AS15-1301 LINEAR ALGEBRA AND TRANSFORM TECHNIQUES

Course Objectives: To acquire fundamental knowledge of linear algebra and transformation techniques and throw light on their application in engineering disciplines.

Course Outcomes: On completion of this course, a student will be able to

1. Solve linear system of equations and to determine Eigen values and vectors of a matrix.
2. Understand basic principles of vector space and its properties including linear transformation and their applications.
3. Determine Fourier series and transform.
4. Solve linear differential equation and integral equation using Laplace transform.

Module I

Linear Algebra 1: Rank of a matrix, solution of linear system of equations- existence, uniqueness, general form - Eigen values and Eigen vectors - properties of Eigen values - Diagonalization of a matrix - Cayley Hamilton theorem (without proof) Verification-Finding inverse and power of a matrix using it - Quadratic form-orthogonal reduction of quadratic form to Canonical form.

Module II

Linear Algebra 2: Vector space-subspace-Linear dependence and independence-Spanning of a subspace- Basis and Dimension. Inner product- Inner product spaces - Orthogonal and Orthonormal basis –Gram- Schmidt Orthogonalization process. Linear Transformation.

Module III

Fourier Analysis: Periodic function, Fourier series, Functions of arbitrary period, Even and odd functions, Half Range Expansion, Harmonic analysis, Complex fourier Series, Fourier Integrals, Fourier Cosine and Sine Transform, Fourier Transform.

Module IV

Laplace Transforms: Gamma functions and Beta function-Definition and properties, Laplace transforms. Inverse Laplace Transform, Shifting theorem, Transform of Derivative and Integrals, Solution of differential equation and integral equation using Laplce transform, Convolution, Unit step function, Second Shifting theorem, Laplace transform of periodic function.

References:

1. Kreyzig, E. (2011). *Advanced Engineering Mathematics* (10th edition). John Wiley & Sons, Hoboken, N.J.
2. Grewal, B. S. (2013). *Higher Engineering Mathematics* (43rd edition). Khanna Publishers, New Delhi.
3. Hsiung, C. Y. and Mao, G. Y. *Linear Algebra*. World Scientific, New Jersey.
4. Hoffman, K. and Kunze, R. (1971). *Linear Algebra*. Prentice Hall of India, New Delhi.
5. Venkataraman, M. K. *Linear Algebra*. (1999). The National Publishing Company, Chennai.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), …] (10 marks each with option to answer either II or III) from Module I.
Question nos. IV and V [with sub sections (a), (b), …] (10 marks each with option to answer either IV or V) from Module II.
Question nos. VI and VII [with sub sections (a), (b), …] (10 marks each with option to answer either VI or VII) from Module III.
Question nos. VIII and IX [with sub sections (a), (b), …] (10 marks each with option to answer either VIII or IX) from Module IV.

CE15–1302 SURVEYING – I

Course Objectives: To acquaint with basic principles and basic instruments related with surveying and levelling.

Course Outcomes: On completion of the course, a student will be able to:

1. Carry out preliminary surveying in the field of civil engineering applications such as structural, highway and geotechnical engineering.
2. Plan a survey, taking accurate measurements, field booking, plotting and adjustment of traverse.
3. Use various conventional instruments involved in surveying with respect to utility and precision.
4. Plan a survey for applications such as road alignment and height of the building undertake measurement and plotting in civil engineering.

MODULE I

Introduction : Classification of surveys, primary division of Surveying-Principle of working from whole to part-conventional signs. **Chain Surveying**: Instruments - principles of chain surveying- Tie and check line-Chaining and Ranging-obstacles-chaining on sloping ground -Errors in chain Survey- uses of cross staff and optical square. **Compass survey** : Prismatic compass-surveyor's Compass, whole circle system and Quadrantal system-True and magnetic bearing-Dip and Declination-Local attraction-Traversing-Plotting a Traverse Survey -Graphical adjustment of closing error in a closed Traverse. **Plane Table Survey**: Instruments and accessories- Advantages and disadvantages of plane tabling - Different methods of plane Tabling-Two point problem-Three point problem - Errors in plane tabling.

MODULE II

Levelling: Definitions of Terms used in Leveling- levelling instruments-Temporary and permanent adjustments-principles of levelling-Simple levelling, Differential levelling-Reduction of levels-Classification of levelling-Profile levelling and cross sectioning -correction for curvature and refraction-Reciprocal levelling- Errors in levelling. **Contour Survey**: Definition-characteristics of Contour- uses of contours- Methods of contouring-Interpolation Contours-uses of Contour map.

MODULE III

Area and volumes: Areas along Boundaries- Mid ordinate rule-Average ordinate rule-Trapezoidal rule-Simpson's rule- Area by Meridian distance method- Area by Double meridian method. Departure and total latitude method-Coordinate method- Computation of volume by Trapezoidal and Prismoidal formule -Mass haul curve.

Introduction to advanced surveying Equipments – Total station – GPS – Electronic theodolite.

MODULE IV

Theodolite Surveying: Study of Theodolite - Temporary and permanent adjustments-measurement of horizontal angle- method of repetition and reiteration- measurement of vertical angle – Theodolite traversing by direct observation of Angles and by direct observation of Bearings- Adjustment of a closed Traverse (angular error, bearings and closing error) - Bowditch rule-Transit rule-Gale's traverse Table- Omitted measurements.

Tacheometric Surveying : Instruments used-Stadia System-fixed and movable hair methods-Tacheometric constants- Anallatic lens-Tangential System

References:

1. Punmia, B.C, Jain, A. K. and Jain, A. K. (2010). *Surveying*. Vol. I & II, Laxmi Publications.

2. Chandra, A. M. (2007). *Higher Surveying*. New Age International Publishers.
3. Ghilani, C. D, and Wolf, P. R. (2012), *Elementary Surveying*. Prentice Hall.
4. Arora, K.R. (2012). *Surveying*. Vol.I and II. Standard Book House.
5. Duggal, S. K. (2010), *Surveying*. Vol. I. Tata Mc Graw Hill Publishing Co Ltd.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), …] (10 marks each with option to answer either II or III) from Module I.
Question nos. IV and V [with sub sections (a), (b), …] (10 marks each with option to answer either IV or V) from Module II.
Question nos. VI and VII [with sub sections (a), (b), …] (10 marks each with option to answer either VI or VII) from Module III.
Question nos. VIII and IX [with sub sections (a), (b), …] (10 marks each with option to answer either VIII or IX) from Module IV.

CE15–1303 STRENGTH OF MATERIALS

Course Objectives: To smoothly drive the student's imagination and thought process from the realm of rigid body (Newtonian) mechanics into the wonderful world of elementary deformable body solid mechanics through the introduction of internal effects of forces on linearly elastic, homogeneous and isotropic materials, motivated by the application of the principles developed (in this course) in structural design.

Course outcome: On completion of the course, a student will be able to

1. Assimilate the fundamentals of stress and strain and their relationship, basic elastic and inelastic properties of materials and elastic response of bodies to axial force.
2. Thoroughly understand the importance of principal stresses and strains, physical measurement of strains and internal actions like shear force and bending moment due to transverse external forces.
3. Deep root ideas regarding the theory of simple bending, shear stresses due to shear force and simplified theory of torsion of bars with circular cross-sections (importance of geometry in torsion).
4. Conceive the concept of strain energy and its applications, elementary analysis of stability of slender columns and principal stresses and strains in thin pressure vessels distinguishing the role of "thickness" in structural action.

MODULE I

Material properties and Basic assumptions in strength of materials – elasticity, plasticity, ductility, brittleness, malleability, isotropy / anisotropy, linear / non-linear elasticity, Stress-strain curve of a mild steel bar in a tension test.

The concept of Stress and Strain: Definition of stress and strain, average stress and strain, stress and strain at a point, normal stress and shear stress, Complementary shear stress, shear strain, Hooke's law and Poisson' s ratio, Constitutive equations, Elastic moduli, Relationship between elastic moduli of an isotropic material, Factor of safety, Allowable stress.

Axially loaded Members: Changes in lengths of axially loaded members, Changes in lengths of non-uniform bars, Statically indeterminate problems, Thermal effects, misfits and pre strains.

MODULE II

Principal stresses and strains - Stress on inclined planes for axial and biaxial stress fields associated with shear stress, principal stresses, Mohr's circle of stress, principal strains, strain rosette.

Shear force and bending moment: Types of beams (determinate and indeterminate), loads and reactions in determinate beams, shear force and bending moment, relationships between intensity

of loading, shear forces and bending moment, Shear force and bending moment diagrams of statically determinate beams.

MODULE III

Stresses in beams : Pure bending and non uniform bending, Assumptions, Curvature of a beam, Longitudinal strains in a beam, Normal stresses in beams (linearly elastic and isotropic materials) due to bending, Design of beams for bending stresses, Non-prismatic beams, **Shear stresses** in beams of rectangular, circular, I and T cross sections.

Torsion: Circular bars of linearly elastic and isotropic materials, uniform torsion, assumptions, angle of twist, transmission of power by circular shafts, statically indeterminate problems, non-uniform torsion, Close and open coiled helical springs.

MODULE IV

Strain Energy: Definition of strain energy and complementary energy, strain energy due to axial load, bending moment, shear force and twisting moment, Introduction to applications of strain energy in solid mechanics.

Columns : Structural behavior of short and slender (long) columns, Buckling and stability, Euler's formula, Columns with pinned ends, and other support conditions, Slenderness ratio, Limitations of Euler's formula, Columns with eccentric axial loads, The secant formula for columns.

Thin Cylinders: Stresses and strains in thin cylinders and spherical shells.

References:

1. Gere, J. M. *Mechanics of Materials*. Brooks/Cole Thomson Learning.
2. Popov, E. P. *Engineering Mechanics of Solids*. Prentice-Hall of India Limited, New Delhi, India.
3. Timoshenko, S. P. and Young, D. H. *Elements of strength of materials*. East-West Press Private Limited, New Delhi, India.
4. Case, J., Chilver, L. and Ross, C. T. F. *Strength of Materials and Structures.* Elsevier, New Delhi.
5. Nash. *Strength of Materials*. Shaum's outline series, McGraw Hill publishers.
6. Subramanian, R. *Strength of Materials*. Oxford University Press.
7. Vazirani, V. N. and Ratwani, N. M. *Strength of Materials*. Vol I. Khanna Publishers.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), …] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), …] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), …] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), …] (10 marks each with option to answer either VIII or IX) from Module IV.

CE15-1304 CONCRETE TECHNOLOGY

Course Objectives: To introduce the most versatile civil engineering construction material, concrete, its ingredients, properties, manufacture, tests and uses.

Course Outcomes: On completion of the course, a student will be able to

1. Understand the constituent materials of concrete, their properties and functions in concrete.

2. Design concrete mixes of specified grades via IS and ACI methods and generate an awareness regarding manufacturing process of concrete.
3. Clearly understand properties of concrete in its fresh and hardened state and tests for determination of them.
4. Generate awareness regarding special forms of concrete and some non-destructive testing methods of concrete.

MODULE I

Materials: Cement – Ingredients, Chemical composition, basic properties of cement compounds, Hydration of cement- heat of hydration, physical properties of Portland cements, Indian standard tests and specification, various types and grades of cement, storage of cement

Aggregates:- Classification of aggregates. Characteristics of aggregates – Strength of aggregate, particle shape and texture, specific gravity, bulk density, porosity, water absorption and moisture content of aggregate, bulking of fine aggregate, deleterious substance in aggregate, soundness of aggregate , alkali- aggregate reaction , sieve analysis:- grading curves, fineness modulus, grading requirements, grading of fine and coarse aggregates, zoning, IS tests and specification for aggregates for concrete.

Water: - Quality of mixing water, effect of impurities in water on properties of concrete. permissible impurities as per I.S

Admixtures:- Functions and classification of admixtures, factors influencing the dosage of different admixtures- IS specification for admixtures for concrete. accelerators - retarders - plastizers - water reducing agents - use of silica fumes.

MODULE II

Mix Design: Quality Control - Factors causing variations in the quality of concrete - mix design - nominal mixes - design mixes - factors influencing mix design - A.C.I method - I.S method - design for high strength mixes.

Process of manufacture of Concrete:- Mix proportion and grade of concrete - Various types of batching, mixing, transporting, placing, compacting, curing and finishing of concrete (in detail). Joints in concreting – construction and expansion.

MODULE III

Properties of fresh concrete: Water / Cement ratio and its significance in fresh concrete- workability- different methods for assessing workability according to IS Specification, factors affecting workability, requirements of workability for various work, segregation, bleeding, setting, hardening, strength development.

Properties of Hardened concrete: Strength of concrete- strength of concrete in compression, tension and flexure - stress- strain characteristics and elastic properties - shrinkage and creep. durability of concrete - permeability - chemical attack - sulphate attack - resistance to abrasion and cavitaion - resistance to freezing and thawing - resistance to fire - marine atmosphere - quality control - frequency of sampling - test specimens - statistical analysis of test results - standard deviation - acceptance criteria.

MODULE 1V

Special concrete: Lightweight concrete, High strength concrete, Polymer concrete, fiber reinforced concrete, Ferro-cement, Ready mixed concrete. vacuum concrete - shotcrete - steel fibre reinforced concrete- high performance concrete, reactive powder concrete, self-compacting concrete.

Non-destructive testing of concrete: Rebound hammer test, ultrasonic pulse velocity test, core cutter test.

References :

1. Neville, A. M. *Concrete Technology*. Pearson Education.

2. Neville, A. M. *Properties of Concrete* (4th edition). Pearson Education.
3. Santhakumar, A. R. (2013). *Concrete Technology*. Oxford University Press, India.
4. Orchard, D. F. *Concrete Technology*. Vol. I & II
5. Raju, K. N. *Design of Concrete Mixes*. CBS publishers.
6. Bungey, J. H. *The Testing of Concrete in Structures*. Urrey University of Press Hall.
7. Shetty, M. S. *Concrete Technology*. S I Chand & Company.
8. Gambhin, M. L. *Concrete Technology*. Tata McGraw Hill.
9. Thomas, J. (2015). *Concrete Technology*. Cengage Learning (India), 475p.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), …] (10 marks each with option to answer either II or III) from Module I.
Question nos. IV and V [with sub sections (a), (b), …] (10 marks each with option to answer either IV or V) from Module II.
Question nos. VI and VII [with sub sections (a), (b), …] (10 marks each with option to answer either VI or VII) from Module III.
Question nos. VIII and IX [with sub sections (a), (b), …] (10 marks each with option to answer either VIII or IX) from Module IV.

CE15-1305 FLUID MECHANICS – I

Course Objectives: To introduce the students to the mechanics of fluids through a thorough discussion of the properties of the fluids, behavior of fluids under static conditions and to expose to the applications of the conservation laws to flow measurements and flow through pipes (both laminar and turbulent).

Course Outcomes: On completion of the course, a student will be able to

1. Appreciate the purpose of learning fluid mechanics, properties of fluids and pressure measurement devices.
2. Understand thoroughly how to compute hydrostatic forces and transport of mass, momentum and energy through introduction of the dynamics of fluids through the control volume approach.
3. Apply principles of dimensional analysis to design experiments.
4. Analyze and design simple pipe systems.

MODULE I

Introduction: Fundamental difference between a solid and a fluid, constituent relationships for solids and fluids, conservation principles applied in fluid mechanics.

Properties of fluids, concept of continuum, viscosity, compressibility, ideal and real fluids, surface tension, capillarity.

Stress at a point, pressure, Pascal's law, Variation of pressure with elevation in compressible and incompressible fluids, hydrostatic law, Pressure measurement, piezometers and manometers.

MODULE II

Hydrostatic forces exerted on submerged surfaces.

Description of fluid flow: with reference to translation, rotation and deformation, concept of continuum, control mass and control volume approach, Reynolds transport theorem. Steady flow and uniform flow.

Velocity field, one and two-dimensional flow analysis, circulation and vorticity, stream function and velocity potential function, potential flow, standard flow patterns, combination of flow patterns, flownet.

MODULE III

Forces exerted in a fluid flow, derivation of Continuity equation and Euler's equation. Bernoulli's equation and its applications. Momentum equation and its applications.
Dimensional Analysis as a tool in design of experiments, identification of non-dimensional numbers and their significance, dimensional analysis methods.
Measurement of flow in pipes and open channels.

MODULE IV
Head loss in flow through pipes, Darcy Weisbach equation, major and minor losses. Flow through pipes and pipe networks, equivalent pipe.
Laminar flow and its characteristics, Reynolds experiment. Laminar flow between parallel plates.
Laminar flow through pipes, Hagen-Poiseuille equation.
Turbulence, Reynolds turbulent stresses, Prandtl's mixing length theory.
Velocity distribution in turbulent flow.

References:

1. White, F. M. (2011). *Fluid Mechanics*. Tata McGraw Hill Publication.
2. Fox, R. W., Pritchard, P. J. and McDonald, A. T. (2011). *Introduction to Fluid Mechanics* (7th Student edition). Wiley India Edition.
3. Shames (1988). *Mechanics of Fluids*. McGraw Hill Book Co., New Delhi.
4. Streeter, V. L. and Wylie, B. (1999). *Fluid Mechanics*. McGraw Hill Book Co., New Delhi.
5. Modi, P. N. and Seth, S. M. *Hydraulics and Fluid Mechanics (including hydraulic machines)*. Standard Book House, Delhi, India.

Type of Questions for End Semester Examination.
PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).
PART B: ($4 \times 10 = 40$ marks)
Question nos. II and III [with sub sections (a), (b), …] (10 marks each with option to answer either II or III) from Module I.
Question nos. IV and V [with sub sections (a), (b), …] (10 marks each with option to answer either IV or V) from Module II.
Question nos. VI and VII [with sub sections (a), (b), …] (10 marks each with option to answer either VI or VII) from Module III.
Question nos. VIII and IX [with sub sections (a), (b), …] (10 marks each with option to answer either VIII or IX) from Module IV.

CE15-1306 BUILDING TECHNOLOGY

Course Objectives: To motivate the students to learn and appreciate various components of a building, their functions, materials of construction and different stages of construction.

Course Outcomes: On completion of the course, a student will be able to
1. Assimilate properties of certain building materials, mortar, gypsum, etc. and their tests so as to assure precautions in building construction.
2. Make one aware of certain non-structural building materials and their uses in construction.
3. Thoroughly understand regarding certain components of building construction, like stairs, doors, windows, lintels, cavity walls, etc. and their appropriate uses.
4. Acquaint with finishing works in building construction.

MODULE I
Building stones -Requirement of good building stone- characteristics - testing. Common building stones. Preservation of stones. Clay products: Tiles- Manufacture-Properties-Types-Problems of efflorescence and lime bursting in tiles. Lime: Properties- Classifications -Manufacture -Testing of lime. Mortar: Types –Properties-Tests on mortar, selection and desirable properties of fine aggregate for good mortar. Gypsum: Forms of gypsum and gypsum plaster, properties of gypsum

plaster, building products of gypsum and their uses. Pozzolona: Natural and Artificial fly ash, Surkhi (burnt clay pozzolona), rice husk and ash pozzolona,

MODULE II

Timber - Defects - Seasoning - Decay - Preservation, Wood based products. Iron and steel - Structural sections - Properties and uses of structural steel – Corrosion- forms and preventive measures. Paints varnishes and distempers, Common constituents, types and desirable properties, Cement paints. Glass - Ingredients, properties types and use in construction. Plastics - classification, advantages of plastics, Mechanical properties and their use in construction. Miscellaneous materials – Asbestos, Insulating Materials - Thermal and sound insulating material desirable properties and type.

MODULE III

Cavity walls – Partition walls – Types and features.
Lintels – Classification and loading, Arches – Classification and construction details- Technical terms.
Stairs- Technical terms- Classification and Types of stairs.
Doors, Windows and Ventilations- Technical terms-Construction details of different types.

MODULE IV

Floors and flooring - Types of floors - Types of floor coverings; Roof - Types of roofs - Types and uses of roofing materials.
Finishing works - Plastering, pointing, painting, white washing, colour washing, distempering ; Damp proofing ant termite treatment.

References:

1. Singh, G. (1996). *Building materials*.
2. Rangwala, S. C. (1992). *Engineering Materials*. Charotar Publishing House, Anand.
3. Punmia, B. C. (1999). *Building Construction*. Laxmi Publications, New Delhi.
4. Rangwala, S. C. (1992). *Building Construction*. Charotar Publishing House, Anand.
5. Huntington, W. C. (1959). *Building Construction*. John Wiley, New York.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), …] (10 marks each with option to answer either II or III) from Module I.
Question nos. IV and V [with sub sections (a), (b), …] (10 marks each with option to answer either IV or V) from Module II.
Question nos. VI and VII [with sub sections (a), (b), …] (10 marks each with option to answer either VI or VII) from Module III.
Question nos. VIII and IX [with sub sections (a), (b), …] (10 marks each with option to answer either VIII or IX) from Module IV.

CE15–13L1 CONCRETE LAB

Course Objectives: To reinforce the concepts learned in concrete technology and to familiarize testing methods for the determination of certain properties of cement, mortar and concrete (fresh and hardened).

Course Outcomes: On completion of the course, a student will be able to

1. Feel the constituent materials of concrete and test their properties of engineering interest and assess the quality and suitability of such materials.
2. Clearly understand batching and mixing of concrete and the concept of workability and water-cement ratio.
3. Determine strength of concrete in compression and tension and hence appreciate grade of concrete and mix design.

4. Determine desirable properties of concrete of engineering interest.

LIST OF EXPERIMENTS

1. Determination of Standard consistency and Initial Setting time of Cement.
2. Determination of Soundness of cement (Le Chatelier's apparatus).
3. Particle size distribution of fine aggregate – sieve analysis
4. Bulking of sand.
5. Determination of compressive strength of cement mortar cube.
6. Mix Design of concrete.
7. Determination of workability of fresh concretes: slump and compaction factor tests.
8. Preparation of concrete cubes and cylinders.
9. Compression test on concrete cubes and split-tensile test on concrete cylinders.
10. Determination of Modulus of elasticity of concrete.
11. Flexure test on concrete.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 45 %minimum in the end semester examination for a pass. .

CE15-13L2 STRENGTH OF MATERIALS LAB

Course Objectives: To reinforce the concepts learned in strength of materials and to familiarize testing methods for the determination of certain material properties.

Course Outcomes: On completion of the course, a student will be able to

1. Conceive and reinforce the ideas of axial tension, compression, bending, torsion (circular bar), thoroughly through the respective experiments.
2. Understand the determination of certain material properties, like, hardness, toughness, Young's modulus, Rigidity modulus, ductility, flexural strength, etc.
3. Familiarize with testing equipment and machine in the laboratory.

LIST OF EXPERIMENTS

1. Tension test on mild steel bar.
2. Double shear test on mild steel bar
3. Torsion test on mild steel bar
4. Izode Impact test.
5. Charpy Impact test.
6. Rockwell Hardness test.
7. Brinell Hardness test.
8. Determination of modulus of rigidity of springs – close coiled and open coiled.
9. Fatigue strength test
10. Bending test of wooden / steel beam – determination of flexural strength and modulus of elasticity.
11. Compression test on wood and brick.
12. Verification of Clark-Maxwell's theorem.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and* 45 %*minimum in the end semester examination for a pass.