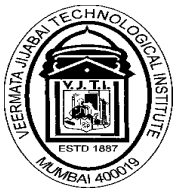
VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
(VJTI)
MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)



Curriculum

(Scheme of Instruction & Evaluation and Course contents)

(Revision 2014)

For

Second Year

Of

Four Year Undergraduate Programmes Leading to

Bachelor of Technology (B Tech) Degree in Civil Engineering

Implemented from the batch admitted in Academic Year 2014-15

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Autonomous Institute affiliated to University of Mumbai)

Curriculum
(Scheme of Instruction & Evaluation and Course contents)

For
Second Year
of
Four Year Undergraduate Programmes Leading to
Bachelor of Technology (B Tech)
in

101 Civil Engineering

Programme Outcomes (PO)

Engineering Graduates will be able to:

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Educational Objectives (PEO)

PEO1	Develop a professional to pursue career as a Civil Engineer with adequate technical knowledge and skills while using modern tools for problem solving and exhibiting qualities of communication, team membership, and leadership.
PEO2	Develop ability to practice ethically focusing on social relevance, environmental sustainability, optimal solutions and safety of stakeholders.
PEO3	Develop abilities of lifelong learning to continuously strive to enhance decision making abilities to investigate, design and develop complex facilities.

Programme Specific Outcomes (PSO)

PSO1	Able to analyze various Civil Engineering structures and systems by using basic and advanced technologies.
PSO2	Able to design civil engineering facilities and their elements and also use of modern software tools for the same.
PSO3	Able to plan, monitor and supervise construction activities to complete civil engineering facilities satisfactorily.
PSO4	Able to practice as construction professional through ethical practice while focusing on sustainability and economy.

Veermata Jijabai Technological Institute
B Tech. Civil Engineering
Scheme of Instruction and Evaluation

SEMESTER III

Scheme of Instruction						Scheme of Evaluation				
SN	Course Code	Course Title	L	T	P	Credits	TA	IST	ESE	ESE hours
1	MA2001S	Mathematics for Civil Engineers	3	1	0	4	10	30	60	3
2	SE2002T	Mechanics of Solids	3	0	0	3	10	30	60	3
	SE2002P	Mechanics of Solids Laboratory	0	0	2	1	100% CIE			
3	CE2001T	Construction Engineering and Infrastructure Projects	3	0	0	3	10	30	60	3
	CE2001P	Construction Engineering Laboratory	0	0	2	1	100% CIE			
4	CE2002T	Fluid Mechanics	3	1	0	4	10	30	60	3
	CE2002P	Fluid Mechanics Laboratory	0	0	2	1	100% CIE			
5	CE2003T	Geomatics	3	0	0	3	10	30	60	3
	CE2003P	Geomatics Laboratory	0	0	3	1.5	100% CIE			
6	CE2004L	Engineering Geology Laboratory	0	0	3	1.5	100% CIE			
7	CE2005A	Professional Ethics	2	0	0	0				
		TOTAL	17	2	12	23				
				31						

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In semester tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

Veermata Jijabai Technological Institute
B Tech. Civil Engineering
Scheme of Instruction and Evaluation

SEMESTER IV

Scheme of Instruction						Scheme of Evaluation				
SN	Course Code	Course Title	L	T	P	Credits	TA	IST	ESE	ESE hours
1	MA2011S	Statistics and Vector Calculus	3	1	0	4	10	30	60	3
2	SE2003S	Structural Analysis – I	3	1	0	4	10	30	60	3
3	SE2004T	Soil Mechanics	3	0	0	3	10	30	60	3
	SE2004P	Soil Mechanics Laboratory	0	0	3	1.5	100%CIE			
4	CE2006S	Construction Techniques	3	0	0	3	10	30	60	3
5	CE2013S	Environmental Studies	3	0	0	3	10	30	60	3
6	CE2007T	Applied Hydraulics	3	0	0	3	10	30	60	3
	CE2007P	Applied Hydraulics Laboratory	0	0	3	1.5	100%CIE			
7	CE2008L	Geospatial Laboratory	0	0	2	1	100%CIE			
8	CE2009L	Construction Material Laboratory	0	0	2	1	100%CIE			
9	CE2010A	Engineering Economics	2	1	0	0				
		TOTAL	20	3	10	25				
				33						

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In semester tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

Programme Name	Bachelor of Technology in Civil Engineering	Semester – III
Course Code	MA2001S	
Course Title	Mathematics for Civil Engineers	
Prerequisites	Mathematics	

Course Outcomes

After completion of course students will be able to:

1. Demonstrate knowledge of Matrix calculations as an elegant and powerful mathematical language in connection with rank of a matrix, linear system of equations, linear dependence and independence
2. Solve successive differentiation, Leibnitz theorem and mean value theorems.
3. Demonstrate the ability of using Laplace Transform and Fourier Series in solving Ordinary Differential Equations and Partial Differential Equations
4. Use basic knowledge of Laplace Transform. Fourier Series, Bessel Functions, Vector Algebra and Complex Variables in solving real problems.

Course Contents

Module-1 : Laplace Transforms

1.1 Functions of bounded variation

1.2 Linear property of Laplace transforms.

1.3 Laplace transforms of standard functions such as $1, t^n, e^{at}, sinat, cosat, sinhat, \text{erf}(t)$.

1.4 Change of scale property ,First shifting theorem, Second shifting theorem $L\{t^n f(t)\}, L\{f'(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\left\{\frac{d^n}{dt^n} f(t)\right\}$

1.5 Inverse Laplace transform using linear property, theorems, partial fractions and convolution theorem.

1.6 Unit step functions, Heaviside, Dirac delta functions, Periodic functions and their Laplace transforms.

1.7 Application to solve ordinary differential equations with one dependent variable.

Module-2: Matrices

2.1 Eigen values Eigen vectors of square matrix.

2.2 Cayley Hamilton's theorem and function of square matrix.

2.3 Similarity Matrices, Modal Matrix

2.4 Function of Square a Matrix,Minimal Polynomial and Minimal Equation of a Matrix Derogatory and Non-Derogatory Matrices.

2.5 Quadratic forms : Linear Transformation , Linear Transformation of Quadratic forms , Congruence of a square Matrix ,Reduction to Canonical form under Congruent and

Orthogonal Transformation of Quadratic form , rank , index ,signature and class value of Quadratic form.

Module-3: Fourier Series and Integrals

3.1 Orthogonal orthonormal functions, Expression for a function in series of orthogonal functions.

3.2 Dirchlet's conditions.

3.3 Fourier series of periodic function with period, Dichlet's theorem, even and odd functions.

3.4 Half range expansions, Parseval's relations.

3.5 Complex form of Fourier series. Fourier integral.

Text Books

1. Advanced Engineering Mathematics, H K Dass, S Chand & Co. Ltd, 3rd Edition, 2006
2. Higher Engineering Mathematics, Dr B S Grewal, Khanna Publications, 39th Edition,2005
3. A Text Book of Engineering mathematics,N.P.Bali & Dr.Manish Goyal, Eight Edition ,Laxmi Pubilcation.

Recommended Reading

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Ltd
2. Engineering Mathematics for semester III, T Veerrajan, Tata McGraw Hill.
3. Matrices, A R Vasishtha , 2005.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – III
Course Code	SE2001T	
Course Title	Mechanics of Solids	
Prerequisites	Applied Mechanics Course	

Course Outcomes

After completion of this course students will be able to:

1. Evaluate stress - strain behavior and other physical properties of material.
2. Apply the principles of axial and bending action for stress analysis of structural elements.
3. Apply the principles of shear and torsion action for the stress analysis of structural elements
4. Determine the stress and strain in special structural element.
5. Plot Axial force, Shear Force and Bending Moment diagram for determinate structural elements.

Course Contents

1. Simple Stress and Strain

Definitions of stress, strain, modulus of elasticity, modulus of rigidity, bulk modulus, yield stress, ultimate stress, factor of safety and shear stress. Poisson ratio, bars of varying sections, stress due to self weight. Composite sections, temperature stresses.

2. Shear Force and Bending Moment

Axial force, shear force and bending moment diagram for statically determinate beams and frames.

3. Theory of Pure Bending

Flexure formula for straight beams, moment of inertia, product of inertia and polar moment of inertia of plane areas, principal axes of inertia, moments of inertia about principal axes, transfer theorem, flitched beams. Unsymmetrical bending. Flexural stresses due to bending in two planes for symmetrical sections, bending of unsymmetrical sections.

4. Shear Stress in Beams

Distribution of shear stress across plane sections, shear connectors. Shear center of thin walled sections such as angle, tee, channel and I sections.

5. Simple Theory of Torsion

Torsion of circular solid and hollow shafts, stresses in shaft when transmitting power, close-coiled helical springs under axial load.

6. Bending Moment Combined with Axial Loads

Application to member's subjected to eccentric loads, core of a section, problems on chimneys, retaining walls etc., involving lateral loads.

7. Thin Cylinder and Spherical Shell

Stresses and strains in thin cylindrical and spherical shells under internal pressure.

8. Principal Stresses and Strains

General equations for transformation of stress, principal planes and principal stresses, maximum shear stress, determination using Mohr's circle, principal stresses in beams, principal stresses in shafts subjected to torsion, bending and axial thrust, concept of equivalent torsional and bending moments.

Text Books

1. S.B. Junnarkar, Mechanics of Structures Vol I, Charotar Publication house, 27th Edition, 2008.
2. E.P. Popov, Mechanics of Materials, Prentice Hall of India Pvt. Ltd.,2nd edition, 1976.
3. S.S. Bhavikatti, Strength of Material, Vikas Publishing House Pvt. Ltd,3rd edition, 2008.

Recommended Reading

1. Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill, 1956.
2. Strength of Material, Schaum's Outline Series, William A. Nash, McGraw Hill, 4th edition, 1998.
3. Timoshenko and Gere, Mechanics of Materials, PWS Publication Co. Ltd.,3rd edition, 1997.
4. James M. Gere, Mechanics of Materials, Brooks/Cole. Publishing Co.,6th edition, 2008.
5. G.H. Ryder, Strength of Materials, Prentice Hall Publications, 7th edition, 1969.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – III
Course Code	SE2001P	
Course Title	Mechanics of Solids Laboratory	
Prerequisites		

Course Outcomes

After completion of this course students will be able to:

1. Identify the standard codes and specifications which should be used for physical testing of different materials.
2. Evaluate the strength of a material under bending, shear and torsion loads
3. Evaluate hardness and impact values of metals.
4. Evaluate stress strain behavior of different materials.

Course Contents (List of Experiments)

1. Tension test on mild steel bar
2. Tension test on tor steel bar
3. Shear test on mild steel bar
4. Tension test on steel plates
5. Flexural test on steel plates
6. Bend and rebend test on mild and tor steel
7. Torsion test on mild and tor steel.
8. Brinnel's Hardness tests on metal specimen
9. Impact test on metal
10. Compression test on wood
11. Tensile test on wood specimen
12. Flexural test on wood

Text Books

1. S.B. Junnarkar, Mechanics of Structures Vol I, Charotar Publication house, 27th Edition, 2008.
2. E.P. Popov, Mechanics of Materials, Prentice Hall of India Pvt. Ltd.,2nd edition, 1976.
3. S.S. Bhavikatti, Strength of Material, Vikas Publishing House Pvt. Ltd,3rd edition, 2008.

Recommended Reading

1. Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill, 1956.
2. Strength of Material, Schaum's Outline Series, William A. Nash, McGraw Hill, 4th edition, 1998.

3. Timoshenko and Gere, Mechanics of Materials, PWS Publication Co. Ltd.,3rd edition, 1997.
4. James M. Gere, Mechanics of Materials, Brooks/Cole. Publishing Co.,6th edition, 2008.
5. G.H. Ryder, Strength of Materials, Prentice Hall Publications, 7th edition, 1969.
6. Peter and Singer, Mechanics of Materials,McGraw Hill,2004.
7. Beer and Johnston, Mechanics of Materials, McGraw Hill, 4th edition, 2009.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – III
Course Code	CE2001T	
Course Title	Construction Engineering and Infrastructure projects	
Prerequisites	Element of civil Engineering	

Course Outcomes

After completion of course students will be able to:

1. Identify factors to be considered in implementation of different Civil engineering projects
2. Define the procedures and techniques of construction of infrastructures projects.
3. Draw layout and components of various projects.

Course Contents

1. **Types of structures**
   Framed structure & Load bearing structure. Components of a Building
2. **Excavation and foundations**
   Excavation in soils and rocks. Shoring and strutting, dewatering, types of foundation.
3. **Masonary Construction**
   Masonry: Definitions of terms used in masonry, Materials used, Stone masonry, Brick masonry, Different bonds used for brick masonry and stone masonry, Composite masonry.
4. **Doors & windows**
   Location of roofs and windows, Definition of technical terms, Size of doors and windows, Door frames, Types of doors and windows, Ventilators, Fixtures and fastenings.
5. **Floor and Roofs**
   Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings.
6. **Vertical Transportation: Stairs and Lift**
   Definition of technical terms, Location of Stairs and Lift, Types of Stairs, Design.
7. **Arches and Lintels**
   Definition of technical terms, Classification of Arches and Lintels, Types of Arches and Lintels.
8. **Damp proofing & Fire proofing**
   Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting

properties of common building materials, Fire resistant construction, General methods of thermal insulation and thermal insulating materials

9. **Pointing and Plastering**
   Terminology used in Pointing and Plastering Work, Types of Mortars for Pointing and Plastering, Methods of Pointing and Plastering, Defects in Pointing and Plastering Works
10. **Infrastructure projects**
    Introduction, need, purpose, function, classification, various terminologies of various infrastructure projects like railways, airport, harbor, ports and docks, bridge, sewage disposal system, water treatment plant, dams and reservoir, canals and tunnel

Text Books

1. Building construction – Dr. B.C. Punmia, Laxmi publications, 10th edition
2. S. P. Bindra, S. P. Arora, Building Construction, DhanpatRai Publication, New delhi, Fourth Edition, 1988.
3. Harbour dock and tunneling- R. Srinivasan, Charotar publishing house private limited.

Recommended Reading

1. Irrigation and water power engineering- B. C. Punmia, Laxmi publications [P] lt. Sixteenth edition.
2. Construction planning, equipments, and methods-Tata mcgraw- hill edition, sixth edition.
3. Roy Chudley, Roger Greeno, Building Construction Handbook, Butterworth-Heinemann, Tenth Edition, 2006

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – III**
Course Code	**CE2001P**	
Course Title	**Construction Engineering Laboratory**	
Prerequisites	**Elements of Civil Engineering**	

Course Outcomes

After completion of course students will be able to:

1. Identify the elements of civil engineering structures.
2. Draw sketches of different civil engineering structures & components.
3. Use symbols & signs required in civil engineering drawings.

Course Contents

To prepare drawings sheets of following works on half imperial sheets;

1. Elements of Civil Construction Works; cross section view of a two storied building, cross section view of road structure, cross section view of rail track, simple bridge, Gravity dam, Earthen dam.
2. Types of Foundations
3. Types of Damp Proofing Course
4. Types of masonry Bonds
5. Types of Stairs
6. Types of Doors and Windows
7. Types of Roofs
8. Types of Floors
9. Types of Electrical Fittings and Plumbing Fixtures
10. Signs and Symbols required in Civil Engineering Drawings

Text Books

1. S. P. Bindra, S. P. Arora, Building Construction, DhanpatRai Publication, New delhi, Fourth Edition, 1988.
2. M.G. Shah, C.M. Kale, S. Y. Patki, Building Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, Third Edition, 1996

Recommended Reading

1. Roy Chudley, Roger Greeno, Building Construction Handbook, Butterworth-Heinemann, Tenth Edition, 2006

Programme Name	Bachelor of Technology in Civil Engineering	Semester – III
Course Code	CE2002T	
Course Title	Fluid Mechanics	
Prerequisites	Mathematics For Engineers-I,II, Applied Physics	

Course Outcomes

After completion of course students will be able to:

1. Use the various units of measure and basic fluid mechanics concepts to analyze incompressible fluids at rest or in motion.
2. Analyze and solve problems involving hydrostatic pressure and buoyancy forces.
3. Apply mass balance and momentum equations to analyze, model and solve problems involving water motion in open channels.
4. Solve problems in fluid flow system.

Course Contents

1. Properties of Fluid

Mass density, specific weight, specific gravity, specific volume, vapour pressure, compressibility, elasticity, surface tension, capillarity; Newton's law of viscosity, classification of fluids, dynamic viscosity and kinematics viscosity, variation of viscosity with temperature; Basic concept applicable to fluid mechanics.

2. Fluid Statics

Measurement of Pressure:

Pressure variation in a static fluid, Pascal's law, units and scales of pressure measurement – Atmospheric Pressure, Absolute Pressure, Gauge Pressure and Vacuum Pressure, Hydrostatic Paradox.

Piezometer,U-Tube Manometer, Single Column Manometer,U-Tube Differential Manometer , Inverted U-Tube Differential Manometer, Micromanometers.

Mechanical Pressure Gauges.

Hydrostatic force on plane and curved surface:

Total Pressure and Center of Pressure, Pressure Diagram, Total Pressure on Plane Surfaces and Depth of Center of Pressure, Total Pressure on Curved Surfaces, Practical applications of Total Pressure and Center of Pressure.

Buoyancy and Flotation:

Buoyant force, Buoyancy and Center of Buoyancy, Archimedes Principle, Principle of Floatation Metacentre and Metacentric Height, Equilibrium of Floating bodies and Submerged bodies Evaluation of Metacentric Height –Theoretical Method and Experimental Method

Oscillation of Floating Body

Fluids in Relative Equilibrium:

Static fluid subjected to uniform linear acceleration

Liquid containers subjected to constant horizontal acceleration and constant vertical acceleration, Liquid containers subjected to constant rotation

3. Fluid Kinematics

Fluid flow Methods of analysis of fluid motion, Streamlines, Pathlines, Streaklines and Streamtubes.Types of fluid flow Steady and unsteady flow, Uniform and non-uniform flow, Laminar, Transitional and Turbulent flow Reynolds number, Reynolds Experiment, Rotational and Irrotational flow, Subcritical , Critical and Supercritical flow, Compressible and Incompressible Flow , One , Two and Three dimensional
Circulation and vorticity, Velocity potential and Stream function, Flow net

4. Fluid Dynamics

Euler's equation, Bernoulli's equation, Energy correction factor

5. Flow Measuring Devices

Measurement of discharge- Venturi meter, Orifice meter, Nozzle meter, Bend meter, Rotameter. Measurement of velocity-Pitot tube.
Orifice - Classification, Flow through a Reservoir Opening i.e. Orifice, Trajectory of free –jet, Hydraulic Coefficients, Experimental determination of hydraulic coefficient, Small and large orifice, Time of emptying a tank with orifice
Mouthpieces-Classification, External cylindrical mouthpiece, Convergent – divergent mouthpiece, Borda's mouthpiece
Notches and Weirs -Discharge over a rectangular notch and a triangular notch, Velocity of approach, End contractions, Cippoletti Notch, Discharge over a stepped notch, Time of emptying a tank with notch or weir, Ventilation of weir, Proportional Weir or Sutro Weir

6. Flow Past immersed bodies:

Drag and lift, Types of drag, drag on a sphere, cylinder, flat plate and Airfoil, Karman Vortex Street, effect of free surface and compressibility on drag .Development of lift on immersed bodies, Lift, Magnus Effect and Circulation, lift characteristics of airfoils, polar diagram.

7. Compressible flow:

Basic equations of flow (elementary study), Mach number, Mach cone,
Area – Velocity relationship, Stagnation Properties

8. Ideal fluid flow

Uniform flow, source and sink, doublet, free vortex.

Text Books

1. Engineering Fluid Mechanics, K L Kumar, 8th Edition, S Chand & Company Ltd

Recommended Reading

1. Hydraulics and Fluid Mechanics, Dr P M Modi and Dr S M Seth, Standard Book House.
2. Theory and Applications of Fluid Mechanics, K. Subramanya,1st edition, Tata McGraw Hill Publishing Co. Ltd.
3. Fluid Mechanics, Dr A K Jain, 4th edition, Khanna Publishers

\

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – III**
Course Code	**CE2002P**	
Course Title	**Fluid Mechanics Laboratory**	
Prerequisites	**Mathematics For Engineers-I,II, Applied Physics**	

Course Outcomes

After completion of course students will be able to:

1. Calculate the force exerted by fluid on object boundary.
2. Measure the rate of flow in open channel and pipe system.
3. Select proper discharge measurement techniques.

Course Contents

List of Experiments

1. Hydrostatics
2. Measurement of viscosity
3. Study of Pressure Measuring Devices
4. Stability of Floating Body
5. Hydrostatics Force on flat Surfaces/curved Surfaces
6. Bernoulli's Theorem
7. Calibration of Flow meter
8. Calibration of Orifices
9. Calibration of Notches
10. Calibration of Weirs
11. Flow Visualisation -Ideal Flow
12. Flow around an Aerofoil / circular cylinder

Text Books

1. Engineering Fluid Mechanics, K L Kumar, 8th Edition, S Chand & Company Ltd.
2. Hydraulics and Fluid Mechanics, Dr. P M Modi and Dr S M Seth, Standard Book House
3. Theory and Applications of Fluid Mechanics, K Subramanya, Tata McGraw Hill Publishing co. Ltd.
4. Open channel Flow, K Subramanya, Tata McGraw Hill Publishing Co. Ltd.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – III
Course Code	CE2003T	
Course Title	Geomatics	
Prerequisites		

Course Outcomes

After completion of course students will be able to:

1. Gain basic knowledge of principles of surveying and field procedures to conduct the Land survey.
2. Develop skills for collection of field data using traditional surveying equipments such as Levels, Compass, plane table and theodolite.
3. Read, prepare topographic map including contours of any site.
4. Record the field data and analyze the same.
5. Calculate the area of land parcel, volume of earthwork and to do the setting out works.

Course Contents

Introduction

Various types of surveying- based on methods and instruments, classifications, uses and necessity of geodetic surveying, photographic, astronomy and hydrographic surveying

Diagonal scale, various types of venires, micrometers on surveying instruments, principles of surveying

Chain surveying, instruments required for linear measurement, minor instruments for setting out right angle

Leveling and contouring

Definitions, technical terms, different types of levels such as dumpy, quickset, precise, auto

Temporary and permanent adjustments of dumpy and auto level

Different methods of leveling, reduction of levels, problems

Difficulties in leveling work, corrections and precautions to be taken in leveling work

Contour – definitions, contour interval, equivalent, uses and characteristics of contour lines, direct and indirect methods of contouring

Running a level line, L section, cross section, methods of interpolation

Grade contour- definition, use, setting out in field

Computation of volume by trapezoidal and prismoidal formula, volume from spot levels, volume from contour plan

Plane Table Surveying

Definitions, uses and advantages, temporary adjustments

Different methods of plane table surveying, Two point problem

Errors in plane table survey, use of telescopic alidade

Traverse Surveying

Compass: Bearings- different types, compass – prismatic, surveyor, whole circle, reduced bearings, Local Attraction

Theodolite:- Various parts and axis of transit, technical terms, temporary and permanent adjustments of a transit, horizontal and vertical angles, methods of repetition and reiteration

Different methods of running a theodolite traverse, Gales' traverse table, balancing of traverse by Bow-Ditch's transit and modified transit rules

Problems on one-plane and two-plane methods, omitted measurements, Precautions in using theodolite, errors in theodolite survey, Use of theodolite for various works such as prolongation of a straight line, setting out an angle

Setting out Works

General horizontal and vertical control, setting out of foundation plan for load bearing and framed structure, batter board, slope and grade stakes, setting out with theodolite

Setting out of sewer line, culvert, use of laser for works

Setting out center line for tunnel, transfer of levels to underground work

Project / route survey for bridge, dam and canal

Checking verticality of high rise structures

Areas

Area of a irregular figure by Trapezoidal rule, average ordinate rule, Simpson's 1/3 rule, various co ordinate methods

Planimeter: types of planimeter including digital planimeter, area of zero circle, use of planimeter

Text Books

1. N.N.Basak, Surveying and Leveling, Tata McGraw Hill Publications, 1st Edition.
2. B C Punmiya, Surveying and Leveling, Vol I & II, Laxmi Publications.
3. R Agor, Surveying, Khanna Publishers.

Recommended Reading

1. Kanetkar and Kulkarni, Surveying and Leveling, Vol I & II, Pune Vidyarthi Griha, Pune, 24th edition.
2. R Agor, Surveying, Khanna Publishers.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – III**
Course Code	**CE2003P**	
Course Title	**Geomatics Laboratory**	
Prerequisites		

Course Outcomes

After completion of course students will be able to:

1. Gain basic knowledge on minor and major surveying equipments.
2. Use equipments/instruments for conducting chain and compass traversing, levelling, theodolite traversing, Plane table survey and setting out curves and civil works.
3. Record observations in field book and prepare the various types of maps.

Course Contents

Concepts:

1. Linear and angular measurements
2. Traditional surveying and mapping techniques
3. Contour maps , irregular area calculations and volumes of earthworks
4. Fieldwork record keeping and drawing sheet preparation
5. Land record documentation, height of buildings / Towers etc

Practicals:

1. Use of Amslar polar planimeter for finding the area of irregular figures and certifying it by using Digital Planimeter
2. Use of optical theodolite / Electronic theodolite for measurement of horizontal and vertical angles
3. Theodolite traverse, Gale's traverse table
4. A two day project on theodolite traversing and plane table detailing,
5. Use of optical theodolite / Electronic theodolite for one plane and two plane methods
6. Simple and compound leveling by using Dumpy / Auto Level, booking methods
7. Methods of plane tabling: - Radiation. Intersection and Traversing
8. Setting out a simple foundation plan in the field

Text Books

1. N Basak, Surveying and Leveling, Tata McGraw Hill Publications, 1st Edition.
2. B C Punmiya, Surveying and Leveling, Vol I & II, Laxmi Publications.
3. R Agor, Surveying, Khanna Publishers.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – III**
Course Code	**CE2004L**	
Course Title	**Engineering Geology Laboratory**	
Prerequisites		

Course Outcomes

After completion of course students will be able to:

1. Apply the basics of engineering geology at site.
2. Identify the different types and forms of rock and mineral from core samples
3. Read topographical map.
4. Use knowledge of geology in solving civil engineering problems.

Course Content

1. Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects.

2. Study of Topographical features from Geological maps. Identification of symbols in maps

   Physical Geology Study

   Weathering. Erosion and Denudation.

   Superficial deposits and its geotechnical importance: Water fall and Gorges , River meandering , Alluvium, deposits,

3. Study of physical properties of minerals.

4. Study of different group of minerals.

5. Study of Crystal and Crystal system.

6. Identification of minerals

   a. Silica group: Quartz, Amethyst, Opal
   b. Feldspar group: Orthoclase, Plagioclase
   c. Cryptocrystalline group: Jasper
   d. Carbonate group: Calcite
   e. Element group: Graphite
   f. Pyroxene group: Talc
   g. Mica group: Muscovite

h. Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum

7. Identification of rocks(Igneous Petrology)

   a. Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff.
   b. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.

8. Identification of rocks(Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties , Laterite, Limestone and its varieties, Shales and its varieties

9. Identification of rocks(Metamorphic Petrology) : Marble, slate,

   Gneiss and its varieties, Schist and its varieties, Quartzite, Phyllite

Recommended Text Book:

1. Engineering and General Geology, Parbin Singh, 8th Edition, Publisher: S.K.Kataria & Sons.

Recommended Reference Books:

1. Text Book of Engineering Geology, Kesavalu, Publisher :MacMilan
2. Geology For Geotechnical Engineers , J.C.Harvey, Cambridge University Press

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – III**
Course Code	**CE2005A**	
Course Title	**Professional Ethics**	
Prerequisites		

Course Outcomes

After completion of course students will be able to:

1. Use knowledge and skills considering societal, health, safety, legal, and cultural issues in professional practice.
2. Practice responsibly with a commitment to ethical principles.

Course Contents

1 Introduction

What is ethics? Core areas of ethics: Social ethics, personal ethics Integrity and Trustworthiness, Honesty, Loyalty, Courage, Prudence, Confidence, Confidentiality.

2 Codes of Ethics

Importance of Codes, Abuse of Codes ,Limitations of Codes, Justification of Codes.

3 Moral Frameworks

Rights Ethics, Duty Ethics, Virtue Ethics, Self-Realization Ethics

4 Engineering as Social Experimentation

Similarities to Standard Experiments, Learning from the Past 79 Contrasts with Standard Experiments.

5 Commitment to Safety

Safety and Risk, The Concept of Safety,Risks Acceptability of Risk, Assessing and Reducing Risk,Personal Risk versus Public Risk.

6 Workplace Responsibilities and Rights

Confidentiality and Conflicts of Interest, Confidentiality and Changing Jobs Confidentiality and Management Policies An Ethical Corporate Climate.

development cycle

7 Truth and Truthfulness

Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Honesty and Research Integrity.

8 Computer Ethics

The Internet and Free Speech, Power Relationships, Property, Privacy

9 Environmental Ethics

Engineering, Ecology, and Economics ,Environmental Moral Frameworks , Human-Centered Ethics Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives

10 Global Justice

Multinational Corporations, Technology Transfer and Appropriate Technology, Weapons Development and Peace.

Text Books

1 Introduction To Engineering Ethics, Second Edition Published by McGraw-Hill

2 P S R Murthy : "Indian Culture Values and Professional Ethics, 2" Edition, B S Publications, Hyderabad. 2013.

Recommended Reading

1 M. Govindarajan, S Natarajan and V.. Senthil Kumar : "Engineering Ethics and Human Values, 1Edition, PHI Publications, 2013.

2 A. Alavudden, R. Kalil Rahaman & M . Jayakumaran

Professional Ethics & Human Values, 1Edition, University Science Press (An Imprint of Laxmi Publications Pvt Ltd., Chennai, Bangalore. 2008.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – IV**
Course Code	**MA2011S**	
Course Title	**Statistics and Vector Calculus**	
Prerequisites	**Mathematics for Civil Engineers**	

Course Outcomes

After completion of course students will be able to:

1. Demonstrate knowledge of Matrix calculations as an elegant and powerful mathematical language in connection with rank of a matrix, linear system of equations, linear dependence and independence.
2. Solve successive differentiation, Leibnitz theorem and mean value theorems.
3. Demonstrate the ability of using Laplace Transform and Fourier Series in solving Ordinary Differential Equations and Partial Differential Equations.
4. Use basic knowledge of Laplace Transform. Fourier Series, Bessel Functions, Vector Algebra and Complex Variables in solving real problems.

Course Contents

Statistics

1.1 Review of measures of central tendency, measures of variation and probability.
1.2 Discrete and continuous Random variable.
1.3 Binomial, Poisson and Normal distribution.
1.4 Random sampling, sampling distribution, standard error, Central limit theorem.
1.5 Estimation of parameters, point estimation, interval Estimation, confidence internal.
1.6 Testing of Hypothesis, large sample and small sample, tests‘t’ test and ‘F’ test, Chi-square test.
1.7 Correlation and regression.
1.8 Coefficient of correlation and Rank correlation
1.9 Regression analysis, curve fitting, method of least square
1.10 Statistical quality control and control charts.
1.11 Analysis of variance (One way & Two way).

Vector Calculus

1.1 Scalar and vector point functions.
1.2 Directional derivative Curl and Divergence.
1.3 Conservative, Irrotational and Solenoidal field.

1.4 Line integral and its properties.
1.5 Green's theorem, Stoke's theorem, divergence theorem and its applications.

Text Books

1. Fundamentals of Mathematical Statistics, S.C. Gupta & V.K.Kapoor, S Chand & Sons Co. Ltd.
2. Engineering Statistics, T Veerarajan, Tata McGraw-Hill Publishing Company 2nd Edition.
3. Advance Engineering Mathematics, H K Dass, S Chand & Sons Co.Ltd, 3rd Edition, 2006.

Recommended Reading

1. A Text Book of Engineering mathematics,N.P.Bali & Dr.Manish Goyal, Eight Edition, Laxmi Pubilcation
2. Applied mathematics for Semester-IV (Civil) by G V Kumbhojkar, C Jamnadas & Co.Ltd.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – IV**
Course Code	**SE2002S**	
Course Title	**Structural Analysis I**	
Prerequisites	**Mechanics and Mechanics of Solids Course/Strength of Material Courses**	

Course Outcomes

After completion of this course students will be able to:

1. Calculate deflection of statically determinate structures under various loading and support conditions.
2. Apply basic concepts of structural mechanics for the analysis of beams and frames.
3. Apply basic concepts of structural mechanics for the analysis of truss, arches and cables.
4. Apply basic concept of structural mechanics for the analysis of strut.

Course Contents

1. General Theorems

Theorems relating to elastic structures, principle of virtual work, strain energy in elastic structures, complementary energy, Castigliano's theorem, Betti's and Maxwell's reciprocal theorems.

2. Deflection of Statically Determinate Structures

Deflection of determinate beams by double integration (Macaulay's) method, moment area and conjugate beam methods, principle of virtual work (unit load method) and Castigliano's theorem, Deflection of determinate pin jointed trusses and rigid jointed frames by principle of virtual work (unit load method), Strain Energy and Castigliano's theorem

3. Influence Lines for Statically Determinate Structures

Influence lines for cantilever beam, simply supported beam, overhanging beam and pin jointed trusses. Criteria for maximum shear force and bending moment under moving loads for simply supported beams, absolute maximum bending moment.

4. Elastic Arches

Determination of normal thrust, shear force and bending moment for parabolic and segmental three hinged arches. Influence lines for normal thrust, shear force and bending moment for three hinged parabolic arch.

5. Suspension Bridges

Suspension cable with three hinged stiffening girder. Influence line diagrams for horizontal tension in the cable, shear force and bending moment at any section of the stiffening girder.

6. Column and Struts

Struts subjected to axial loads, concept of buckling. Euler's formula for strut with different support conditions. Euler's and Rankine's design formulae. Struts subjected to eccentric and lateral loads and struts with initial curvature.

Text Books

1. Junnarkar S.B, Structural Mechanics Vol I & II, Charotar Publishers, 2008.
2. Devdas Menon, Structural Analysis Volume – I, Narosa Publication, 2010.
3. C.S. Reddy, Basic Structural Analysis, Publisher: Tata McGraw Hill, 2001.

Recommended Reading

1. C.K. Wang, Intermediate Structural Analysis, McGraw Hill, 1984.
2. B.G. Neal, Structural theorems and their application, Pergaman Press., 1972.
3. Bhavikatti, Structural Analysis Volume – I, Vikas Publishers, 3rd edition, 2008.
4. Timoshenko and Young, Theory of Structures, Publisher: Tata McGraw Hill, 2009.
5. Norries and Wilbur, Elementary Structural Analysis, Publisher: McGraw Hill, 1990.
6. Laursen H I, Structural Analysis, Publisher: McGraw Hill, 1988.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – IV**
Course Code	**CE2006S**	
Course Title	**Construction Techniques**	
Prerequisites	**Construction Engineering**	

Course Outcomes

After completion of course students will be able to:

1. Describe different construction techniques used at site.
2. Justify use of various construction equipments with reference to cost and site conditions.
3. Analyze and suggest ground improvement techniques.

Course Contents

1 Pile construction

Types of piles & construction, pile driving equipments

2 Dewatering

Well point system, deep well, selection of pumps, types of pumps, numericals based on HP & selection of pump

3 Tunelling

Geotechnical investigations, selection of alignment, methods of tunneling in soft soils and in hard rock, sequence of operations for drilling and blasting method, mechanical moles,

boomers, tunnel boring machines, mucking, ventilation of tunnels, dust control, types of tunnel supports, sequence of lining operation, lining with pneumatic placers and by pumpcrete method.

4 Bridge construction

Geotechnical investigation, Site selection, launching of bridges by incremental launching, using false work, balanced cantilever construction method, Coffer dams

types and applications

5 Ground improvement techniques,

stone column, sand drain, grouting

6 Equipment costs

Owning and operating costs, numerical

7 Owning and operating costs, numerical

Capacity, effects of altitude

8 Cranes

Types, lifting capacity, safety

9 Dragline, clamshell

Operation, dragline, production, numerical based on probable production & time required, Size of dragline, clamshell operation, production rate

Text Books

1. Construction planning, equipments, and methods-Tata McGraw- hill edition, sixth edition
2. Building construction- B. C. Punmia, Laxmi publications [P] lt. tenth edition
3. Harbour dock and tunneling- R. Srinivasan, Charotar publishing house private limited

Recommended Reading

1. Concrete Bridge Practice by Dr.V.K.Raina,, Tata McGraw Hill Publications, 2nd edition
2. Ground Improvement Techniques, Dr.P.Purushothama Raj, Bangalore University Press, 7th edition
3. Foundation Design Manual, N.V.Nayak, Dhanpatrai Prakashan, 3rd edition

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – IV**
Course Code	**CE2007L**	
Course Title	**Construction Material Laboratory**	
Prerequisites	**Elements of Civil Engineering, Construction Engineering Laboratory**	

Course Outcomes

After completion of course students will be able to:

1. Perform lab experiments for determining the properties and behavior of construction materials.
2. Record, calculate and analyze data obtained by performing experiments.
3. Prepare technical reports.

Course Contents

Following experiments to be performed as per relevant IS standards:

1. Methods of Sampling of Clay Building Bricks, IS 5454: 1969
2. Methods of Tests of Burnt Clay Building Bricks, IS 3495 (Part 1 to 4): 1992: Compressive Strength Test, Water Absorption Test
3. Methods for Sampling of Aggregates for Concrete, IS 2430: 1969
4. Methods of Test for Aggregates for Concrete, IS 2386 (Part 1 to 5): 1963: Aggregate Crushing Value, Aggregate Impact Value, Los Angeles Aggregate Abrasion Value, Aggregate Specific Gravity, Water Absorption Test, Shape Test: Flakiness and Elongation Index, Sieve Analysis
5. Methods for Testing Tar and Bituminous Materials, IS 1201 to IS 1220, 1978: Penetration Test, Ductility Test, Softening Point Test, Viscosity Test, Specific Gravity

Text Books

1. M. L. Gambhir and Neha Agarwal, Building and Construction Materials Testing and Quality Control, McGraw Hill Education India Private Limited, First Edition, 2014
2. Micheal S Mamlouk and John P Zaniewski, Materials for Civil and Construction Engineers, Pearson Prentice Hall, Third Edition, 2006.

Recommended Reading

1. Indian Standard Code with number as IS 5454: 1969, IS 3495 (Part 1 to 4): 1992, IS 2430:1969, IS 2386 (Part 1 to5): 1963, IS 1201 to IS 1220: 1978

Programme Name	Bachelor of Technology in Civil Engineering	Semester – IV
Course Code	CE2013S	
Course Title	Environmental Studies	
Prerequisites	Basic Science and Social Science	

Course Outcomes

After completion of course students will be able to:

1. Identify and analyze impact of human development on natural resources.
2. Identify the impact of environmental problems on socio economic growth and human health.
3. Evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation of degraded environment.
4. Identify impact of human population on the environment and human health.

Course Contents

Unit 1: The Multidisciplinary Nature of Environmental Studies

Definition, Scope and Importance
Need for Public awareness

(2 Lectures)

Unit 2: Natural Resources

Renewable and Non-renewable Resources:
Natural resources and associated problems.
(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, Case studies.
(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
(f) 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.

(6 lectures)

Unit 3: Ecosystems

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 following ecosystem:
(a) Forest ecosystem
(b) Grassland ecosystem
(c) Desert ecosystem
(d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(3 lectures)

Unit 4: Biodiversity and its Conservation.

Introduction, 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.

(5 lectures)

Unit 5: Environmental Pollution.

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.
Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: Foods, earthquake, cyclone and landslides.

(8 lectures)

Unit 6: Social Issues and the Environment

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.
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 Protection Act.
Air (Prevention and Control of Pollution) Act.
Water (Prevention and Control of Pollution) Act.
Wildlife Protection Act.
Forest Conservation Act.
Issues involved in enforcement of environmental legislation.
Public awareness.

(7 lectures)

Unit 7: Human Population and the Environment

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.

(4 Lectures)

Unit 8: Field Work

Visit to a local area to document environmental assets—river/forest/grassland/hill/ mountain.
Visit to a local polluted site—Urban/Rural/Industrial/Agricultural.
Study of common plants, insects, birds.
Study of simple ecosystems—pond, river, hill slopes, etc.

(Field work equal to 5 lecture hours)

Text Books

1. Soli J Arceivala and Shyam R. Asolekar, Environmental Studies A Practitioner's Approach, Tata McGraw Hill Education Private Limited, New Delhi, First Edition, 2012.
2. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, USA, Second Edition, 2011.
3. Benny Joseph, Environmental Studies, McGraw Hill Education (India) Private, Second Edition, 2008

Recommended Reading

1. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001
2. Jadhav, H & Bhosale, V.M., Environmental Protection and Laws. Himalaya Pub. House, Delhi, 1995
3. Wanger K.D., Environmental Management. W.B. Saunders Co. Philadelphia, USA, 1998

Programme Name	Bachelor of Technology in Civil Engineering	Semester – IV
Course Code	CE2008T	
Course Title	Applied Hydraulics	
Prerequisites	Fluid Mechanics	

Course Outcomes

After completion of course students will be able to:

1. Apply knowledge of integrated mass continuity and energy/ momentum balance equations to pressurized pipe and open channel system.
2. Design and develop the Civil Engineering system (pipe and open channel flow).
3. Use basic concepts of Hydraulics to analyse flow in open channel and pipes.

Course Contents

1. Laminar Flow

Laminar flow through: circular pipes, annulus and parallel plates. Stokes law, Measurement of viscosity.

2. Turbulent Flow:

Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.

3. Boundary Layer Analysis:

Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

4. Dimensional Analysis and Hydraulic Similitude:

Dimensional homogeneity, Rayleigh method, Buckingham's Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

5. Introduction to Open Channel Flow

Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section.

6. Uniform Flow

Continuity Equation ,Energy Equation and Momentum Equation ,Characteristics of uniform flow Chezy's formula , Manning's formula Factors affecting Manning's Roughness Coefficient 'n '.

Most economical section of channel. Computation of Uniform flow Normal depth.

7. Non-Uniform Flow

Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth .Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer.

8. Gradually Varied Flow

Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and Direct integration method.

9. Hydraulic Jump

Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types ,applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.

10. Dynamics of Fluid Flow:

Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation

11. Flow through Pipes:

Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles.

12. Analysis of pipe networks :

Hardy Cross method, water hammer in pipes and control measures , branching of pipes , three reservoir problem

13. Computational Fluid Dynamics:

Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow, Boundary layer flow as applicable to C.F.D.

14. Hydro informatics:

Concept of hydro informatics –scope of internet and web based modeling in water resources engineering.

Text Books

1. Hydraulics and Fluid Mechanics, Dr. P.M. Modi and Dr. S.M. Seth, Standard Book House.

Recommended Reading

1. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill Publishing co. Ltd
2. Fluid Mechanics, Dr. A.K. Jain, Khanna Publishers
3. Fluid Mechanics and fluid pressure Engineering, D. S. Kumar, F.K. Kotharia and sons.
4. Open channel Flow, K. Subramanya, Tata McGraw Hill Publishing co. Ltd
5. Open channel Hydraulics, Ven Te Chow, Tata McGraw Hill Publications.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – IV
Course Code	CE2008P	
Course Title	Applied Hydraulics Laboratory	
Prerequisites	Mathematics For Engineers-I,II, Applied Physics	

Course Outcomes

After completion of course students will be able to:

1. Calculate the force exerted by air on object boundary.
2. Design an open channel.
3. Design a pipe system.

Course Contents

List Of Experiments

1. Flow Visualization
2. Studies in Wind Tunnel
3. Boundary Layer
4. Open Channel and control structure
5. Uniform Flow
6. Gradually Varied Flow
7. Hydraulic Jump
8. Flow under Sluice Gate
9. Flow through pipes
10. Major losses / Minor losses in pipe
11. Pipe Networks

Text Books

1. Hydraulics and Fluid Mechanics, Dr. P.M. Modi and Dr. S.M. Seth, Standard Book House

Recommended Reading

1. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill Publishing co. Ltd.
2. Fluid Mechanics, Dr. A.K. Jain, Khanna Publishers

3. Fluid Mechanics and fluid pressure Engineering, D. S. Kumar,Publishers : F.K. Kotharia and sons
4. Open channel Flow, K. Subramanya, Tata McGraw Hill Publishing co. Ltd.
5. Open channel Hydraulics, Ven Te Chow, Tata McGraw Hill Publications

Programme Name	Bachelor of Technology in Civil Engineering	Semester – IV
Course Code	SE2003T	
Course Title	Soil Mechanics	
Prerequisites		

Course Outcomes

After completion of this course students will be able to:

1. Determine basic properties of soil using knowledge of engineering mechanics and hydraulics.
2. Evaluate index properties of soil and identify the soil classification.
3. Estimate the compressibility potential and analyze shear strength parameters.
4. Apply shear strength parameters for stability of slopes.

Course Contents

1. Introduction

Definitions: soils, soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison between soil and rock

2. Basic Definitions and Relationships

Soil as three-phase system in terms of weight, volume, voids ratio, and porosity Definitions: moisture content, unit weights, degree of saturation, void ratio, porosity, specific gravity, mass specific gravity etc. Relationships between volume- volume, weight-volume and weight-weight. Determination of various parameters such as: Moisture content by oven dry method, sand bath method, torsional balance method Specific gravity by density bottle method, pycnometer method. Unit weight by core cutter method, sands replacement method.

3. Plasticity Characteristics of Soil

Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits.

4. Classification of Soils

Introduction of soil classification: particle size classification, unified soil classification, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

5. Permeability of Soil

Introduction to hydraulic head, Darcy's law, validity of Darcy's law. Determination of coefficient of permeability Laboratory method: constant head method, falling head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil.

6. Seepage Analysis

Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

7. Effective Stress Principle

Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

8. Compaction of Soil

Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field.

9. Consolidation of Soil

Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, consolidation test results, basic definitions, Terzaghi's theory of consolidation, final settlement of soil deposits, consolidation settlement: one- dimensional method, secondary consolidation.

10. Shear Strength

Principle planes parallel to the coordinate axes, Mohr's circle, important characteristics of Mohr's circle, Mohr-Coloumb theory, types of shear test: direct shear test, merits of direct shear test, triaxial compression tests, test behavior of UU, CU and CD tests, relation between major and minor principal stresses, unconfined compression test, vane shear test.

11. Stability of Slopes

Introduction, different factors of safety, types of slope failures, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Text Books

1. Holtz, R.D.,An Introduction to Geotechnical Engineering, Prentice Hall, New Jersey, 2008
2. Lambe T.W. and Whitman R.V., Soil Mechanics,John Wiley & Sons.1969.
3. K. Terzaghi,Theoretical Soil Mechanics, John Wiley & Sons, 3rd Edition, 1965.

Recommended Reading

1. Craig, R F, Soil Mechanics, Chapman & Hall. 2004.
2. Relevant Indian Standard Specifications & Codes, Indian Standard Institution. BIS.
3. C. Venktatramaiah, Geotechnical Engineering, New Age International.2009.
4. Alam Singh, Soil Engineering in Theory and Practice, Standard Publishers and Distributors, New Delhi. 2009.
5. Ranjan, G. and Rao, A.S.R., Basic and applied soil mechanics, New Age International Pvt. Ltd., 2004.
6. Das B. M. Principles of Geotechnical Engineering, 5th Ed. Thomson.
7. Taylor D.W., Fundamentals of Soil Mechanics, Asia publications Bombay, 1967

Programme Name	Bachelor of Technology in Civil Engineering	Semester – IV
Course Code	SE2003P	
Course Title	Soil Mechanics Laboratory	
Prerequisites		

Course Outcomes

After completion of this course students will be able to:

1. Prepare soil samples for testing, perform the test, collect and analyze data according to IS 2720 in various parts.
2. Determine the basic and index physical properties of soil/rock.
3. Evaluate consistency of soil for its classification.
4. Determine the hydraulic behavior of soil.
5. Measure mechanical behavior of soil.

Course Contents (List of Experiments- Minimum 14)

1. Natural moisture content using Oven Drying method.
2. Specific gravity of Soil grains
3. Field Density using Core Cutter method
4. Field Density using Sand replacement method
5. Grain size distribution by Sieve Analysis.
6. Field identification of Fine Grained soils.
7. Grain size distribution by Hydrometer Analysis.
8. Consistency limits by Liquid limit
9. Consistency limits by Plastic limit
10. Consistency limits by Shrinkage limit.
11. Permeability test using Constant Head test method.
12. Permeability test using Falling Head method
13. Compaction test: Standard Proctor test.
14. Compaction test: Modified Proctor test.
15. Relative density.
16. Specific gravity of rock
17. Water absorption of rock samples

Text Books

1. Holtz, R.D.,An Introduction to Geotechnical Engineering, Prentice Hall, New Jersey, 2008
2. Lambe T.W. and Whitman R.V., Soil Mechanics,John Wiley & Sons.1969.
3. K. Terzaghi,Theoretical Soil Mechanics, John Wiley & Sons, 3rd Edition, 1965.

Recommended Reading

1. Craig, R F, Soil Mechanics, Chapman & Hall. 2004.
2. Relevant Indian Standard Specifications & Codes, Indian Standard Institution. BIS.
3. C. Venktatramaiah, Geotechnical Engineering, New Age International.2009.
4. Alam Singh, Soil Engineering in Theory and Practice, Standard Publishers and Distributors, New Delhi. 2009.
5. Ranjan, G. and Rao, A.S.R., Basic and applied soil mechanics, New Age International Pvt. Ltd., 2004.
6. Das B. M. Principles of Geotechnical Engineering, 5th Ed. Thomson.
7. Taylor D.W., Fundamentals of Soil Mechanics, Asia publications Bombay, 1967

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – IV**
Course Code	**CE2009L**	
Course Title	**Geospatial Laboratory**	
Prerequisites	**Geomatics**	

Course Outcomes

After completion of course students will be able to:

1. Design and set out horizontal and vertical curve.
2. Develop skills for the use of various electronic instruments such as Digital Planimeter, Electronic Theodolite, Total station, Auto and Digital Levels and GPS receiver.
3. Acquire geospatial techniques such as Geographical Information System (GIS), Global Positioning System (GPS) and Remote Sensing in the field of surveying and Mapping.

Course Contents

Tachometric surveying

Principles and uses, advantages, stadia formula, different methods of tacheometer, subtense bar method, location details by tachometer, stadia diagram and tables, error and accuracy in tacheometry survey work

Curves

Definitions of different terms, necessity of curves and types of curves. Simple circular curves and compound curves, office and field work, linear methods of setting out of curves

Angular methods for setting out of curves, two theodolite and Rankine deflection angle methods

Reverse and transition curves, their properties and their advantages, design of transition curves, shift, spiral angle

Composite curves – office and field work, setting out of curve by angular method, composite curve problems

Vertical curves – definitions, geometry and types, tangent correction and chord gradient methods, sight distance on a vertical curve, difficulties in setting out curves and solutions for the same

Geographical Information System (GIS):

Information systems, spatial and non- spatial information, geographical concept and terminology, advantages of GIS, Basic component of GIS, Commercially available GIS hardware and Software, Field data, statistical data, maps, aerial Photographs, satellite data, points , lines, and areas features, vector and raster data, data entry through keyboard, digitizer and scanners, preprocessing of data rectification and registration , interpolation technique

Global Positioning System (G.P.S)

G.P.S. Segments: Spaces Segment, Control Segment, User Segment, Features of G.P.S. Satellites, Principle of Operation, Surveying with G.P.S.: Methods of observations, Absolute Positioning, Relative Positioning, differential G.P.S., Kinematics of G.P.S., G.P.S. Receivers: Navigational Receivers, Surveying Receivers, Geodetic Receivers, Computation of Co- ordinates:- Transformation from Global to Local Datum , Geodetic Coordinates to map co- ordinates , G.P.S. Heights and mean sea level Heights, Applications of G.P.S

Remote Sensing:

Electromagnetic remote sensing process, Physics of radiant energy: Nature of Electromagnetic radiation, Electromagnetic spectrum, Energy Source and its Characteristics, Atmospheric influences: Absorption, Scattering

Energy interaction with Earth Surfaces: Spectral reflectance Curve, Image Acquisition: Photographic sensors, Digital Data, Earth Resource satellites, Image resolution, Image Interpretation, Application of Remote Sensing

Practicals:

1. To find the constants of a tacheometer and to verify field distances
2. Height and distance problems in tacheometric surveying
3. Setting out the circular curve by Rankine's method of deflection of angles
4. A two day project on L section and cross section, block contouring and tacheometric survey
5. Study of satellite images and its interpretation, false color combination etc.
6. Determination of horizontal, sloping and vertical distance between any two points by using Total Station
7. Preparation of contour map by using road suitable software such as Surfer or Road Master
8. Geo-registration of map and its digitization by using suitable GIS software.
9. Map editing, vector and raster analysis of digitized map by using suitable GIS software

10. Preparation of Contour map by using Triangulated Irregular Network(TIN) in GIS software
11. Generation of 2D and 3D digital elevation model (DEM) from contour map using GIS software
12. Collection of field data like point data, line data and area data by using surveying and mapping GPS receiver
13. Post-processing the GPS data by using post processing software such as Pathfinder software.
14. Generation of Databases and relation database management system (RDBMS) using MS ACCESS.

Text Books

1. Advanced Surveying - Total station , GIS and Remote sensing , Satheesh Gopi, R.Sathikumar , N. Madhu , Pearson education

Recommended Reading

1. Surveying and Leveling, N N Basak, 1st Edition, Tata McGraw Hill Publications.
2. Surveying and Leveling, Vol I & II, III, B.C.Punmiya , Laxmi Publicatiov
3. Surveying, R Agor, Khanna Publishers
4. Concepts and Techniques of Geographical Information System, Lo C.P.Yeung A K W, Prentice Hall India
5. Introduction to Geographical Information System, Kang-tsung Chang, Tata McGraw Hill
6. Remote sensing and Geographical information system, K. Anji Rao , BS Publications

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – IV**
Course Code	**CE2010A**	
Course Title	**Engineering Economics**	
Prerequisites		

Course Outcomes

After completion of course students will be able to:

1. Work effectively demonstrating entrepreneurship in diverse teams.
2. Work in a team and provide leadership to multi-disciplinary teams for satisfactory completion, operation and maintenance of facilities.

Course Contents

1. Fundamental concepts ;-
Demand and supply, cost and revenue, price and income, consumer behavior: demand, elasticity of demand, demand forecasting

2. Cost aspects
Cost-volume-profit analysis, break even analysis and its applications to decision making

3. Importance of good accounting and audit practice
Double entry book keeping system, profit and loss statement and balance sheet

4. Engineering economy
Equivalence, value of time, present value and annual equivalence cost, rate of return

5. Market Structure
Pricing and output decisions under different market conditions, technological considerations under competitive economical and global business environments

6. Investment decisions
Identification of investment opportunities, government regulatory framework, scouting for ideas, preliminary screening, project identification, project development cycle

7. Project appraisal
Market, technical, financial, economic, social, ecological, organizational, tools of analysis: profitability, payback period, net present value, social cost-benefit analysis

Text Books

1. Prasanna Chandra, Projects: Preparation, appraisal, budgeting & implementation, Tata Mcgraw Hill

Recommended Reading

1. Engineering Economics and financial accounting (ASCENT SERIES): Aryasri, A Ramana Murthy, V V, Tata Mcgraw Hill