

**DEPARTMENT OF CIVIL ENGINEERING****LIST OF COURSES OFFERED FOR MINOR PROGRAM (R20)**

Course code	Course Title	Contact hours/week				Credits
		L	T	P	Total	
20CEM1	Surveying	4	0	0	4	4
20CEM2	Building Materials and Principles of Planning	4	0	0	4	4
20CEM3	Fundamentals of Water Resources Engineering	4	0	0	4	4
20CEM4	Introduction to Environmental Engineering	4	0	0	4	4
20CEM5	Fundamentals of Transportation Engineering	4	0	0	4	4
20CEM6	Basics of Geo Technical Engineering	4	0	0	4	4
20CEM7	Elements of Quantity Estimation and Valuation	4	0	0	4	4
20CEM8	Applied Mechanics and Strength of Materials	4	0	0	4	4

B.Tech. (Sem.)

SURVEYING

L	T	P	Cr.
4	0	0	4

**Pre-requisites:** Nil

**Course Educational Objective:**

The course aims to teach the basic conceptual principles of surveying and various methods for measuring linear and angular measurements. The coverage of the course enables the students to differentiate the available surveying equipments suitable for a specific purpose.

**Course Out comes:** At the end of the course, the student will be able to:

- CO1:** Understand the basic principles involved in linear and angular measurements, levelling measurements and characteristic properties of simple curves, functioning of advanced equipment such as EDM, Total station, DGPS (Understanding – L2).
- CO2:** Develop the longitudinal, lateral and contour profiles of a given area using fundamental principles of levelling and interpret the same (Understanding-L2).
- CO3:** Calculate the area and volume of required boundaries (Apply-L3).
- CO4:** Recognize the significance of modern instruments used in surveying (Understanding-L2).

**UNIT-I: BASICS OF SURVEYING**

**Basic Terminology:** Definition-Uses of Surveying- Overview of Plane Surveying (Chain, Compass and Plane Table), Objectives, Principles and Classifications.

**Linear and angular measurements:** Linear Measurements Using Tape and Chain, Compass Survey - Bearings, Local Attraction and Computation of angle.

**UNIT II: LEVELING AND CONTOURING**

**Leveling:** Concept and Terminology, Temporary and Permanent Adjustments, Rise-Fall method and HI method, Reciprocal Levelling.

**Contouring:** Characteristics and applications of Contours, Purpose and methods of conducting Contour Surveys.

**UNIT III: AREAS AND VOLUMES**

**Area calculations:** Area from Field notes, Computation of Areas along Irregular boundaries and area consisting of regular boundaries by using Simpson's rule-trapezoidal rule- Mid ordinate & Average ordinate rule.

**Volume calculations:** Computation of volume using trapezoidal rule and prismoidal rule for roadwork and canal work.

**UNIT IV: THEODOLITE**

Description, Applications, Adjustments – Temporary and Permanent, Procedure for measurement of Horizontal and Vertical Angles, Repetition and Reiteration, Traversing – Purpose, -Types of Traverse, -simple calculations in traverse computation.

**UNIT V: SIMPLE CURVES AND ADVANCED EQUIPMENT**

**Simple curves:** Introduction, Types of curves, elements, Applications, Simple problems on simple curves,

**Advanced Equipment:** concept and application of Planimeter, Introduction to Total Station, working principle, applications and advantages, Introduction to Global Positioning System, DGPS, Applications.

**TEXT BOOKS**

1. R. Agor “A Text Book of Surveying and Leveling”, Khanna Publishers, New Delhi, 1998.
2. Punmia B.C., “Surveying Vol I and II”, Laxmi Publications 9th, 10th Edition, 1987.

**REFERENCES:**

1. R.Subramanya, “Surveying and Leveling”- Oxford Publication
2. Arora K R, “Surveying Vol 1, 2 & 3”, Standard Book House, Delhi, 2004
3. N.N Basak, “Surveying and Leveling”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1994.
4. Kanetkar T.P and S.V. Kulkarni, “Surveying and Leveling- Part I and II”, Vidyarthi Prakasan, Pune, 1997.

B.Tech. (Sem.)

**BUILDING MATERIALS AND PRINCIPLES OF PLANNING**

L	T	P	Cr.
4	0	0	4

**Pre-requisites: NIL**

**Course Educational Objective:** This course aims to study the properties, making and applications of basic civil engineering materials and principles of building bye-laws, NBC regulations and basic principles of planning using the concepts of Architecture. It also covers the properties and applications of different materials required for the construction.

**Course Outcomes:** At the end of the course, the student will be able to:

**CO1:** Understand the preparation process and the composition of construction materials such as Stones, bricks, tiles, cement, and lime (Understanding-L2)

**CO2:** Describe the application of lime and cement for their appropriate usage as building materials based on their specific properties (Understanding-L2).

**CO3:** Identify the different components in a building, specific purpose and their techniques in the construction (Remember-L1).

**CO4:** Recognize the prevailing building bye laws, NBC regulations and the basic principles of architectural planning used in construction practice (Understanding-L2).

**UNIT-I: STONES, BRICKS & TILES**

**Stones and Rocks:** Classification of rocks, Characteristic of good building stone, Dressing of stones, common building stones, their properties, uses.

**Bricks:** Composition, Manufacturing process, Characteristics of good building bricks, Classification, Fly ash bricks, hollow bricks, Applications.

**Tiles:** Characteristics, Types,

**Other materials:** Applications of alternate building materials such as Aluminium, Gypsum, Glass and Bitumen.

**UNIT-II: LIME, CEMENT & MORTAR**

**Lime:** Sources, Lime stone cycle, Properties, Classification, Storage, Precautions in handling.

**Cement:** Constituents, Outline of manufacture of Portland cement, Properties of cements, Functions of ingredients of cement, Consistency and setting of cement, Comparison between cement and lime, Applications of different cements.

**Mortars:** Types, Classification, Characteristics of good mortar, Preparation of mortar, Precautions in the uses of mortars, Applications.

**UNIT-III: BUILDING COMPONENTS & FORMWORK**

**Building Components:** Components of a building, Substructure and superstructure, Importance of foundation, Different types of foundations, Purposes of foundation.

**Concrete:** Purpose in construction, Quality control techniques -batching, -mixing, -transporting, and -curing.

**Formwork:** Requirements of Formwork- Types of Formwork- Scaffolding.

#### **UNIT-IV: BUILDING BYE LAWS AND NBC REGULATIONS**

**Introduction:** Types of buildings, criteria for location and site selection, site plan and its detail, Components of building.

**Building Bye Laws and NBC Regulations:** Objective of bye-laws, Regulation regarding; means of access, lines of building frontages, covered area, floor area ratio, open spaces around buildings, height & sizes of rooms, plinth regulation and sanitation provisions

#### **UNIT-V: PRINCIPLES OF PLANNING**

Different factors affecting planning viz-aspect, prospect, furniture requirement, roominess, grouping, circulation, elegance, privacy, Bubble diagram approach for Residential buildings and non residential buildings.

#### **TEXT BOOKS**

1. Rangwala “Engineering Materials (Material science)” Charotar Publishing House Pvt. Ltd., Edition-2012
2. N. Kumara Swamy and A. Kameswara Rao, “Building Planning and Drawing”, Charotar Publications, 2013.

#### **REFERENCE TEXT BOOKS**

1. P.C Varghese “Building Construction” Prentice Hall of India Private Ltd.
2. R.K. Rajput “Engineering Materials (Including construction materials)”, S.Chand Publications.

B.Tech. (Sem.)

**FUNDAMENTALS OF WATER RESOURCES  
ENGINEERING**

L	T	P	Cr.
4	0	0	4

**Pre-requisites:** Nil

**Course Educational Objectives:**

The course allows the student to understand the fundamentals involved in the water resources, irrigation, and hydraulic structures. The student is exposed to the different types of the above aspects, their significance and applications in civil engineering.

**Course Outcomes:** At the end of the course, the student will be able to:

- CO1: Understand the physical processes in hydrology and estimate the average rainfall over a basin (Understanding – L2)
- CO2: Recognize the different methods of irrigation and its importance (Understanding – L2).
- CO3: Realize the different type of water storage works (Understanding – L2).
- CO4: Illustrate the different types of water resource structures (Understanding – L2)..

**UNIT I: HYDROLOGY BASICS**

**Introduction:** Engineering hydrology and its applications, Hydrologic cycle.

**Precipitation:** Types and forms of precipitation, types of rain gauges, rain gauge network. Presentation of rainfall data, Mean precipitation over an area.

**Abstractions:** Evaporation, factors affecting evaporation, Evapotranspiration, factors affecting evapotranspiration, Infiltration, factors affecting infiltration.

**Runoff:** Factors Affecting Runoff, Components of Runoff, Features of a Hydrograph, base flow separation.

**UNIT-II: GROUNDWATER AND IRRIGATION BASICS**

**Ground water:** Introduction, Occurrence of ground water.

**Irrigation:** Necessity and Importance of Irrigation, advantages and ill effects of Irrigation, types of Irrigation, methods of application of Irrigation water, Duty and delta, factors affecting duty.

**UNIT-III: STORAGE WORKS**

**Storage Works:** Reservoirs –Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, Types of dams, Advantages and disadvantages, factors affecting selection of type of dam, factors governing selection of site for a dam.

**UNIT-IV: DAMS AND DIVERSION HEAD WORKS**

**Gravity dams:** Forces acting, causes of failure, elementary profile and practical profile.

**Earth dam:** Types of Earth dams, causes of failure

**Spillways:** Types of spillways, applications

**Diversion head works:** Types of diversion head works, weirs and barrages, layout of diversion head works, components.

**UNIT-V: IRRIGATION CHANNELS AND OTHER STRUCTURES**

**Irrigation Channels:** Classifications of canals, Cross-section of an irrigation channel, Design parameters.

**Canal Regulation Works:** Regulators-Necessity of Head and cross regulators.

**Canal Falls:** Types of falls and their location, Necessity.

**Canal outlets:** Types of canal outlets, Necessity.

**Cross-Drainage Works:** Types and selection of site for cross drainage works, Necessity.

**TEXT BOOKS:**

1. Punmia.B.C, "Irrigation and Water Power Engineering," Standard Publishers, New Delhi, 1997.
2. Santhosh Kumar Garg, "Irrigation Engineering and Hydraulic Structures," Khanna Publishers, New Delhi, 2003

**REFERENCES**

1. Sharma R.K., "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing company, New Delhi, 1994.
2. Modi.P.N., "Irrigation Water Resources and Water Power Engineering", Standard Book House, Delhi, 1995.
3. Subramanya.K., "Engineering Hydrology", Tata McGraw Hill, New Delhi , 1999
4. Jayarami Reddy.P., "Hydrology", Tata McGraw Hill, New Delhi , 1999

B.Tech. (Sem.)

## INTRODUCTION TO ENVIRONMENTAL ENGINEERING

L	T	P	Cr.
4	0	0	4

**Pre-requisites:** NIL

**Course Educational Objective:** This course is aimed to introduce the students the basic concepts covered under the subject domains involved in Environmental Engineering. Students will be exposed to the basic terminology, impacts of pollutant on receptors, basic principles involved in the control techniques, and the appropriate guidelines issued by Government of India.

**Course Out comes:** At the end of the course, the student will be able to:

- CO1:** Understand the basic terminology involved in the relevant subject domains under Environmental Engineering (Remembering – L1)
- CO2:** Realize the impacts of environmental pollutants on the receptors. (Understanding-L2)
- CO3:** Exposed to the basic principles of operation of various control techniques used to control Environmental pollution. (Understanding – L2)
- CO4:** Apprehend the necessity of pollution prevention and its reduction in the society. (Understanding – L2)

### UNIT-I: WATER SUPPLY ENGINEERING

Hydrologic cycle, Water supply system, Sources of water, Major water quality parameters and their impacts, Indian standards, Fluctuations in water demand, Principle of operation and objectives of basic treatment mechanisms – screens, aeration, sedimentation, coagulation, filtration, disinfection, Water distribution systems, Mass curve, Types of reservoirs, Different types of pipe networks.

### UNIT-II: WASTEWATER ENGINEERING

Basic terminology, Sources of wastewater, Major quality parameters and their impacts, Fluctuations in sewage generation, Water carriage system, Different types of sewers, Principle of operation and objectives of basic treatment mechanisms – screens, grit channel, skimming tank, sedimentation, aeration systems, sludge characteristics, sludge handling – digester, sludge drying beds, dewatering, Dilution principle, Disposal options for wastewater - Indian standards.

### UNIT-III: AIR POLLUTION

Types of air pollutants, sources and properties of major pollutants, Impacts on receptors, Indoor air pollution, Windrose, Lapse rates, Atmospheric stability, Control equipment – Basic principles of operation, working and applicability, Indian standards.

### UNIT-IV: SOLID WASTE MANAGEMENT

Types of wastes, Generation, collection, transfer and transport of solid wastes, Recovery and recycling of solid wastes, Composting, Landfilling, Biogas recovery, Incineration, Pollution problems.

### UNIT-V: NOISE POLLUTION & EIA

Basic terminology, Transmission of sound and its measurement, Leq, Lavg, Noise climate, Impacts of Noise pollution, Control techniques, Traffic noise, Indian standards.



Environmental Impact assessment (EIA) – Concept, Necessity, Environmental Resources and Attributes, Interpretation, Advantages, Indian Guidelines, Case studies.

**TEXT BOOKS:**

1. B.C. Punmia, A.K. Jain and A.K. Jain, Water Supply Engineering, Laxmi Publications. 2<sup>nd</sup> Edition 1995, Reprint 2005.
2. B.C. Punmia, A.K. Jain and A.K. Jain, Waste water Engineering, Laxmi Publications; 2<sup>nd</sup> Edition 1998, Reprint 2014

**REFERENCE BOOKS**

1. S.K. Garg, “Water Supply Engineering”, Khanna Publishers, 11<sup>th</sup> Edition, New Delhi. 1999.
2. S.K. Garg, “Sewage Disposal and Air Pollution Engineering”, Khanna Publishers New Delhi. 2001
3. K.N. Duggal, “Elements of Environmental Engineering”, S. Chand & Company Limited, New Delhi, 2000.

B.Tech. (Sem.)

**FUNDAMENTALS OF TRANSPORTATION  
ENGINEERING**

L	T	P	Cr.
4	0	0	4

**Pre-requisites: NIL**

**Course Educational Objective:** This course aims to know the transportation development in India and significance of individual elements concerned. It covers the technical parameters related to the quality of highway planning, materials, and traffic engineering aspects. Students will also get exposed to fundamentals of airport, railway and harbour engineering and realize their importance in National development.

**Course Outcomes:** At the end of the course, the student will be able to:

- CO1:** Understand the hierarchy of Highway planning in India and the associated Codal Regulations advocated towards pavement construction and traffic engineering.
- CO2:** Recognize the different types of materials, their properties and components used in highway and railway engineering.
- CO3:** Realize the technical parameters related to the meteorological parameters and site selection of highway and railway alignments, airports and harbours.
- CO4:** Demonstrate the safety measures, road networks, railway track drainage systems, and transportation engineering development in the country through case studies.

**UNIT-I: HIGHWAY PLANNING AND ALIGNMENT**

History of road development in India, Jayakar committee recommendations, Road networks, Alignment, Factors, Engineering Surveys for alignment, IRC Classifications of highways based on location and function, Highway cross sectional elements and introduction of Geometric standards, Gradient, Sight Distance, Super elevation, Extra widening, Horizontal curves and vertical curves.

**UNIT-II: TRAFFIC ENGINEERING**

Basic Parameters of Traffic- Volume, -Speed and Density, -Traffic Volume Studies, -Speed studies, -Parking Studies and -Parking characteristics, Road Accidents-Causes, Road Traffic Signs – Types and Specifications, Road markings-Need and Types, Indian scenario.

**UNIT-III: HIGHWAY MATERIALS AND CONSTRUCTION**

Desirable properties of -Sub grade soil, -Aggregates, -Bituminous materials, Principle and Interpretation of tests for highway materials – Abrasion, -Impact Test, -Penetration, -Ductility, -Viscosity, -Binder content and -Softening point Test for bitumen, Construction practices and suitability of different types of roads -Earth, -Gravel, -WBM, -Bituminous and -Cement Concrete roads as per IRC and MORTH specifications.

**UNIT-IV: RAILWAY ENGINEERING**

Role of Indian Railways in National Development, Permanent way, Alignments, Specification of Components – ballast, -sleepers, -rail heads, -Signals, -Junction boxes, -Gauges, Typical cross sections, Embankments and cuttings, Construction and maintenance of permanent way, Drainage pattern, Indian scenario.

**UNIT-V: AIRPORTS AND HARBOR**

Importance of Airports in National Transportation Sector, Site selection survey, Windrose concept, Harbors and Ports – Requirement and classification, Wind and waves, Hydrographic Surveying, Indian scenario.

**TEXT BOOKS:**

1. Khanna,S.K and Justo, “Highway Engineering”, Nem Chand and Bros, Roorkee, 8thedition, 2001.
2. Khanna, S.K and Arora, M.G and Jain, S.S, “Airport Planning and Design”, NewChand and Bros, Roorkee, 2001.
3. Saxena.S.C and Arora. S, “A Text Book of Railway Engineering”, Dhanpat Rai Publications Pvt., Ltd, New Delhi, 2005
4. Bindra.S.P, “A course work in Docks and Harbour Engineering”, Dhanpat Rai Publications Pvt., Ltd, New Delhi, 2003.

**REFERENCE BOOKS/SITES:**

1. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna Publishers Ltd. New Delhi, 2000
2. Rangwala.S.C, “Principles of Railway Engineering”, Charotar Publishing House, Court Road, Anand, 2000
3. Srinivasan. R, “Dock, Harbour and Tunnel Engineering”, Charotar Publishing House, Court Road, Anand, 1989
4. Transportation Engineering-2, NPTEL Video Lectures

B.Tech. (Sem.)

BASICS OF GEO TECHNICAL ENGINEERING

L	T	P	Cr.
4	0	0	4

**Pre-requisites: NIL**

**Course Educational Objective:** The course aims to teach the different properties and classifications of soil and address the various approaches in the site investigation for soil exploration. The course coverage includes the several procedures for determining index and engineering properties of soils and the various procedures for determining the bearing capacity of various.

**Course Out comes:** At the end of the course, the student will be able to:

- CO1: Classify the soils and identify the engineering and index properties of soil (Understand-L2).  
 CO2: Exemplify the shear strength and consolidation properties of soil. (Understanding-L2)  
 CO3: Illustrate the stress distribution of soil subjected to different loading conditions (Understanding-L2).  
 CO4: Recognize the different types of site investigation methods (Understand-L2).  
 CO5: Realize the significance of safe bearing capacity of soil and apply it for different types of foundations (Understanding-L2).

**UNIT –I: TYPES AND PHYSICAL PROPERTIES OF SOIL**

**Soil classification:** Physical properties of soil, Important definitions related to three phase diagram and relationships, Consistency limits and their significance to the field behaviour of soil, Classification of soils based on grain size and plasticity characteristics of soils.

**Soil Compaction:** Concept of compaction, Factors affecting compaction, Field applications.

**Permeability characteristics of soils:** Darcy's Law and its validity, Factors affecting permeability, Permeability in stratified soils, Applications.

**UNIT –II: STRESSES IN SOIL**

**Effective stress in soils:** Terzaghi's effective stress concept for saturated soil deposits, seepage flow and seepage pressure, Quick sand condition and critical hydraulic gradient

**Stress Distribution in soils:** Boussinesq's and Westergaard's theories for point loads, Approximate methods of determination of stresses and its validity, Computation of stresses beneath circular and square loaded areas, Concept of pressure bulb.

**UNIT –III: SHEAR STRENGTH OF SOILS**

Analysis of shear failure, Shear and normal stress at a point, Construction of Mohr's stress circle, Assessment of  $C-\phi$  values, Mohr's coulomb failure criterion, Applications of - Direct shear test, - Triaxial shear test, - Vane shear test, -Unconfined compression test.

**UNIT- IV: COMPRESSIBILITY CHARACTERISTICS OF SOILS**

**Consolidation:** Terzaghi's theory of one-dimensional consolidation, concept of consolidation Calculation of consolidation settlement.

**Site investigation:** Objective of site investigation, Methods of investigation, Planning of Site investigation, Depth of soil exploration, Spacing of bore holes, Standard penetration test and its significance in soil exploration, Requirements of an undisturbed sample.

**Foundations:** Functions and requisites of foundation, Different types of shallow foundations, Applications.

#### **UNIT-V: BEARING CAPACITY AND DEEP FOUNDATIONS**

**Bearing Capacity of soils:** Significance, Factors affecting Bearing capacity of soil, Theoretical coverage of Terzaghi's bearing capacity theory, Plate bearing test and its application, Settlement of foundation

**Deep Foundations:** Pile foundation, Selection of pile foundation, Functions of piles, Types of piles, Friction pile, End bearing pile, Pile grouping.

#### **TEXT BOOKS**

1. Arora. K.R, "**Soil Mechanics and Foundation Engineering**", Standard Publishers & Distributors, NaiSarak, Delhi, 1987
2. Murthy.V.N.S, "**A Text book of Soil Mechanics and Foundation Engineering**", KripaTechnical Consultants, Bangalore, 1992

#### **REFERENCES**

1. Venkataramaiah, "**Geotechnical Engineering**", Wiley Eastern Ltd., Madras, 1993.
2. Punmia. B.C, "**Soil Mechanics and Foundation Engineering**", A.Saurabh and Co.,(P) Ltd., Madras, 1988.
3. Taylor. D.W, "**Fundamentals of Soil Mechanics**", Asia Publishing house, 1948.
4. Terzaghi and Peck, "**Soil Mechanics in Engineering**", Asia Publishing house,

B.Tech. (Sem.)

## ELEMENTS OF QUANTITY ESTIMATION AND VALUATION

L	T	P	Cr.
4	0	0	4

**Pre-requisites:** NIL

### Course Educational Objective:

This course provides a basic knowledge of estimating the quantities in building, roads and canals. The course also provides details about the procedures and practices for writing specifications, preparation of analysis of rates and procedural aspects of valuating the property.

**Course Outcomes:** At the end of the course, the student will be able to:

**CO1:** Understand the basic terminology involved in quantity estimation practices (Understanding-L2).

**CO2:** Compute the quantity estimate for simple structures, roads and canals (Apply-L3).

**CO3:** Develop and write specifications for items of work (Understanding-L2).

**CO4:** Prepare valuation of the property as per the prevailing regulations (Understanding-L2).

### UNIT-I: ESTIMATE OF BUILDINGS

Methods of estimating, Main items of work, Deduction for openings, Degree of accuracy, Units of measurement, Plinth area, Floor Area, Carpet area, Approximate Estimate.

#### METHODS OF BUILDING ESTIMATES

Estimate of steps, Building estimates using simple examples for -Individual wall method, -Centre line method, -Arch masonry calculation.

### UNIT-II: ESTIMATION OF ROADS

Estimate of earthwork, Estimate of pitching of slopes, Estimate of earthwork of road from longitudinal sections, Estimate of earthwork in hill roads.

### UNIT-III: CANAL ESTIMATE AND SPECIFICATIONS

Earthwork in canals–different cases, Estimate of earthwork in irrigation channels.

**Specifications:** Purpose and method of writing specifications, General specifications. Detailed Specifications for Brick work; R.C.C, Plastering, Mosaic Flooring, R.R. Stone Masonry.

### UNIT-IV: PWD ACCOUNTS AND PROCEDURE OF WORKS

Organization of Engineering department, Work charged establishment, Contract, Tender, Tender notice, Tender Schedule, Earnest money, Security money, Measurement book, Administrative approval, Technical sanction, Plinth area estimate, Revised Estimate, Supplementary estimate.

### UNIT-V: VALUATION

Cost, Price & value, Methods of valuation, Out goings, Depreciation, Methods for estimating cost depreciation, Valuation of building.

**Miscellaneous Topics:** Gross income, Net income, Scrap value, Salvage value, Obsolescence, Annuity, Capitalized value, Years purchase, Life of structures, Sinking fund, Standard rent, Process of fixing standard rent, Mortgage.

**TEXT BOOKS**

1. B.N. Dutta “Estimating & Costing in Civil Engineering”, U. B. S. Publishers & Distributors, New Delhi.2002
2. S.C. Rangwala “Valuation of Real properties”, Charotar Publishing House, 9<sup>th</sup> Edition, 2015.

**REFERENCES**

1. M Chakraborty, “Estimating, Costing Specification and Valuation”, 2006

**APPLIED MECHANICS AND STRENGTH OF MATERIALS**

**B.Tech. (Sem.)**

L	T	P	Cr.
4	0	0	4

**Pre-requisites:** Physics

**Course Educational Objective:** This course comprises the basic knowledge on analysis of structures based fundamentals. The coverage includes equilibrium of planar force systems, free body diagrams, conditions for equilibrium, analysis of framed structures, Stresses in beams, bending theory, development of shear force and bending moment diagrams, Deflections in beams and buckling of columns.

**Course Outcomes:** At the end of the course, the student will be able to:

- CO1:** Calculate the unknown forces in members of planar systems by constructing free body diagrams and applying static equilibrium conditions. (Apply - L3)
- CO2:** Analyze for the internal forces in the members of a pin jointed perfect frames subjected to horizontal, and vertical loads. (Apply - L3)
- CO3:** Classify the stresses and strains in an object, compute and analyze them (Apply - L3)
- CO4:** Construct the bending stress for different cross sections and shear force and bending moment diagrams (Apply-L3)
- CO5:** Evaluate the buckling capacity of columns, deflections in the beams and compute the corresponding values (Apply-L3)

**UNIT – I: Systems of Forces**

Parallelogram law-forces and components- Resultant of Coplanar Concurrent Forces– Moment of Force, Couples and Resultant of Force Systems, Free Body Diagrams, Equations of Equilibrium, Lami’s Theorem, Equilibrium of planar systems.

**UNIT-II: Analysis of Perfect Frames**

Types of Frames- Assumptions for forces in members of a perfect frame, Boundary conditions, Method of joints, Method of sections for simple 2D framed structures.

**UNIT-III: Stress and Strain**

Concept of stress-strain, Tensile test, Poisson ratio, Elastic constants, Temperature stresses

**Unit-III: Bending and Shear stresses**

**Bending stresses:** Different types of loadings on beams, Bending theory, Shear force and Bending moments for point and udl loads, Pure bending stresses in simple objects

**Unit-IV: Deflections due to Bending and Buckling**

**Bending:** Moment-curvature relationship, Superposition principle, Load-Deflection differential equation, Applications and simple problems

**Buckling:** Concept, Euler’s theory, Long columns, Axial load buckling.

**Text Books**

1. R.K. Rajput, “Engineering Mechanics”, Dhanpat Rai and Sons, New Delhi.



2. B.C. Punmia, A.K. Jain, and A.K. Jain, “Strength of materials and Theory of structures”, Vol.I, & II., XI edition, Laxmi Publications (P) Ltd, New Delhi, 2002.
3. S.S. Bhavikatti, “Strength of Materials”, Vikas Publishing House (P) Ltd., New Delhi, Seventh edition, 2002.

**Reference Books**

1. S. C. Crandall, N.C. Dahl, T.J. Lardner and M.S. Sivakumar, “Mechanics of Solids”, McGraw Hill Publications, New Delhi, India
2. R.K. Rajput, “Strength of Materials, S. Chand & Co, New Delhi.
3. R.K. Bansal, “Introduction to text book of Strength of Materials”, Laxmi Publications, 2004.