**

BME 101/BME 151	**Technical Arts**	
Course Category	:	Professional Skill
Pre-requisite Subject	:	NIL
Contact Hours/Week	:	Lecture: 0, Tutorial: 0, Practical: 04
Number of Credits	:	02
Course Assessment Method	:	Continuous assessment through one Viva-voce, Practical work/record, attendance, and Major Practical Examination
Course Objective		This course introduces basic concepts of various manufacturing processes and their applications in production of complex shape and size products based on the concepts of forming, welding, casting and machining.
Course Outcomes	:	After completion of this course the students are expected to be able to demonstrate following knowledge, skills, and attitudes

1. Understand the importance, materials, applications, and safety in different shops for the development of a product/component.
2. The knowledge of tools and processes used in carpentry and foundry shops for the development of products through the casting process.
3. The knowledge of forming process will develop skills for producing products using different tools and processes in the blacksmithy and sheet metal shops.
4. The knowledge and practical skill of various welding processes and their application.
5. The knowledge and practical skill of various machining processes.
6. The knowledge of non-conventional machining will develop the ability to produce various products.

Topics Covered (Make at least one job in each shop):

Introduction:

- Need for and importance of Technical Arts.
- Shop Layout: Concept and Importance.
- Mechanical properties of metals& non-metals.
- Ferrous Metals and alloys- composition and applications.
- Non-Ferrous Metals and alloys- composition and applications.
- Safety precautions at shopfloor.

Carpentry Shop:

- Draw layout of carpentry shop
- Study of tools & operations and carpentry joints.
- Preparation of half-lap corner joint, mortise &Tennon joint
- Simple exercise on woodworking lathe

Fitting Shop:

- Layout of fitting shop
- Study of tools & operations
- Simple exercises involving fitting work
- Simple exercises involving drilling/tapping/die

Black Smithy Shop:

- Layout of Smithy Shop

• Study of tools & operations • Hot and cold working • Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.	
Welding Shop: • Layout of welding shop • Study of equipment of gas welding & arc welding • Preparation of simple butt and lap welded joints. • Oxy-acetylene flame cutting • Study of welding defects.	
Sheet-metal Shop: • Layout of Sheet metal shop • Metals used in sheet metal work such as Galvanized iron, Copper sheet, Aluminum sheet • Study of tools & operations • Fabrication of Funnel, toolbox, tray, electric panel box etc.	
Machine Shop: • Layout of Machine shop • Study of Lathe, Drilling, Shaper, Planer and Milling Machines and commonly done operations on these machines • Single point and Multi-point Cutting tools • Making a job on lathe involving plane turning step turning, taper turning, and threading operations	
Foundry Shop: • Layout of foundry shop • Study of tools & operations • Study on pattern allowances • To prepare a Mould with the use of a core and cast it • Study of casting defects	
Advanced Machining Lab: • Layout of the Advanced Machining Lab. • Study about Computerized Numerically Controlled and Non- conventional machining processes. • Study of Flexible Manufacturing System. • Simple experiments on CNC turning and milling.	
Project: • Each group will fabricate a simple utility project using above different shops.	
Books and References: **1.** Fundamental of Modern Manufacturing: Materials, Processes and Systems: M. P. Groover (John Wiley) **2.** Fundamental of Manufacturing Processes: G. K. Lal and S. K. Choudhary (Narosa). **3.** Manufacturing technology – Machine Tools: P. N. Rao (TMH)	

4. Manufacturing technology – Foundry, Forming and Welding: P. N. Rao (TMH).
5. Manufacturing Engineering & Technology: Kalpakjian (Pearson)
6. Advanced Machining Processes: V. K. Jain (Allied Publishers)
7. Manufacturing Science: A. Ghosh and A.K. Mallik (East- West Press).
8. Workshop Technology Vol-I: B. S. Raghuvanshi (Dhanpat Rai and Sons)
9. Workshop Technology Vol-II: B. S. Raghubanshi (Dhanpat Rai and Sons)

BME-102 **ENGINEERING MECHANICS**

Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two test examinations and One Major Theory & Practical Examination
Course objective	:	This course introduces basic concepts of force and its applications in solving engineering problems based on the various laws in statics and dynamics. This course also introduces the applications of force in deformable bodies.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the laws of mechanics and two-dimensional force systems, equivalent force system, types of friction and its application in belt drives.
2. The ability to draw shear force and bending moment diagrams for beams under various types of loads and calculate the forces in truss.
3. To determine centroid of plane composite surfaces; moment of inertia of composite bodies and mass moment of inertia of simple and complex shape bodies.
4. The ability to understand the relationships of kinematic quantities of rigid bodies involving linear, curvilinear and angular motions
5. The ability to understand the applications of force in kinetics of rigid bodies involving general motion and application of D'Alembert's principles.
6. Understand the effects of deformation, types of stress generation and relationships among elastic constants, stresses in beams of different cross-sections in simple bending as wellas stresses in circular shafts under pure torsion.

Topics Covered

UNIT-I **(9)**

Two-dimensional Force Systems

Basic Concepts, Laws of Mechanics, System of forces, Varignon‘s theorem, Transfer of a force to parallel position, Equivalent force system, Resultant of concurrent and non-concurrent force system, Free body diagrams, Equations of equilibrium, Applications

Friction and Applications

Introduction, Dry friction, Rolling friction, Fluid friction, Laws of Coulomb friction, Angle of friction, Cone of friction, Angle of repose, Equilibrium of bodies involving dry friction, Bodies resting on rough horizontal and inclined planes, Belt friction-Flat and V belt, Ratio of driving tensions for flat belt, Centrifugal tension, Initial tension, Condition of maximum power Transmission

UNIT-II **(9)**

Beams

Introduction, Types of supports, Beams classification, Free body diagram, Shear force and bending moment, Analysis of beams, Shear force and bending moment diagrams for concentrated and uniformly distributed loads

Trusses: Simple Trusses, Zero force members, Method of Sections, Method of Joints

Properties of Plane Surfaces

First moment of area, Centroid of a plane and composite bodies joined by different surfaces, Surface of revolution and volume of revolution, Moment of Inertia of area, Parallel axis theorem, Perpendicular axis theorem, Moment of inertia of composite bodies, Principal axes and principal moments of inertia, Mass moment of inertia of a thin rod, thin uniform plate, thin rectangular sheet, circular ring, thin disc, solid cylinder, sphere, and cone about their axis of symmetry

UNIT-III **(9)**

Kinematics of a rigid body

Introduction, Plane motion of a rigid body, Linear motion, Translation of a point with constant acceleration, Equation of motion due to gravity, Angular motion, Relation between angular displacement and angular velocity with constant angular acceleration, Curvilinear motion of a particle, Normal and tangential acceleration, General plane motion, Instantaneous centre of rotation

Kinetics of rigid body

Introduction, Laws of motion, Kinetics of rigid bodies, Motion on inclined rough surface, Analysis of lift motion, Motion of two bodies connected by a string, Pure rotation of a rigid body, General motion of a rigid body, Work and energy, Linear and angular momentum, D‘Alembert‘s principle.

UNIT-IV **(9)**

Mechanics of Deformable Bodies

Introduction, Normal and shear stresses, Poisson‘s ratio, Elastic constants and their relationships, Generalized Hooke‘s law, Deformation of bars of uniform and varying cross-sections, Strain energy in members due to static loading, Statically determinate problems, Stress-strain diagrams for ductile and brittle materials; Pure Bending of beams, Assumptions, Simple bending theory, Stress of beams of different cross sections ; Torsion of Circular shafts, Shear stress due to torsion, Polar modulus, Power transmission

EXPERIMENTS

Note: Minimum Eight experiments are to be performed

1. Tensile strength test on universal testing machine
2. Compressive strength test on universal testing machine
3. Impact test on Impact testing machine
4. Torsion test of a rod on torsion testing machine
5. Experiments on friction between belt and pulley
6. Experiments on flywheel
7. Friction experiments on inclined plane/Screw jack
8. Experiments on bending of simple supported and cantilever beams
9. Statics experiments on equilibrium
10. Experiment on moment of inertia

Books & References

1. Engineering Mechanics: Statics and dynamics - I.H. Shames (PHI)
2. Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, F. P. Beer and E. R. Johnston(Tata McGraw Hill).
3. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II –Dynamics, J. L.Meriam and L. G. Kraige (John Wiley).
4. Engineering Mechanics: Principles of Statics and Dynamics R. C. Hibbler, (Pearson Press).
5. Engineering Mechanics -S S Bhavikatti (New Age International)
6. Engineering Mechanics - D S Kumar (Katson)
7. Engineering Mechanics, M. K. Harbola, (Cengage Learning)
8. Engineering Mechanics - H D Ram and A K Chauhan (McGraw Hill)
9. Engineering Mechanics- R. K. Bansal (Laxmi Publications)

BME-103 MATERIAL SCIENCE AND ENGINEERING

Course category	:	PLBSE
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory & Practical Examination
Course Objective		This course introduces basic concepts of material and their applications for engineering problems based on the concepts of crystallography, mechanical properties and testing. This course also introduces the concept of microstructural examination and various heat treatment processes.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the importance of various materials with their basic concepts including crystallography and imperfections.
2. The understanding of the various mechanical properties and testing by different testing methods suchas strength, hardness, fatigue, NDT, etc.
3. The knowledge of various microstructural examinations and Phase diagrams.
4. The knowledge of different ferrous and non-ferrous metals and their applications.
5. The knowledge of different heat treatment processes, TTT diagram, and their application.
6. The knowledge of different concepts regarding smart materials and electrical, magnetic, electronic properties of materials.

Topics Covered

UNIT-I **(9)**

Introduction

Historical perspective, importance of materials, Crystallography and imperfections: Concept of unitcell, space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density.

Miller indices, X-ray crystallography techniques, imperfections, Defects & Dislocations in solids

UNIT-II **(9)**

Mechanical Properties and Testing

Stress strain diagram, Ductile and brittle materials, stress Vs strength, toughness, hardness, fracture,fatigue and creep. Testing, such as Strength testing, Hardness testing, Impact tests, Fatigue testing Creep testing, Non-destructive testing (NDT). Performance of materials in service: Brief theoretical consideration of fracture, fatigue, and corrosion and its control.

Micro Structural Examination

Microscope principle and methods, Preparation of samples and microstructure exam and grain size determination, comparative study of microstructure of various metals and alloys, such as Mild steel,CI, Brass.

Phase Diagram and Equilibrium Diagram

Unary and Binary diagrams, Phase rules, Types of equilibrium diagrams: solid solution type, eutectic type and combination type, Iron-carbon equilibrium diagram.

UNIT-III **(9)**

Ferrous & Non-ferrous materials

Iron and steel manufacture, furnaces, various types of carbon steels, alloy steels and cast irons, its properties and uses. 3 Heat Treatment: various types of heat treatment, such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams.

Non-Ferrous metals and alloys

Non-ferrous metals, such as Cu, Al, Zn, Cr, Ni etc. and its applications

UNIT-IV **(9)**

Magnetic properties

Concept of magnetism- Dia, para, ferro magnetic materials, Hysteresis, Soft and hard magnetic materials, Magnetic Storages.

Electrical Properties

Energy band, concept of conductor, insulator and semi conductor. Intrinsic and extrinsic

semi- conductors, P-n junction and transistors, Basic devices and their applications. diffusion of Solid, Super conductivity and its applications, Messier effect. Type I & II superconductors. High Temp. superconductors

Brief description of other material such as optical and thermal materials, Composite Materials and its uses. Smart materials & Nano-materials and their potential applications

EXPERIMENTS

Minimum Eight experiments are to be conducted from the following:

1. Tensile test on universal testing machine
2. Compressive on universal testing machine
3. Torsion test of a rod on torsion testing machine
4. Creep test on creep testing machine
5. Fatigue test on fatigue testing machine
6. Hardness testing of given specimen on Vicker/Brinell/Rockwell hardness testing machine
7. Determination of deflection of cantilever under point/uniformly distributed loading
8. Determination of deflection of beam under point/uniformly distributed loading
9. Study of corrosion and its effects.
10. Comparative study of microstructures of different specimens of different materials (mild steel,gray C.I., brass, copper etc.)
11. Study of heat treatment processes such as annealing, normalizing, quenching, case hardening andcomparison of hardness before and after heat treatment.
12. Study of non destructive testing methods such as ultrasonic flaw detector, magnetic flaw detectorand eddy current testing machine

Books & References

1. Material Science and Engineering – Smith, Hashemi and Prakash (Tata McGraw Hill)
2. Material Science- Narula (Tata McGraw Hill)
3. Material Science for Engineering Students- Fischer (Academic Press)
4. Material Science & Engineering - Van Vlash (John Wiley & Sons)
5. Elements of Material Science & Engineering -W.D. Callister (Wiley India Pvt. Ltd.)
6. Technology of Engineering Materials- Philip and Bolton (Butterworth-Heinamann)
7. Material Science -V. Raghvan (Prentice Hall of India)
8. Elements of Material Science & Engineering- Van Vlack (Pearson)

BME 152	**AUTOCAD AND REFRIGERATION & AIR CONDITIONING**
Course category	Programme Specific (PS)
Pre-requisite Subject	NIL
Contact hours/week	Lecture:0,Tutorial:0 , Practical:4
Number of Credits	2

Course Assessment Methods	Continuous assessment through one Viva-voce, Practical work/record, attendance, and Major Practical Examination
Course objective	This course introduces basic concepts of drawing of various objects and its commands in AutoCAD. This course also introduces the basic concept of refrigeration and air conditioning involving service and maintenance.
Course Outcomes	After completion of this course the students are expected to be able to

1. Understand the different types of commands used in AutoCAD.
2. Candidate should be able to draw different types of drawing views in 2D and 3D.
3. Candidate should be able to understand the significance of AutoCAD.
4. Understand the elementary knowledge of refrigeration and air conditioning systems.
5. Understand the domestic applications of refrigeration and air conditioning systems
6. Understand the maintenance of various components of refrigeration and air conditioning systems.

Topics Covered

Automatic Computer Aided Design (AutoCAD)

- To study and understand the different components of AutoCAD.
- To understand and use the different draw commands in AutoCAD.
- To understand and use the different modify commands in AutoCAD.
- To understand and use the display and editing commands in AutoCAD.
- To write the text and dimensions by using AutoCAD.
- To draw the different two-dimensional Figures such as rectangle, circle, ellipse, arc, polygon, and polyline etc. in AutoCAD.
- Draw the Two Dimensional vies of given Figures by using AutoCAD.
- Draw the Isometric view of Object by using AutoCAD.

Refrigeration & Air Conditioning systems

- To determine refrigeration effect and COP using vapour compression refrigeration test rig
- To find out various psychrometric properties of atmospheric air using psychrometric chart
- To study various expansion devices used in RAC systems
- To study domestic refrigerator
- To study window air conditioner
- Leak detection test and gas charging in refrigerator
- Dismantling of Hermetic sealed compressors used in RAC systems
- Servicing and maintenance of different components of window air conditioner

Books & References

- Engineering Graphics with AutoCAD- D.M. Kulkarni , A. P. Rastogi, A K Sarkar (PHI Publication).
- Engineering Graphics and Design- P.S.Gill (S.K.Kataria and SONS , New Delhi)
- A Text book of Engineering Drawing – Dr. R. K. Dhawan , 3rd Edition (S. Chand Publication, New Delhi).
- Engineering Drawing +AutoCAD -K.Venugopal and V Prabhu Raja, New Age International Publisher.
- Refrigeration and Air conditioning - Manohar Prasad (New Age International (P) Ltd)
- Refrigeration and Air conditioning - C.P Arora (Tata McGraw Hill).
- Refrigeration and Air conditioning - Arora & Domkundwar (Dhanpat Rai & Co.(p) Ltd, Delhi).
- Refrigeration and Air conditioning – Stoecker & Jones (McGraw-Hill Education India Pvt. Ltd - New Delhi).
- Refrigeration and Air conditioning – R.K. Rajput (Katson publications)

BME-153 ENGINEERING THERMODYNAMICS

Course category	:	PLBSE
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives		This course introduces basic concepts of thermodynamics and their applications in solving engineering problems based on the concepts based on the various laws of thermodyanmics. This course also introduces the concept of boilers, heat engines, internal combustion engine, properties of steam, Rankine cycle, reheat and regeneration.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The basic understanding of the nature of the Thermodynamic processes for pure substances and ideal gases and ability to demonstrate the Zeroth law and First Law of Thermodynamics.
2. Ability to apply the First Law of Thermodynamics for control surface and control volume systems and demonstrate the Second Law of Thermodynamics and its application to various systems.
3. Students will demonstrate ability to use the Second Law of Thermodynamics for entropy balance analysis of different Thermodynamics processes of systems and control volume.
4. Ability to demonstrate the various plots pertaining to properties of steam and Thermodynamic cycles and the working of IC Engines.
5. Estimate vapor-liquid properties and solve basic problems using steam tables, Mollier diagrams and equation of state.
6. Apply the first and second laws of thermodynamics for the complete thermal analysis of vapor power cycle.

Topics Covered

UNIT-I **(9)**

Fundamental Concepts and Definitions

Introduction and definition of thermodynamics, Dimensions and units, Microscopic and Macroscopic approaches, Systems, surroundings and universe, Concept of continuum, Control system boundary, control volume and control surface, Properties and state, Thermodynamic properties, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibilityand irreversibility, Quasi static process, Energy and its forms, Work and heat, Gas laws, Ideal gas,Real gas, Law of corresponding states, Dalton‘s law, Amagat‘s law, Property of mixture of gases. **Zeroth law of thermodynamics**

Zeroth law of thermodynamics, Temperature and its‘ measurement, Temperature scales

First law of thermodynamics I

Thermodynamic definition of work, Thermodynamic processes, Calculation of work in various processes and sign convention, Non-flow work and flow work, Joules‘ experiment, First law of thermodynamics, Internal energy and enthalpy

UNIT-II **(9)**

First law of thermodynamics-II

First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. First law analysis for closed system (non flow processes), Analysis of unsteady processes such as filling and evacuation of vessels with and without heat
transfer, Limitations of first law of thermodynamics, PMM-I

Second law of Thermodynamics

Devices converting heat to work, Thermal reservoir, Heat engines, Efficiency, Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance, Reversed heat engine, Kelvin Planck statement of second law of thermodynamics, Clausius statement of second law of thermodynamics, Equivalence of two statements of second law of thermodynamics, Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it‘s corollaries, thermodynamic temperature scale, PMM-II.

UNIT-III **(9)**

Entropy

Clausius inequality, Concept of Entropy, Entropy changes in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

Availability and Irreversibility

Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb‘s function

UNIT-IV **(9)**

Properties of steam and thermodynamics cycles

Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables & Mollier charts, Dryness factor and it‘s measurement, processes involving steam in closed and open systems, Simple Rankine cycle

Introduction to working of IC engines

Compression Ignition engines, Spark Ignition engines, 2 stroke and 4 stroke engines, Performance parameters of IC engine, Heat balance sheet

Books & References

1. Engineering Thermodynamics - P.K. Nag (Tata McGraw Hill)
2. Fundamentals of Thermodynamics – Sonntag (Wiley India Pvt. Ltd)
3. Fundamentals of Classical Thermodynamics - Van Wylen (John Wiley & sons)
4. Thermodynamics - J.P. Holman (McGraw Hill)

5. Engineering Thermodynamics - Jones and Dugans (PHI Learning Pvt. Ltd)

BME154 FUNDAMENTALS OF MECHANICAL ENGINEERING

Course category	:	For Other Department
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial : 0 , Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor test and One Major Theory & Practical Examination
Course Objective		This course introduces basic fundamentals of mechanical engineering and their applications in solving engineering problems based on the concepts of thermodynamics, engine, measurement, engineering materials, mechanical properties and testing etc.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The knowledge of basic laws of thermodynamics; steam generation and its properties; refrigeration cycles, properties and machines; and reciprocating engine such as two/four strokes IC engines.
2. The knowledge of measuring instruments, types of transducers for measurement of different geometrical parameters.
3. The knowledge of various engineering materials and their applications.
4. The ability to understand different types of stresses, Hooke's law and its applications,
5. Understand the different mechanical properties and testing of engineering materials.
6. The knowledge of different types of beams, shear force and bending moment diagrams for statically determinate beams, stresses in simple bending of beams and torsion in circular shafts.

Topics Covered

UNIT-I **(9)**

Thermodynamics

First and second law of thermodynamics, statements of Second Law of Thermodynamics and their equivalence, Third law of thermodynamics, Steam properties, Steam processes at constant pressure, volume, enthalpy and entropy, Classification of steam boilers, boiler mounting and accessories, Refrigeration, Basics of Vapour compression and vapour absorption system, Coefficient of performance (COP), Refrigerants properties.

Reciprocating Machines

Carnot cycle, Otto and Diesel cycles, Working of two and four strokes petrol and diesel engines.

UNIT-II **(9)**

Measurement & Metrology

Introduction to measurement and measuring instruments, Types of sensors and transducers and their characteristics, measuring error uncertainty analysis, Temperature, pressure, velocity, flow, strain, force and torque introduction of dial gauges, slip gauges and sine bar

Engineering Materials

Classification of materials, Ferrous and nonferrous metals, Composition of cast iron, carbon steel, alloy steel and their mechanical properties, Non-ferrous metals such as Cu, Al, Zn, Cr, Ni etc. properties and its applications.

UNIT-III **(9)**

Simple Stress and Strain

Introduction, Normal and shear stresses, Poisson's ratio, Elastic constants and their relationships, Hooke's law, Deflection of bars of uniform and varying cross-sections, Strain energy in due to static loading, Stress-strain diagrams for ductile and brittle materials

Mechanical Properties and Testing

Introduction to Toughness, Hardness, Fracture, Fatigue, Strength and deformation, Tensile, compression, Hardness, Impact, Fatigue, spring stiffness tests.

UNIT-IV **(9)**

Beams

Introduction, Beams classification, types of loading, Free body diagram, Shear force and bending moment, Analysis of beams, Shear force and bending moment diagrams for statically determinate beams, Simple bending theory, Stress of beams of different cross sections

Torsion of Circular shafts

Introduction, Torsion of circular shafts, Shear stress due to torsion, Polar modulus, Power transmission

EXPERIMENTS

Note: Minimum Eight experiments are to be performed

1. Tensile strength test on universal testing machine.
2. Compressive strength test on universal testing machine.
3. Bend/rebend test on Izod.

4. Impact test on Impact testing machine.
5. Hardness testing on Vicker/Brinell hardness testing machine.
6. Torsion test of a rod on torsion testing machine.
7. Stiffness test on spring testing machine.
8. Study of two stroke and four stroke engine model.
9. Fatigue test on fatigue testing machine.
10. Deflection on bending of simple supported and cantilever beams.
11. Determination of COP of vapour absorption system.
12. Determination of COP of vapour compression refrigeration system.
13. Study of steam boilers model.
14. Study of domestic refrigerator

Books & References

1. Basic and Applied Thermodynamics-P. K. Nag (Tata McGraw Hill)
2. Basic Thermodynamics- Cengel(Tata McGraw Hill).
3. Applied Thermodynamics-Onkar Singh (New Age International)
4. Elements of Materials science and Engineering-Van Vlash (Jhon Wiley & Sons)
5. Material Science-V. Raghvan (Prentice Hall India Limited)
6. Mechanical Measurement-G. Beckwith Thomas (Narosa Publishing House)
7. Mechanical Measurement – Sirohi (New Age Publications)
8. Strength of Materials-S. Ramamurtham (Dhanpat rai Publishing Co.)
9. Strength of Materials-R. K. Rajput (S. Chand)
10. Strength of Materials–R. K. Bansal (Lakshmi Publications)

BSM-102/BSM-152 Ordinary and Partial Differential Equations

Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To solve the ordinary differential equations.
2. To solve the partial differential equations using Lagrange and charpit's method.
3. To solve and understand the properties of Bessel`s and Legendre`s differential equation.
4. Application of partial differential equation in real life problems
5. To solve Wave, Heat and Laplace equation upto two dimensions.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I 9

Ordinary Differential Equations I: Linear differential equations with constant coefficients $(n^{th} order)$, complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems

UNIT-II 9

Ordinary Differential Equations II: Series solution of second order differential equations with variable coefficient (Frobeneous method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

UNIT-III 9

Partial Differential equations I: Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.

UNIT-IV 9

Partial Differential Equations II: Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two dimensions, Heat conduction equations up to two dimensions

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.
5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S Chand Publications.

BSM-153 Complex Analysis and Integral Transforms

Course category : Basic Sciences & Maths (BSM)
Pre-requisite Subject : NIL
Contact hours/week : Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits : 4

Course Assessment methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination

Course Objectives : The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Prove basic results in complex analysis.
2. Establish the capacity for mathematical reasoning through analysing, proving, and explaining concepts from complex analysis.
3. Solve the problems using complex analysis techniques applied to different situations in engineering contexts.
4. Use of Laplace Transform to solve the differential equation.
5. Use of Fourier transforms, and Z transforms to solve the differential equation.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I 9

Functions of Complex Variable I: Complex differentiability, Cauchy-Riemann equations, Analytic functions, Harmonic functions, Harmonic conjugates, Cauchy-Integral Theorem, Cauchy-Integral formula, Cauchy's integral formula for higher derivatives.

UNIT-II 9

Functions of Complex Variable II: Taylor's Series and Laurent Series, Zero's and Singularities of functions, Removable singularity, Poles and essential singularities, Residues, Cauchy's residue theorem., Residue theorem, Evaluation of the real integrals of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ *and* $\int_{-\infty}^{+\infty} f(x)dx$.

UNIT-III 9

Integral Transform I: Laplace Transform Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function. Laplace transform of periodic function, Impulse function.

Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

UNIT-IV 9

Integral Transform II: Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equation, wave equation.

Z- transform and its application to solve difference equations

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers.
2. Jain, Iyenger and Jain: Advanced Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. James W. Brown & R. V. Churchill: Complex variables and applications, Mcgraw-Hill Asia
4. Debanth L. and Bhatta D., "Integral Transforms and Their Applications", 2nd edition, Taylor and Francis Group, 2007.
5. Sneddon I. N. Fourier Transforms, Dover Publication, 2010.

BHM-101/151 PROFESSIONAL COMMUNICATION (L-T-P: 2-0-0)

Course Category: Humanities & Social Science (HSS)
Pre-requisite Subject: None
Contact hours/week: 2 Credit
No of Credits: Lecture: 2, Tutorial:0, Practical: 0(Total Credit: 02)
Course Assessment Methods: Continuous assessment through tutorials, Attendance, home assignments, quizzes, Two Test and one Major Theory Exam.

Course Objective: The course aims:

1) To sensitize the students to understand the role& importance of communication for personal & professional success.
2) To enable learners to exhibit knowledge, skills, and judgment in and around human communication that facilitates their ability to work collaboratively with others in an interpersonal environment.
3) To develop awareness and understanding of applying appropriate communication strategies resulting into the enhancement of learners' employability skills.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1) Use of various facets of communication skills, such as, Reading, Writing, Listening and speaking skills.
2) To identify, formulate and solve the real life problems with positive attitude.
3) To inculcate the habit of learning and developing the communication and soft skills by practice.
4) To enhance effortless speaking and writing skills with the help of rich word power.
5) To develop personality by introducing and inculcating effective presentation strategies.
6) To focus on audio, visual aids for effective oral communication skills

UNIT – I: VERBAL COMMUNICATION: 6 Hours

Received Pronunciation; how to activate passive vocabulary; Technical/non-technical and Business Presentations; questioning and answer skills; soft skills for professionals; role of body postures, movements, gestures, facial expressions, dress in effective communication; Information/ Desk/ Front Office/ Telephone conversation; how to face an interview/press conference; Group discussions, debates, elocution.

UNIT – II: READING COMPREHENSION **6 Hours**

Skimming and Scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; use and interpretation of visuals and graphics in technical writing.

UNIT – III: WRITTEN COMMUNICATION: **6 Hours**

Note Making and Note Taking; summarizing; invitation, advertisement, agenda, notice and memos; official and commercial letters; job application; resume and curriculum vitae; utility, technical, project and enquiry reports; paragraph writing: General – Specific, Problem – Solution, Process – Description, Data – Comment.

UNIT – IV: SHORT ESSAYS: **6 Hours**

Description and Argument; comparison and contrast; illustration; using graphics in writing: tables and charts, diagrams and flow charts, maps and plans, graphs; how to write research paper; skills of editing and revising; skills of referencing; what is a bibliography and how to prepare it.

Text & Books:

1) Bansal, R.K. & Harrison J.B., (1972)*Spoken English*, Orient Longman, India.
2) Chauhan, Narender Kr. & Singh, Sudhir N., (2013) *Formal Letters*, Pankaj Publication International, New Delhi.
3) Chhabra T.N., (2019) *Business Communication*, Sun India Publication, New Delhi.
4) Dixon Robert J., (1986)*Complete Course in English*, Prentice Hall of India, New Delhi.
5) Jones, Daniel.(2012) *Cambridge English Pronouncing Dictionary*, 18th Edition, Paperback, CUP, India.
6) Lewis, Norman, (2015) *Word Power Made Easy*, Penguin India.
7) Sethi J. & Jindal, (1993)*Handbook of Pronunciation of English Words* - D.V.A, Prentice Hall of India, New Delhi.
8) Sharma R.C. & Mohan Krishna, (2017)*Business Correspondence and Report Writing*, Tata McGraw Hill.
9) Thomson, A. J. & and Martinet A. V., (1997)*A Practical English Grammar*,Paperback,Ed. IVth, Oxford.

BCS-105 Basic Computer Programming

(For the students of Mechanical Engineering Department)

Course Category EF

Pre-requisite Subject NIL

Contact Hours/Week Lecture: 3, Tutorial: 0 & Practical: 2

Number of Credits 4

Course Assessment Methods	Continuous assessment through attendance, home assignments, quizzes, practical work record, viva-voce, two tests and one major examination (T & P)

Course Objective: This course helps the students in gaining the knowledge to write simple C language applications, mathematical and engineering problems. This course helps to undertake future courses that assume this programming language as a background in computer programming. Read and understand C programs.

1. Discuss basic theory and practice of programming
2. Design and implement practical programs using C language

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Use compiler and feel comfortable with Windows environment
2. Identify and fix common C errors
3. Upon completion of the course, the students will be able to:
4. Write, compile and debug programs in C language.
5. Use different data types in a computer program.
6. Design programs involving decision structures, loops, arrays and functions

TOPIC COVERED

UNIT-I **9L**

Basics of Computer: Introduction to Digital Computer, Basic Operations of Computer, Functional Components of Computer, Classification of Computers. Introduction to Operating System: DOS, Windows, Linux, Function, Services and Types. Basics of Programming: Approaches to Problem Solving, Concept of Algorithm and Flow Charts, Types of Computer Languages: Machine Language, Assembly Language and High-Level Language, Concept of Assembler, Compiler, Loader and Linker.

UNIT-II **9L**

Standard I/O in "C", Fundamental Data Types: char, int, short, long, float, double, long double. Storage Classes: Automatic, Register, Static, External. Operators and Expressions: Using Numeric and Relational Operators, Mixed Operands and Type Conversion, Logical Operators, Bit Operations, Operator Precedence and Associativity. C Conditional Program Execution: Applying if and Switch Statements, Nesting if and else, Restrictions on switch Values, Use of Break. Program Loops and Iteration: Uses of while, do and for Loops, Multiple Loop Variables, Assignment Operators, Use of break and continue keywords.

UNIT-III **9L**

Functions: Designing Structured Programs, Functions in C, User Defined and Standard Functions, Formal vs. Actual Arguments, Function Category, Function Prototype, Parameter Passing, Recursive Functions. Arrays: One Dimensional, Multidimensional Array and their Applications, Declaration and Manipulation of Arrays. Strings: String Variable, String Handling Functions, Array of Strings. Storage Classes revisited.

UNIT-IV **9L**

Pointers: Pointer Variable and its Importance, Pointer Arithmetic and Scale Factor, Compatibility, Dereferencing, L value and R-Value, Pointers and Arrays. Structure and Union: Declaration and Initialization of Structures, Structure and array, Structure Pointers, Declaration and Initialization of union, Union vs Structure. Implement the concept of simultaneous linear equations, Bisection, Newton Raphson, Interpolation, Trapezoidal and Simpson methods.

EXPERIMENTS

1. Write a program that finds whether a given number is even or odd.
2. Write a program that tells whether a given year is a leap year or not.
3. Write a program that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
    a. Between 90-100%----------Print "A"
    b. 80-90%----------Print "B"
    c. 60-80%----------Print "C"
    d. Below 60%----------Print "D"
4. Write a program that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
5. Write a program to print sum of even and odd numbers from 1 to N numbers.
6. Write a program to print the Fibonacci series.
7. Write a program to check whether the entered number is prime or not.
8. Write a program to find the reverse of a number.
9. Write a program to print Armstrong Numbers from 1 to 100.
10. Write a program to convert binary number into decimal number and vice versa.
11. Write a program that simply takes elements of array from user and finds sum of these elements.
12. Write a program that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
13. Write a program to find the minimum and maximum element of the array.
14. Write a program to implement the concept of simultaneous linear equations.
15. Write programs to implement the Bisection, Newton Raphson, Interpolation, Trapezoidal and Simpson methods.

TEXTBOOKS

1. Jeri R. Hanly and Elliot B. Koffman, Problem Solving and Program Design in C, 7th Edition, Pearson.
2. Schildt, Herbert, Complete Reference with C, Tata McGraw Hill Publication.
3. Kerninghan and Ritchie, The C programming Language, 2nd Edition, Prentice Hall.

BHM-104/154 HUMAN VALUES & PROFESSIONAL ETHICS-1 (L-T-P: 2-0-0)

Course Category: Humanities & Social Science Elective (HSSE)
Pre-requisite Subject: None
Contact hours/week: 2 Credit
No of Credits: Lecture: 2, Tutorial: 0, Practical: 0 (Total Credit: 02)
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes and Two test, one major theory.

Course Objective: The Course aims:

1) To give basic insights and inputs to the students to inculcate Human values to grow as a responsible human being with holistic personality.
2) To instil Professional Ethics in the student and enabling them to maintain ethical conduct while discharging their professional duties.
3) To enable them to understand and appreciate versatility and universality of human values and their pivotal role in professional field.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1) To create conducive environment for professionals to grow as good and responsible human beings imbibing values and ethics.
2) Understanding the significance of environment.
3) Developing humanitarian outlook.
4) Assess their own ethical values and the social context of problems.
5) Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human.
6) Identify the multiple ethical interests at stake in a real-world situation or practice.

UNIT-I **6 Hours**

Origin, Meaning, and Definition of Value, Types of Values, Individual Value, Family Value, Societal Value, Human Value, Value in Education System, Understanding Happiness and Prosperity, Self-Exploration and Natural Acceptance.

UNIT-II **6 Hours**

Harmony in family, Harmony in Society, Values Leading to Harmony, Creating a world family, Harmony in Nature, Environment and Sustainable Developmental, Legal aspects of Environment, Holistic Perspectives of Values, Existence and Co-existence.

UNIT-III **6 Hours**

Origin, Meaning and Definition of Ethics, Ethics: The science of the Morality of The Art of Correct Living, Ethics in Human Acts, Ethics and Religion, Ethical Norms and Laws, Ethics in Literature, Ethics in Science and Technology.

UNIT-IV **6 Hours**

Ethical Approaches: Theistic Approach, Atheistic Approach, General and Special Ethics, Professional Ethics: Ethics at work-place, Ethics as Skill, Values and Ethics, Ethics with Value Education, Managerial and Business & Corporate Ethics, Corporate Social Responsibilities.

Text & Books:

1. Bangaria,G.P et.al,(2010)*A foundation course in Human Values and Professional Ethics*, Excel books.
2. Govindrajan, M. (2013) *Professional Ethics and Human Values*, Eastern Economy Edition.
3. Naagrazan, R.S. (2018)*Textbook on Professional Ethics and Human Values*, New age International. Misra, Anuranjan and Shukla, Dr. R.K.,*Human values and Professional Ethics*.
4. Fernando, A.C.,(2009) *Business Ethics: An Indian Perspective*, Pearson,India.

BEE-103/ 153 Basic Electrical Engineering

Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and One Minor tests and One Major Theory & Practical Examination.
Course Objectives	:	**1.** To demonstrate and understand the basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context. **2.** To demonstrate and understand the basic concepts of analysis of simple DC and AC circuits used in electrical engineering and apply the basic concepts in Electrical engineering for multi-disciplinary tasks.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems.
2. Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
3. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance.
4. Classify different electrical measuring equipment's and understanding their principles.
5. Understand the basic concepts of magnetic circuits.
6. Explain construction and working principle of transformer.

Topic Covered

UNIT I **9**

D C Circuit Analysis and Network Theorems:

Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems:

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem.

UNIT II **9**

Steady- State Analysis of Single-Phase AC Circuits:

AC fundamentals: Sinusoidal, square, and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasor, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit

Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, three-phase power, and its measurement

UNIT III **9**

Measuring Instruments & Magnetic Circuit:

Types of instruments, Construction and working principles of PMMC and Moving Iron type voltmeters & ammeters, Use of shunts and multipliers.

Magnetic circuit, concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses.

UNIT IV **9**

Single-Phase Transformers:

Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.

EXPERIMENTS

1. Verification of Kirchhoff's Law.
2. Verification of Norton's Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Verification of Series R-L-C circuit.
7. Verification of Parallel R-L-C circuit.
8. Measurement of Power and Power factor of three phase inductive load by two wattmeter method.
9. To perform O.C. and S.C. test of a single-phase transformer.

Textbooks:

1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-Hill.
2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International.
3. Electrical and Electronics Technology, Edward Hughes; Pearson.
4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.

BSM-130/180 : PHYSICS OF APPLIED MATERIALS (for Mechanical Engineering)

Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	Physics at 12^{th} standard
Contact hours/week	:	Lecture : 3, Tutorial : 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory.
Course Objective		:Understanding of the principle and concepts of Crystallography, Quantum Mechanics, Basic principles of electricity and magnetism, Maxwell's Equations, of and Advanced Materials for their applications Engineering.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basics of crystallography and its applications in Engineering.
2. Quantum Mechanics and its application to understand material properties at atomic level.
3. Basic principles of electricity and magnetism applied in Engineering.
4. Maxwell's equations of electromagnetic theory and its application in engineering.
5. Basic principles of semiconducting materials and its application in engineering.
6. Basic Principles of advanced materials and their applications in Engineering.

Topics Covered

UNIT-I 9

Crystal Structures and X-ray Diffraction: Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Bragg's Law, Bragg's spectrometer.

UNIT-II 9

Quantum Mechanics: De Broglie waves and Group velocity concept, Uncertainty principle and its application, Davisson-Germer experiment, Derivation of Schrodinger equation for time independent and

time dependent cases. Postulates of quantum mechanics, Significance of wave function, Application of Schrodinger wave equation for a free particle; Particle in a box (one dimensional).

UNIT-III 9

Electrodynamics –I: Basic concepts of Gauss's law, Ampere's law and faradays law of electromagnetic induction. Correction of Ampere's law by Maxwell (concept of displacement current), Maxwell's equation, transformation from integral form to differential form, physical significance of each equation

Electrodynamics –II: Maxwell's equation in free space, velocity of electromagnetic wave, transverse character of the wave and orthogonality of E, H and k vectors, Maxwell's equations in dielectric and conducting medium, velocity of e. m. wave, comparison with free space, penetration depth.

9

UNIT-IV

Physics of Advanced Materials

Semiconducting Materials**,** Concept of energy bands in solids, concept of direct and indirect band gap, Carrier concentration and conductivity in semiconductors, Optoelectronic Materials, Superconducting Materials**,** Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, BCS theory (Qualitative), Introduction of nanoscience and technology.

Books & References

1. Introduction to Solid State Physics- Kittel , 7th edition, Wiley Eastern Ltd.
2. Solid State Physics - S. O. Pillai, 5th edition, New Age International.
3. Introduction to Electrodynamics- David J. Griffiths Pearson, New International Edition
4. Quantum Physics by H. C. Verma, 3rd Edition, Surya Publication Ghaziabad,
5. Semiconductor Devices and Application - S.M. Sze, Wiley
6. Introduction to Nano Technology - Poole Owens, Wiley India
7. Engineering Physics by B. K. Pandey and S. Chaturvedi, 2e Cengage Learning Pvt. Limited, India

BCE 101/BCE 151 ENGINEERING GRAPHICS

Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 0, Tutorial : 0 , Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and External Practical Examination

Course Objectives	:	This course aims at the following educational objectives: Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, sections). Dimension and annotate two-dimensional engineering drawings.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1.How Engineering Drawing helps to sketch the imagination? 2.Able to effectively practice the different scales for drawings. 3.Effectively analyze the geometrical shapes and to be able to draw. 4.Know about out solids and discuss about their classification. 5.How to implement the different views for a solid placed in 3dspace. 6.Construction of the object from different perspective. 7.Comparison and contrast between frustum and truncated solid. 8.Sketching of different sections for any 3D regular object. 9.Discussing the principles of Isometric Projection. 10.Sketching isometric projections for different geometrical shapes and solids.

Topics Covered

UNIT-I

Conic Sections and Orthographic Projections Introduction

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only);Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Orthographic Projections

Orthographic Projections covering Principles of Orthographic Projections- Conventions Projections of Pointsand lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Plane

UNIT-II

Projection of Regular Solids

Projections of Regular Solids covering those inclined to both the Planes- Auxiliary Views

UNIT-III

Sections and Sectional Views of Right Angular Solids

Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – AuxiliaryViews; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

UNIT-IV

Isometric Projections

Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions. Overview of computer graphics, demonstrating knowledge of the theory of CAD software.

Textbooks

1. Engineering Drawing-Bhat, N.D.& M. Panchal, Charotar Publishing House, 2008

Reference Books

1. Engineering Drawing and Computer Graphics- Shah, M.B. & B.C. Rana, Pearson Education, 2008
2. A Text Book of Engineering Drawing-Dhawan, R.K., S. Chand Publications,2007
3. Text book on Engineering Drawing-Narayana, K.L. & P Kannaiah, Scitech Publishers, 2008