

**UNIVERSITY DEPARTMENTS**  
**ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025**  
**REGULATIONS – 2008**  
**CURRICULUM FROM III & IV SEMESTERS FOR**  
**B.E CIVIL ENGINEERING**  
**SEMESTER – III**

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MA 92 11	<a href="#">Mathematics – III</a>	3	1	0	4
CE 92 01	<a href="#">Strength Of Materials-I</a>	3	1	0	4
CE 92 02	<a href="#">Fluid Mechanics</a>	3	1	0	4
CE 92 03	<a href="#">Surveying- I</a>	3	0	0	3
AG 92 11	<a href="#">Engineering Geology</a>	3	0	0	3
<b>PRACTICAL</b>					
CE 92 04	<a href="#">Strength Of Materials Laboratory</a>	0	0	3	2
CE 92 05	<a href="#">Computer Aided Building Drawing</a>	0	0	4	2
CE 92 06	<a href="#">Survey Practicals - I</a>	0	0	4	2
	<b>TOTAL</b>	<b>15</b>	<b>3</b>	<b>11</b>	<b>24</b>

**SEMESTER – IV**

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
CE 92 51	<a href="#">Strength Of Materials – II</a>	3	0	0	3
CE 92 52	<a href="#">Construction Techniques And Practices</a>	3	0	0	3
CE 92 53	<a href="#">Applied Hydraulics Engineering</a>	3	1	0	4
CE 92 54	<a href="#">Surveying – II</a>	3	0	0	3
CE 92 55	<a href="#">Soil Mechanics</a>	3	0	0	3
GE 90 21	<a href="#">Environmental Science And Engineering</a>	3	0	0	3
<b>PRACTICAL</b>					
CE 92 56	<a href="#">Hydraulics Engineering Laboratory</a>	0	0	3	2
CE 92 57	<a href="#">Survey Practicals - II</a>	0	0	4	2
	<b>TOTAL</b>	<b>18</b>	<b>1</b>	<b>7</b>	<b>23</b>





**OBJECTIVE:**

Enable the student to understand the behaviour of deformable structural elements, subjected to different types of loadings

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 12**

Rigid and deformable bodies – Stability, strength and stiffness - Axial and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Biaxial state of stress – Elastic Constants - Stresses and deformation of thin cylindrical and spherical shells – Stresses at a point – Stress tensor - Stresses on inclined planes – Principal stresses and principal planes – Mohr’s circle of stress.

**UNIT II ANALYSIS OF PLANE TRUSSES 12**

Stability and equilibrium of plane frames – perfect frames - types of trusses – Analysis of forces in truss members – Method of joints – Method of tension co-efficient – Method of sections.

**UNIT III BENDING OF BEAMS 12**

Beams – types and transverse loading on beams – shear force and bending moment in beams – Cantilever beams – Simply supported beams and over-hanging beams - Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Leaf springs – Flitched beams – Shear stress distribution.

**UNIT IV TORSION 12**

Theory of simple torsion - Stresses and deformation in circular and hollow shafts – Stepped shafts – Shafts fixed at both ends – Stresses and deflection in helical springs.

**UNIT V DEFLECTION OF BEAMS 12**

Double Integration method – Macaulay’s method – Area moment method – Conjugate beam method for computation of slopes and deflections in determinate beams.

**L: 45 + T: 15 TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Egor. P.Popov “ Engineering Mechanics of Solids” Prentice Hall of India, New Delhi 2001
2. Vazirani, N, Ratwani, M. “Analysis of Structures” Khanna Publishers, New Delhi 2001
3. Rajput, R.K “Strength of Materials”, S Chand & Company Ltd., New Delhi 2006

**REFERENCES:**

1. Irwing H.Shames, James M.Pitarresi, “Introduction to Solid Mechanics”, Prentice Hall of India, New Delhi, 2002
2. Roger T.Fenner, “ Mechanics of Solids”, ELBS, Oseny Mead, Oxford, 1990
3. Malhotra, D.R. Gupta, H.C., “The Strength of Materials”, Satya Prakashan (Tech. India Publications), New Delhi, 1995.
4. Beer.F.P. & Johnston.E.R.“Mechanics of Materials”, Tata McGraw Hill, New Delhi 2004.
5. Elangovan.A., “Thinmavisaiyiyal” (Mechanics of Solids in Tamil), Anna University,1995.

**OBJECTIVE:**

The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static conditions. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy. 2. The applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes is studied.

**UNIT I FLUIDS PROPERTIES AND FLUID STATICS 12**

Scope of fluid mechanics - Definitions of a fluid - Methods of analysis - Dimensions and units - viscosity, density, perfect gas, vapour pressure and surface tension - Basic equation of fluid statics - Pressure measurements - Manometers. - Forces on plane and curved surfaces - Buoyancy and floatation - Stability of floating bodies - Relative equilibrium.

**UNIT II BASIC CONCEPTS OF FLUID FLOW 12**

(a) Kinematics – Methods of describing fluid motion - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials - Flow nets; (b) Dynamics - Dimensional Concepts of System and Control volume - Application of control volume to continuity, energy and momentum - Euler's equation of motion along a stream line - Bernoulli's equation - Applications to velocity and discharge measurements - Linear momentum equation and moment-of-momentum equations and their applications.

**UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 12**

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies. Distorted Models.

**UNIT IV INCOMPRESSIBLE VISCOUS FLOW 12**

Laminar flow between parallel plates, and pipes - Development of laminar and turbulent flows in pipes - Reynolds experiment - Darcy-Weisbach equation - Moody diagram - Major and minor losses of flow in pipes - Pipes in series and in parallel.

**UNIT V BOUNDARY LAYERS 12**

Definition of boundary layers - Displacement, momentum and energy thickness - Laminar and turbulent boundary layers - Momentum integral equation - Separation of boundary layer. Drag and Lift. Lift characteristics of airfoils. Induced drag. Polar Diagram.

**L: 45 + T: 15 TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Streeter, V.L. and Wylie, E. B., Fluid Mechanics. McGraw Hill, New York, 1983
2. John F.Douglas, Janusz M. Gasiorek and John A.Swaffield, PEARSON Education, India, 2003

## REFERENCES

1. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 1995.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. New Delhi, 2000.
3. Roberson J.A and Crowe C.T., Engineering Fluid Mechanics. Jaico Books Mumbai, 2000.

**OBJECTIVE:**

The objective of this course is to introduce the principles of surveying, various methods and applications to Civil Engineering projects.

**UNIT I INTRODUCTION AND CHAIN SURVEYING 8**

Definition - Principles - Classification - Field and office work – Precision and Accuracy - Scales - Conventional signs - Survey instruments - Ranging and chaining - Reciprocal ranging - Setting perpendiculars - well - conditioned triangles - Traversing - Plotting - Enlarging and reducing figures.

**UNIT II COMPASS SURVEYING AND PLANE TABLE SURVEYING 7**

Prismatic compass - Surveyor's compass - Bearing - Systems and conversions - Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of error - Plane table instruments and accessories - Merits and demerits - Methods - Radiation - Intersection - Resection - Traversing.

**UNIT III LEVELLING 12**

Level line - Horizontal line - Levels and Staves - Spirit level - Sensitiveness - Bench marks - Temporary and permanent adjustments - Fly and check levelling - Booking - Reduction - Curvature and refraction - Reciprocal levelling - Longitudinal and cross sections - Plotting - Calculation of areas and volumes - Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume - Capacity of reservoirs.

**UNIT IV THEODOLITE SURVEYING 8**

Theodolite - Vernier and microptic - Description and uses - Temporary and permanent adjustments of vernier transit - Horizontal angles - Vertical angles - Heights and distances - Traversing - Closing error and distribution - Gale's tables - Omitted measurements.

**UNIT V SURVEY APPLICATIONS 10**

Reconnaissance, preliminary and location surveys for engineering projects - Lay out - Setting out works - Route Surveys for highways, railways and waterways - Curve ranging - Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite - Compound and reverse curves - Transition curves - Functions and requirements - Setting out by offsets and angles - Vertical curves - Sight distances - Mine Surveying - instruments - Tunnels - Correlation of under ground and surface surveys - Shafts - Adits.

**TOTAL: 45 PERIODS****TEXTBOOKS:**

1. Bannister A. and Raymond S., Surveying, ELBS, Sixth Edition, 1992.
2. Heribert Kahmen and Wolfgang Faig, Surveying, Walter de Gruyter, 1995.
4. Kanetkar T.P., Surveying and Levelling, Vols. I and II, United Book Corporation, Pune, 2002.
5. Punmia B.C. Surveying, Vols. I II and III, Laxmi Publications, 2005.

**REFERENCES:**

1. Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition, 1971.
2. James M.Anderson and Edward M.Mikhail, Introduction to Surveying, McGraw Hill Book Company, 1985.
3. Schofield,W., Engineering Surveying, Butterworth –Heinemann, London, 5<sup>th</sup> Edition, 2001



**OBJECTIVES:**

To study the properties of materials when subjected to different types of loading.

1. Tension test on mild steel / tor steel rod (Tensile strength-Density-Proof Stress- Stress Strain Curve -Youngs Modulus-)
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen
6. Hardness test on metals
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring
10. Tests on bricks, concrete cubes and tiles - Demonstration only

**TOTAL: 45 PERIODS****REFERENCE:**

1. Relevant Indian Standards

**OBJECTIVES:**

Building drawing in accordance with development and control rules satisfying orientation and functional requirements for the following:

1. An approach to planning – Function – Utility – People and their requirements – Extract from Building Rules and Bye- Laws’ – Planning of Residential and Public buildings.
2. Complete joinery Details (Paneled and Glazed Doors and Windows) & Codal Provisions.
3. Buildings with load bearing walls (R.C.C roof).
4. Buildings with sloping roof (R.C.C roof and Tiled roof).
5. R.C.C. framed structures.
6. Industrial buildings – North light roof structures – King Post Truss

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Sikka V.B. “A Course in Civil Engineering Drawing” 4<sup>th</sup> Edition, S.K.Kataria and Sons, New Delhi, 1998.
2. George Omura, “Mastering in Autocad 2002”- BPB Publications, New Delhi, 2002

**REFERENCES:**

1. M.G.Shah, C.M.Kale and S.Y.Patki, “Building Drawing with an Integrated Approach to Built Environment”, Tata McGraw Hill Publishers Limited ,New Delhi, 2004.
2. B.P.Verma, “Civil Engineering Drawing and House Planning”, Khanna Publishers, New Delhi, 1989.
3. K.Venugopal, “Building Drawing”, Wiley Eastern Limited, Madras, 2004
4. Murugesan, Padmini Subbarayan, “Civil Engineering Drawing I”, Pratheeba Publishers, Coimbatore, 1984.
5. K.V.Natarajan, “Engineering Drawing (BIS Specifications)”, Dhanalakshmi Publishers, 2002.
6. Relevant IS Codes.

**OBJECTIVE:**

The objective of this course is to train the students to acquire skill in operation of various survey instruments and to obtain accurate results.

**1. CHAIN AND COMPASS SURVEYING**

Ranging and Chaining – Offsets - Traversing.

**2. PLANE TABLE SURVEYING**

Radiation – Intersection – Resection – Traversing

**3. LEVELLING**

Study of levels and levelling staff - Fly levelling using Dumpy level and Tilting level – Check Levelling.

**4. THEODOLITE SURVEYING**

Study of theodolites - Measurement of angles by reiteration and repetition - Measurement of vertical angles.

**TOTAL: 60 PERIODS**

**OBJECTIVE:**

To learn the computation of deflection of beams and trusses using energy principles, analysis of indeterminate beams and columns, state of stress in three dimensions.

**UNIT I ENERGY PRINCIPLES 10**

Strain energy and strain energy density – Strain energy in axial force - shear, flexure and torsion – Castigliano’s and Engesser’s theorems – Principle of virtual work – Application of energy theorems for computing deflections in beams, pin jointed frames – Maxwell’s reciprocal theorem.

**UNIT II INDETERMINATE BEAMS 9**

Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading — Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams

**UNIT III COLUMNS 8**

Behaviour of short and long columns. Euler’s theory of long columns – Critical loads for prismatic columns with different end conditions - Rankine-Gordon Formula - Eccentrically loaded long columns -Eccentrically loaded short columns - middle third rule – core of section.

**UNIT IV STATE OF STRESS IN THREE DIMENSIONS 8**

Determination of principal stresses and principal planes – volumetric strain – Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – Application in analysis of stress, load carrying capacity and design of members. Interaction problems - interaction curves.

**UNIT V ADVANCED TOPICS 10**

Unsymmetrical bending of beams - symmetrical and unsymmetrical sections, shear centre – stresses on curved beams for simple solid sections – Winkler Bach Formula – Thick cylinders – Compound cylinders - Residual stresses – Stress concentration – Fatigue and fracture.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Irwing H.Shames, James M.Pitarresi, “Introduction to Solid Mechanics, Prentice Hall of India, New Delhi 2002.
2. Rajput.R K - Strength Of Materials - S.Chand & Co, New Delhi, 1996
3. Srinath, L.S. “Advanced Mechanics of Solids”, Tata McGraw Hill Publishing Company Ltd. New Delhi 2004
4. Bedi, D.S., “Strength of Materials”, Khanna Book Publishing Co. (P) Ltd. Delhi 2000

## REFERENCES:

1. Malhotra, D.R. Gupta, H.C., "The Strength of Materials", Satya Prakashan, No. (Tech. India Publications), New Delhi 1995.
2. William A.Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, McGraw Hill International Editions, Third Edition, 1994.
3. Punmia, B.C, Ashok Kumar Jain,, Arun Kumar Jain " Strength of Materials and Theory of Structures" Volume I and II, Lakshmi publications, New Delhi, 1998
4. Andrew Pytel Ferdinard L.Singer, "Strength of Materials", International Student Edition (ISE Reprint), Harper Collins College Division, 1999.
5. Timeshenko, S.P. & Young D.H., "Elements of Strength of Materials, V Edition, affiliated East-West Press Pvt. Ltd. New Delhi 1998.

**OBJECTIVE:**

To make aware of the various techniques and practices on various stages of concreting, masonry works, service requirements, rehabilitation works and careful selection of suitable construction equipment.

**UNIT I CONCRETE TECHNOLOGY 12**

High grade cements – Advances in manufacture of cement –concrete chemicals and applications – concepts of mix design – statistical quality control of concrete – Mix Design as per BIS and ACI methods – Process of manufacture of concrete – Batching – Mixing – Transporting – Placing – Compaction of concrete – Curing – Finishing - Testing of fresh and hardened concrete – Non-destructive testing.

**UNIT II CONSTRUCTION PRACTICES 10**

Types of Foundations – Stones masonry – Brick masonry – Composite masonry – Cavity walls – Flooring – Formwork – Centering and Shuttering sheet piles – Slip and moving forms – Roofs and roof covering – Joints in Concrete – Plastering and Pointing – Shoring – Scaffolding – Under pinning – Submerge Structures.

**UNIT III SERVICE REQUIREMENTS 8**

Painting, Distemping and white washing – Fire Protection – Thermal insulation – Ventilation and air conditioning – Acoustics and Sound insulation – Damp proofing – Termite proofing.

**UNIT IV REPAIR AND REHABILITATION WORKS 7**

Causes of damage and deterioration in masonry and concrete structures – Symptoms and Diagnosis – Common types of repairs.

**UNIT V CONSTRUCTION EQUIPMENT 8**

Selection of equipment for earthwork, concreting, material hardening and erection of structures – Dewatering and pumping equipments.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. P.C.Varghese, "Building Constructions ", Prentice Hall, 2007
2. M.S.Shetty, "Concrete Technology" (Theory and Practice), S.Chand & Company Ltd., 2003.
3. A.R.Santhakumar, "Concrete Technology" Oxford IBH, 2006.

**REFERENCE BOOKS**

1. Arora, S.P. and Bindra, S.P., "Building Construction", Dhanpat Rai and Sons, 1997
2. Punmia, B.C., "Building Construction", Laxmi Publications (P) Ltd., 1993
3. Peurifoy, R.L. "Form work for Concrete Structures", McGraw Hill Book Co., 1999.

4. Gambhir, M.L., "Concrete Technology", Tata McGraw Hill Publishing Company, 1995.
5. Neville A.M., "Properties of Concrete" fourth edition, Pearson Education Ltd. 2004

**CE 92 53**

**APPLIED HYDRAULICS ENGINEERING**

**L T P C**  
**3 1 0 4**

**OBJECTIVE:**

To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

**UNIT I OPEN CHANNEL FLOW 12**  
Steady uniform flow - Best hydraulic sections for uniform flow - Specific energy and specific force.

**UNIT II STEADY GRADUALLY VARIED FLOWS 13**  
Dynamic equation - Water surface flow profile classifications - Profile determination by graphical method, direct step method and standard step methods.

**UNIT III RAPIDLY VARIED FLOWS 11**  
Hydraulic jumps - Types - Energy dissipation - Surges and surge through channel transitions.

**UNIT IV TURBO MACHINES 13**  
Turbines – Classification - Reaction turbines – Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbines - Performance of turbines - Similarity laws; Centrifugal pumps - Minimum speed to start the pump – NPSH - Cavitation in pumps - Operating characteristics - Multistage pumps.

**UNIT V POSITIVE DISPLACEMENT PUMPS 11**  
Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps.

**L: 45 + T:15 TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Subramanya K., Flow in open channels. Tata McGraw Hill, New Delhi 1994.
2. Jain. A.K., Fluid Mechanics. Khanna Publishers, Delhi. 1996.

**REFERENCES**

1. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 1959.
2. Mays L. W., Water Resources Engineering. John Wiley and Sons (WSE), New York, 2004.
3. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 1995
4. Srivastava. R., Flow through open channels Oxford University Press, New Delhi, 2008.

**OBJECTIVE:**

The objective of this course is to equip the students with advanced methods of surveying and to introduce elements of photogrammetry, electromagnetic distance measurement, cartography, hydrographic surveying and cadastral surveying.

**UNIT I TACHEOMETRIC SURVEYING 6**

Tacheometric systems - Tangential, stadia and subtense methods - Stadia systems - Horizontal and inclined sights - Vertical and normal staffing - Fixed and movable hairs - Stadia constants - Anallactic lens - Subtense bar.

**UNIT II CONTROL SURVEYING 8**

Working from whole to part - Horizontal and vertical control methods - Triangulation - Signals - Base line - Instruments and accessories - Corrections - Satellite station - Reduction to centre - Trigonometrical levelling - Single and reciprocal observations - Modern trends.

**UNIT III SURVEY ADJUSTMENTS 8**

Errors - Sources, precautions and corrections - Classification of errors - True and most probable values - weighted observations - Method of equal shifts - Principle of least squares - Normal equation - Correlates - Level nets - Adjustment of simple triangulation networks.

**UNIT IV ASTRONOMICAL SURVEYING 11**

Celestial sphere - Astronomical terms and definitions - Motion of sun and stars - Apparent altitude and corrections - Celestial co-ordinate systems - Different time systems - Nautical almanac - Star constellations - Practical astronomy - Field observations and calculations for azimuth.

**UNIT V MISCELLANY 12**

Electromagnetic distance measurement - Carrier waves - Principles - Instruments - Trilateration - Total Station - GPS Surveying - Hydrographic Surveying - Tides - MSL - Sounding and methods - Location of soundings and methods - Three point problem - Strength of fix - Sextants and station pointer - River surveys - Measurement of current and discharge - Cadastral surveying - Definition - Uses - Legal values - Scales and accuracies.

**TOTAL: 45 PERIODS****TEXTBOOKS:**

1. Bannister A. and Raymond S., Surveying, ELBS, Sixth Edition, 1992.
2. Heribert Kahmen and Wolfgang Faig, Surveying, Walter de Gruyter, 1995.
3. Kanetkar T.P., Surveying and Levelling, Vols. I and II, United Book Corporation, Pune, 1994.
4. Punmia B.C., Surveying, Vols. I, II and III, Laxmi Publications, 1989.

## REFERENCES:

1. Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition, 1971.
2. James M.Anderson and Edward M.Mikhail, Introduction to Surveying, McGraw Hill Book Company, 1985.
3. Wolf P.R., Elements of Photogrammetry, McGraw Hill Book Company, Second Edition, 1986.
4. Robinson A.H., Sale R.D. Morrison J.L. and Muehrche P.C., Elements of Cartography, John Wiley and Sons, New York, Fifth Edition, 1984.
5. Schofield,W., Engineering Surveying, Butterworth –Heinemann, London, 5<sup>th</sup> Edition, 2001

**OBJECTIVE:**

To impart knowledge on behaviour and the performance of saturated soil. At the end of this course student attains adequate knowledge in assessing both Physical and Engineering behaviour of soils, mechanism of stress transfer in two-phase systems and stability analysis of slope.

**UNIT I SOIL CLASSIFICATION AND COMPACTION 9**

Nature of soil – phase relationships – Soil description and classification for engineering purposes, their significance – BIS Classification system – Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.

**UNIT II SOIL WATER AND WATER FLOW 7**

Soil water – static pressure in water – capillary stress – Permeability measurement in the laboratory and field – pumping in and pumping out tests – factors influencing permeability of soils – Seepage – introduction to flow net – Simple problems (sheet pile and wier).

**UNIT III STRESS DISTRIBUTION AND SETTLEMENT 11**

Effective stress concepts in soils – Stress distribution in soil media – Boussinesq theory - Use of Newmarks influence chart – Components of settlement — immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – computation of rate of settlement-  $\sqrt{t}$  and  $\log t$  methods - Factors influencing settlement characteristics of soils.

**UNIT IV SHEAR STRENGTH 9**

Shear strength of cohesive and cohesionless soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Cyclic loading – Pore pressure parameters.

**UNIT V SLOPE STABILITY 9**

Slope failure mechanisms – Types of slopes and infinite slopes – finite slopes – Total stress analysis for saturated clay – Fellenius method - Friction circle method – Use of stability number - slope protection measures.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Murthy, V.N.S., "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New Delhi., 2007.
2. Gopal Ranjan and Rao A.S.R. "Basic and applied soil mechanics", Wiley Eastern Ltd. New Delhi (India) 2000.
3. Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2002.

**REFERENCES:**

1. McCarthy D.F. "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2002.
2. Coduto, D.P. Geotechnical Engineering – Principles and practices, Prentice Hall of India Pvt.Ltd. New Delhi,2002.
3. Das, B.M. Principles of Geotechnical Engineering". Thomson Brooks/coles, Singapore, 5<sup>th</sup> Edition, 2002.

**AIM**

To create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

**OBJECTIVE**

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

### **UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2<sup>nd</sup> edition, Pearson Education, 2004.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

#### **REFERENCE BOOKS**

1. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

**1. FLOW MEASUREMENT**

Calibration of Flow Measuring instruments like Venturimeter, Orificemeter and Rotometer

**2. LOSSES IN PIPES**

Estimation of major and minor losses in pipes

**3. PUMPS**

Performance characteristics of pumps

**4. TURBINES**

Performance characteristics of turbines

**5. WATER MANAGEMENT PARAMETERS**

Recording and Non-Recording raingauges, pan evaporation, measurements, Double ring infiltrometer test and estimation of water management parameters such as soil water, field capacity, infiltration capacity.

**TOTAL: 45 PERIODS**

**REFERENCE:**

1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004.

**OBJECTIVE:**

The objective of this course is to train the students to acquire skill in making precise measurements and obtaining accurate results.

1. Setting out works - Foundation marking - Simple curve (right/left-handed) – Transition curve.
2. Theodolite Traversing
3. Heights and Distances – Triangulation problem – Single plane method
4. Tacheometry - Tangential system - Stadia system - Subtense system.
5. Field observation on SUN to calculate azimuth.
6. Experiments on Total Station – GPS.
7. Study of Micro Optic Theodolite - Digital Theodolite.

**TOTAL: 60 PERIODS**