

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

(Autonomous Institute affiliated to University of Mumbai)



**Curriculum**  
**(Scheme of Instruction & Evaluation and Course contents)**  
(R4-Revision 2018)

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 First year, 2018-2019**

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE (VJTI)

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Bachelor of Technology (B. Tech)

in

Civil Engineering

## **Vision and Mission of the Institute**

**Vision:** To establish global leadership in the field of technology and develop competent human resources for providing service to society.

**Mission:**

- To provide students with comprehensive knowledge of principles of engineering with a multi-disciplinary approach that is challenging.
- To create an intellectually stimulating environment for research, scholarship, creativity, innovation and professional activity.
- To foster relationship with other leading institutes of learning and research, alumni and industries in order to contribute to national and international development

## **Vision and Mission of the Department**

**Vision:** To create and maintain learning environment to produce Civil Engineers who shall maintain professional integrity to serve the society with the knowledge and skills earned.

**Mission:**

- To shape future technocrats for planning, designing, constructing and maintaining the civil engineering projects for public & private sector organizations.
- To upgrade knowledge base of practising engineers.
- To strive to find cost effective and sustainable solutions in various disciplines of Civil Engineering to improve quality of life.

## Programme Outcomes (PO)

Engineering Graduates will be able to:

PO1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	<b>Design/development of solutions:</b> 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	<b>Conduct investigations of complex problems:</b> 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	<b>Modern tool usage:</b> 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	<b>The engineer and society:</b> 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	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	<b>Communication:</b> 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	<b>Project management and finance:</b> 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	<b>Life-long learning:</b> 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 (VJTI)**  
**B Tech. Civil Engineering**  
**Scheme of Instruction and Evaluation**

**SEMESTER III**

Sr.No	Course Code	Course Name	Hr/Week			Scheme of Evaluation				
			L	T	P	Credits	TA	MST	ESE	ESE Hours
1	R4MA2001S	Mathematics for Civil Engineers	3	1	0	4	20	20	60	3
2	R4SE2002T	Mechanics of Solids	3	0	0	3	20	20	60	3
	R4SE2002P	Mechanics of Solids Laboratory	0	0	2	1	60		40	
3	R4CE2002T	Fluid Mechanics	2	1	0	3	20	20	60	3
	R4CE2002P	Fluid Mechanics Laboratory	0	0	2	1	60		40	
4	R4CE2001T	Construction Engineering and Infrastructure Projects	3	0	0	3	20	20	60	3
	R4CE2001P	Construction Engineering Laboratory	0	0	2	1	60		40	
5	R4CE2004L	Engineering Geology Laboratory	0	0	2	1	60		40	
6	R4CE2003T	Geomatics	3		0	3	20	20	60	3
	R4CE2003P	Geomatics Laboratory	0	0	2	1	60		40	
7	R4CE2013MA	Environmental Studies	2	0	0	P/NP				
Total			16	2	10	21				
Total Contact Hours			28							

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **MST** MID Semester Tests (One Mid Semester Test), **ESE**:End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

**Veermata Jijabai Technological Institute (VJTI)**  
**B Tech. Civil Engineering**  
**Scheme of Instruction and Evaluation**

**SEMESTER IV**

Sr.No	Course Code	Course Name	Hr/Week			Scheme of Evaluation				
			L	T	P	Credits	TA	MST	ESE	ESE Hours
1	R4MA2011S	Statistics and Numerical Methods	3	1	0	4	20	20	60	3
2	R4SE2003S	Structural Analysis – I	2	1	0	3	20	20	60	3
3	R4SE2004T	Soil Mechanics	3	0	0	3	20	20	60	3
	R4SE2004P	Soil Mechanics Laboratory	0	0	2	1	60		40	
4	R4CE2007T	Applied Hydraulics	2	1	0	3	20	20	60	3
	R4CE2007P	Applied Hydraulics Laboratory	0	0	2	1	60		40	
	R4CE2006S	Construction Techniques	3	0	0	3	20	20	60	3
5	R4CE2008L	Geospatial Technology Laboratory	0	0	2	1	60		40	
6	R4CE2009L	Construction Material Laboratory	0	0	2	1	60		40	
7	R4CE4007MA	Indian Constitution and laws for civil Engineers	2	0	0	P/NP				
Total			15	3	8	20				
Total Contact Hours			26							

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **MST**: MID Semester Tests (ONE MID semester tests),  
**ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4MA2001S</b>	
<b>Course Title</b>	<b>Mathematics for Civil Engineers</b>	
<b>Prerequisites</b>	<b>Applied Mathematics – I, II</b>	

### **Course Outcomes:**

After completion of course students will be able to:

1. Determine, and apply, the important quantities associated with scalar fields and vector fields, such as the gradient vector, directional derivative, the divergence, curl and evaluate line, surface, and volume integrals to verify the seminal integral theorems (Green's theorem in the plane, Gauss' divergence theorem and Stokes' theorem).
2. Use basic knowledge of Fourier series and develop Fourier series of periodic functions.
3. Demonstrate the ability to evaluate Laplace as well as Inverse Laplace Transform of function and solve the ordinary differential equations and linear time invariant systems.
4. Introduction to partial differential equations (PDEs) and their applications to engineering sciences.
5. Demonstrate knowledge of Matrix calculations as an elegant and powerful mathematical language in connection with Eigen value and Eigen vector, Diagonalization.

### **1. BASIC CONCEPTS OF VECTOR CALCULUS**

- 1.1** Scalar and vector point function, differential operator, gradient, directional derivative, physical meaning of gradient, divergence, curl and Laplacian with their properties
- 1.2** Line Integrals, Surface Integral, Volume integral
- 1.3** Green's theorem, Gauss' theorem and Stoke's theorem & its application.

### **2. FOURIER SERIES**

- 2.1** Definition of Fourier series, Orthogonal and orthonormal functions
- 2.2** Fourier series with arbitrary period, in particular periodic function with period  $2\pi$
- 2.3** Fourier series of even and odd function
- 2.4** Half range Fourier series.

### **3. LAPLACE TRANSFORMS AND APPLICATIONS:**

- 3.1** Introduction, Definition of the Laplace transform,
- 3.2** Useful properties of Laplace transform (without proof): Linearity, First shifting theorem, Multiplication and division by  $t$ , Transforms of derivatives and integrals, Heaviside unit step function, Dirac's delta function, Second shifting theorem, Laplace transform of Periodic function
- 3.3** Inverse Laplace transform using partial fraction and Convolution theorem (without proof)
- 3.4** Application to solve initial and boundary value problem involving ordinary differential equations with one dependent and constant coefficient.



#### **4. PARTIAL DIFFERENTIAL EQUATION**

- 4.1 Second order PDE of mathematical physics (Heat, wave and Laplace equation, one dimensional with standard boundary conditions)
- 4.2 Solution by separation of variable method using Fourier series.

#### **5. MATRICES**

- 5.1 Eigen values Eigen vectors of square matrix
- 5.2 Cayley Hamilton's theorem and function of square matrix
- 5.3 Diagonalization of square matrix
- 5.4 Minimal Polynomial and Minimal Equation of a Matrix
- 5.5 Derogatory and Non-Derogatory Matrices

#### **Recommended Reading:**

- 1) Kreyszing E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int.Student Ed. 1995. (ISBN 8126554231)
- 2) Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed.1993.
- 3) O'Neel Peter., "Advanced Engg. Mathematics", Thompson, Singapore, Ind. Ed. 2002.
- 4) Greenbar Michael D., "Advanced Engg. Mathematics", Pearson, Singapore, Ind. Ed. a. 2007.
- 5) Ramana D. V., "Higher Engg. Mathematics", The MaGraw-Hill Inc., New Delhi, 2007. (ISBN 007063419X)
- 6) Marsden J. E., Tromba A., Weinstein A., "Basic multivariable calculus", Springer, 1993. (ISBN 354097976X)
- 7) A. R. Vasishtha, A. K. Vasishtha, "Matrices", Krishna Prakashan Media, 1991. (ISBN 8182837294)

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4SE2002T</b>	
<b>Course Title</b>	<b>Mechanics of Solids</b>	
<b>Prerequisites</b>	<b>Applied Mechanics Course</b>	

## Course Outcomes

After completion of this course, students will be able to,

1. Evaluate stress-strain behavior and other physical properties of materials.
2. Determine the internal forces in any type of structural elements and their graphical representation.
3. Analyze structural elements subjected to various forces using fundamental concepts of elastic stress-strain behavior of materials.
4. Apply the concept of principal stresses and strains for analysis of 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 section.

### 5. Simple theory of torsion

Torsion of circular solid and hollow shafts, stepped shaft, 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, theories of failure.

### **Text Books**

1. S.B. Junnarkar, Mechanics of Structures Vol I, Charotar Publication house, 32th Edition, 2016, (ISBN-9385039024/978-9385039027).
2. E.P. Popov, Mechanics of Materials, Prentice Hall of India Pvt. Ltd., 2nd edition, 1976. (ISBN- 0135713560/978-0135713563).
3. S.S. Bhavikatti, Strength of Material, Vikas Publishing House Pvt. Ltd., 3rd edition, 2013. (ISBN: 9789325971578/9325971577).

### **Recommended Reading**

1. S. Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill, 2013. (ISBN: 9781259062667/125906266X).
2. W. A. Nash Strength of Material, Schaum's Outline Series, McGraw Hill, 4th edition, 1998. (ISBN- 9780071830805/978-0071830805).
3. S. Timoshenko and Gere, Mechanics of Materials, PWS Publication Co. Ltd., 3rd edition, 1997. (ISBN-0534921744/9780534921743).
4. J. M. Gere, Mechanics of Materials, Brooks/Cole. Publishing Co., 6th edition, 2008. (ISBN- 1111577730/9781111577735).
5. G.H. Ryder, Strength of Materials, Prentice Hall Publications, 3rd edition, 2002. (ISBN:9780333935361/0333935365).

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4SE2002P</b>	
<b>Course Title</b>	<b>Mechanics of Solids Laboratory</b>	
<b>Prerequisites</b>	<b>Applied Mechanics</b>	

### **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 properties of materials.
4. Evaluate stress strain behavior of different materials.

### **Course Contents (List of Experiments)**

1. Tension test on mild steel bar
2. Elastic modulus of concrete
3. Tension test on tor steel bar
4. Shear test on mild steel bar
5. Tension test on steel plates
6. Flexural test on steel plates
7. Bend and re-bend test on mild and tor steel
8. Torsion test on mild and tor steel.
9. Brinell's Hardness tests on metal specimen
10. Impact test on metal
11. Compression test on wood
12. Tensile test on wood specimen
13. Flexural test on wood

### **Text Books**

1. S.B. Junnarkar, Mechanics of Structures Vol I, Charotar Publication house, 32th Edition, 2016, (ISBN-9385039024/978-9385039027).
2. E.P. Popov, Mechanics of Materials, Prentice Hall of India Pvt. Ltd.,2nd edition, 1976. (ISBN-0135713560/978-0135713563).
3. S.S. Bhavikatti, Strength of Material, Vikas Publishing House Pvt. Ltd,3rd edition, 2013. (ISBN: 9789325971578/9325971577).

## **Recommended Reading**

1. S. Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill, 2013. (ISBN: 9781259062667/125906266X).
2. W. A. Nash Strength of Material, Schaum's Outline Series, McGraw Hill, 4th edition, 1998. (ISBN-9780071830805 /978-0071830805).
3. S. Timoshenko and Gere, Mechanics of Materials, PWS Publication Co. Ltd.,3rd edition, 1997. (ISBN -0534921744 / 9780534921743).
4. J. M. Gere, Mechanics of Materials, Brooks/Cole. Publishing Co.,6th edition, 2008. (ISBN- 1111577730/9781111577735).
5. G.H. Ryder, Strength of Materials, Prentice Hall Publications, 3rd edition, 2002. ISBN-10: (ISBN:9780333935361/0333935365).

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4CE2002T</b>	
<b>Course Title</b>	<b>Fluid Mechanics</b>	
<b>Prerequisites</b>	<b>Mathematics For Engineers-I, II, Applied Physics</b>	

## Course Outcomes

After completion of course students will be able to:

1. Use the various units of measure and basic fluid mechanics concepts to analyse incompressible fluids at rest or in motion.
2. Analyse 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 Flotation 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) K L Kumar, Engineering Fluid Mechanics S Chand & Company Ltd 8<sup>th</sup> Edition, (ISBN – 9788121901000)

### Recommended Reading

- 1) Dr. P M Modi and Dr S M Seth, Hydraulics and Fluid Mechanics, Standard Book House (ISBN-8189401262)
- 2) K Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill Publishing co. Ltd. (ISBN - 0074603698)
- 3) A. K. Jain, Fluid Mechanics, 4<sup>th</sup> edition, Khanna Publishers (ISBN - 8174091947)

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>RMCE2002P</b>	
<b>Course Title</b>	<b>Fluid Mechanics Laboratory</b>	
<b>Prerequisites</b>	<b>Mathematics For Engineers-I, II, Applied Physics</b>	

## 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. Verification of Hydrostatics law
2. Measurement of viscosity
3. Study of Pressure Measuring Devices
4. Determination of metacentric height
5. Determination of hydrostatics Force on surface
6. Verification of Bernoulli's Theorem
7. Determination of coefficient of discharge of flow meter
8. Determination of hydraulic coefficient of orifice
9. Determination of coefficient of discharge of notch/weir
10. Flow Visualisation -Ideal Flow
11. Study of wind tunnel and determination of force acting on object

### Text Books

- 1) K L Kumar, Engineering Fluid Mechanics S Chand & Company Ltd 8<sup>th</sup> Edition, (ISBN – 9788121901000)
- 2) Dr. P M Modi and Dr S M Seth, Hydraulics and Fluid Mechanics, Standard Book House (ISBN -8189401262)
- 3) K Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill Publishing co. Ltd. (ISBN – 0074603698)
- 4) K Subramanya, Open channel Flow, Tata McGraw Hill Publishing Co. Ltd. (ISBN - 9789332901339)



<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4CE2001T</b>	
<b>Course Title</b>	<b>Construction Engineering and Infrastructure projects</b>	

## **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. Describe the procedures and techniques of construction of infrastructures projects.
3. Draw layout and components of various Civil Engineering projects.

## **Course Contents**

### **1. Types of structures**

Framed structure & Load bearing structure. Components of a Building, Types of Loads and load combination

### **2. Excavation and foundations**

Excavation in different types of soils and rocks. Shoring and strutting, Scaffolding, Shuttering Formwork, underpinning dewatering, types of foundation.

### **3. Masonry 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. Concrete blocks and light weight block , Reinforced Masonary, Paver Block-Sizes

### **4. Doors & windows**

Location of roofs and windows, Aluminium windows , types of plywood Wood joinery 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. Tile adhesives

### **6. Vertical Transportation: Stairs and Lift**

Materials for lifts 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) Dr. B.C. Punmia, Building construction Laxmi publications, 10<sup>th</sup> edition 2016, (ISBN 9788131804285)
- 2) S. P. Bindra, S. P. Arora, Building Construction, Dhanpat Rai Publication, New delhi, Fourth Edition, 2010 (ISBN - 1234567144035)
- 3) R. Srinivasan, Harbour dock and tunnelling, Charotar publishing house private limited. (ISBN - 9385039199)
- 4) Saxena S.C. and Arora S. P., A Text Book of Railway Engineering, Dhanpat Rai Publications, New Delhi, 2010. (ISBN-9788189928834)
- 5) Khanna and Arora, Airport planning & design, Nemchand Bros, Roorkee (ISBN-9788185240688)
- 6) S. P. Bindra, Docks and Harbour Engineering, Dhanpat Rai and Sons, 2012. (ISBN-9788189928858)
- 7) S K Garg, Water Resources Engineering Vol. II Irrigation Engineering & Hydraulic Structures, Khanna Publishers (2017), (ISBN: 8174090479)
- 8) S. K. Garg, Sewage Disposal and Air Pollution Engineering, Khanna Publishers, Delhi, Thirty seventh edition, 2017. (ISBN: 9788174092304)
- 9) S. K. Garg, Water Supply Engineering, Khanna Publishers, Delhi, 28th edition, 2010. (ISBN: 9788174091208/8174091203)

#### **Recommended Reading:**

- 1) B. C. Punmia, Irrigation and water power engineering ,Laxmi publications [P] It. Sixteenth edition. (ISBN – 9788131807637)
- 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 (ISBN - 113890709X)

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4CE2001P</b>	
<b>Course Title</b>	<b>Construction Engineering Laboratory</b>	

### **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, 2010 (ISBN -9788089928803)
- 2) M.G. Shah, C.M. Kale, S. Y. Patki, Building Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, Fifth Edition, 2002, (ISBN -0074638769)
- 3) B C Punmia, Building Construction ,Laxmi Publication, 10<sup>th</sup> Edition 2010, ( ISBN-9788131804285)

### **Recommended Reading**

- 1) Roy Chudley, Roger Greeno, Building Construction Handbook, Butterworth-Heinemann, Tenth Edition, 2006 (ISBN- 113890709X)

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4CE2004L</b>	
<b>Course Title</b>	<b>Engineering Geology Laboratory</b>	
<b>Prerequisites</b>		

### **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. Identify the topographical features in geological 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
3. Physical Geology Study  
Weathering, Erosion, Denudation.  
Superficial deposits and its geotechnical importance: Water fall and Gorges ,  
River meandering , Alluvium, deposits,
4. Study of physical properties of minerals.
5. Study of different group of minerals.
6. Study of Crystal and Crystal system.
7. 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
8. 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.
9. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties, Laterite, Limestone and its varieties, Shales

and its varieties.

10. Identification of rocks (Metamorphic Petrology) : Marble, slate, Gneiss and its varieties, Schist and its varieties, Quartzite, Phyllite.
11. Study of core samples, Core logging, RQD.
12. Engineering problem based on field data collected during site investigation.
13. Ground water: Sources and zone, water table, factors controlling bearing capacity of rocks, Different types of rock as source of ground water.

**Text Book:**

Parbin Singh, Engineering and General Geology , Publisher: S.K.Kataria & Sons , Edition 2013,( ISBN - 9350142678)

**Recommended Reading:**

- 1) Kesavalu, Text Book of Engineering Geology, Publisher: MacMillan 2<sup>nd</sup> edition, 2009.
- 2) Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press, 1st edition, 1982.

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4CE2003T</b>	
<b>Course Title</b>	<b>Geomatics</b>	
<b>Prerequisites</b>		

## **Course Outcomes**

After completion of course students will be able to:

1. Describe the 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. 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, 2<sup>nd</sup> Edition. (ISBN - 9789332901537)
2. B C Punmiya, Surveying and Leveling, Vol I-16<sup>th</sup> edition & Vol II- 4<sup>th</sup> edition, Laxmi Publications.( ISBN - 9788170088530)
3. R Agor, Surveying, Khanna Publishers- 11<sup>th</sup> edition. (ISBN - 8174092358)

### **Recommended Reading**

1. Kanetkar and Kulkarni, Surveying and Leveling, Vol I & II, Pune Vidyarthi Griha, Pune, 24<sup>th</sup> edition.( ISBN- 8185825114)
2. R Agor, Surveying, Khanna Publishers- 11<sup>th</sup> edition. (ISBN - 8174092358)



<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>R4CE2003P</b>	
<b>Course Title</b>	<b>Geomatics Laboratory</b>	
<b>Prerequisites</b>		

### **Course Outcomes**

After completion of course students will be able to:

1. Demonstrate the use of 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 Amstar 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
9. Introduction to LiDAR/ LADAR

## **Text Books**

- 1) N.N.Basak, Surveying and Leveling, Tata McGraw Hill Publications, 2<sup>nd</sup> Edition.  
(ISBN - 9789332901537)
- 2) B C Punmiya, Surveying and Leveling, Vol I-16<sup>th</sup> edition & Vol II- 4<sup>th</sup> edition, Laxmi Publications. (ISBN - 9788170088530)
- 3) R Agor, Surveying, Khanna Publishers- 11<sup>th</sup> edition. ( ISBN - 8174092358)
- 4) P. Dong & Q. Chen, Lidar Remote Sensing and Applications, CRC press 2017, (ISBN - 9781138747241)

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester-III</b>
<b>Course Code</b>	<b>R4CE2013SMA</b>	
<b>Course Title</b>	<b>Environmental Studies</b>	
<b>Prerequisites</b>	<b>Basic Science and Social Science</b>	

### **COURSE OUTCOMES:**

After completion of course students will be able to:

1. Identify the 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.

#### **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.

#### **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 various ecosystems.

#### **Unit 4: Biodiversity and its Conservation**

Introduction, definition: genetic, species and ecosystem diversity. Bio-geographical 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.

#### **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: Floods, earthquake, cyclone and landslides.

#### **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.

#### **Unit 7: Human Population and the Environment**

Population growth, variation among nations. Population explosion—Family Welfare Programme. Human rights. Value education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in environment and human health. Case Studies.

#### **Unit 8: Field Work**

Visit to environmental assets/ waste treatment facilities inside/ around campus.  
Study of common plants, insects, birds inside campus.

#### **Text Book**

- 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 (ISBN-1259006050)

- 2) R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, USA, Third Edition, 2016.( ISBN - 0199459754)
- 3) Benny Joseph, Environmental Studies, McGraw Hill Education (India) Private, Third Edition, 2017. (ISBN - 9352605179)

**Recommended Reading :**

- 1) Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001 (ISBN - 8172247869)
- 2) Jadhav, H & Bhosale, V.M., Environmental Protection and Laws. Himalaya Pub. House, Delhi, 1995( ISBN- 9352028503)
- 3) Wanger K.D., Environmental Management. W.B. Saunders Co. Philadelphia, USA, 1998

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4MA2011S</b>	
<b>Course Title</b>	<b>Statistics and Numerical Methods</b>	
<b>Prerequisites</b>	<b>Applied Mathematics –I and II</b>	

**Course Outcomes:**

After completion of course students will be able to:

1. Use numerical methods to find integration and differentiation o find an approximate solution of algebraic equations using appropriate method.
2. Find an approximate solution of ordinary differential equations using appropriate iterative method and to understand the basic concepts of regression and curve fitting.
3. Understand and apply the basic concepts of probability, random variables, probability distribution.
4. Use statistical methodology and tools in the engineering problem solving process. Compute and interpret descriptive statistics using numerical and graphical techniques.

**1. NumericalMethods**

**1.1 Roots of Algebraic and Transcendental Equations:** Bisection, false position, Secant and Newton-Raphson methods, Rate of convergence, Power method for computation of Eigen values

**1.2 Solution of a System of Linear Equations:** Gauss elimination, partial pivoting, Gauss-Jacobi and Gauss Seidel methods

**1.3 Finite Differences and Interpolation:** Finite Differences, Forward, Backward and Central operators, Interpolation by polynomials: Newton’s forward, backward interpolation formulae, Gauss & Stirling’s central difference formulae, Newton’s divided and Lagrange’s formulae for unequal Intervals

**1.4 Numerical Integration:** Newton-Cotes formula, Trapezoidal and Simpson’s formulae, error formulae, Gaussian quadrature formulae

**1.5 Numerical solution of Ordinary Differential Equations:** Taylor series method, Euler method, Runge-Kutta method of order four, Milne’s Predictor-Corrector method

**1.6 Curve Fitting:** Fitting of Linear, Quadratic, Exponential and Logarithmic curves, Least squares method

## 2. Probability and Statistics

**2.1 Reorientation:** Definition of probability, Exhaustive events, Pair wise independent events, Multiplicative law of probability, Conditional probability, Baye's theorem.

**2.2 Probability Distributions:** Random variable, Mathematical Expectation, Standard Deviation, Binomial, Poisson and Normal distributions, Mean, Median, Mode.

**2.3 Statistics:** Correlation between two variable, application of correlation, evaluation of coefficients of correlation, Rank correlation, Regression, frequency distribution, Binomial, Poisson's distribution and Normal distribution, application to industrial problem.

**2.4 Testing Of Hypothesis:** Test of significance, Chi-square ( )  $2 \chi$  test, student's t Test, application of the t-test, F-distribution.

**2.5 Time Series Analysis:** Short term fluctuation, trend, Decision theory.

### Recommended Reading:

- 1) Kreyszing E., Advanced Engineering Mathematics, John Wiley & Sons, Singapore, Int.Student Ed. 1995. (ISBN 8177585460)
- 2) Gerald C. F. and Wheatley P.O., Applied Numerical Analysis (5th Edition) Addison-Wesley, Singapore, 1998. ( ISBN 8131717402)
- 3) Conte S. D. and Carl de Boor, "Elementary Numerical Analysis-An Algorithmic Approach (3rd Edition)", McGraw-Hill, 1980. (ISBN No 0070607427)
- 4) Froberg C.E., "Introduction to Numerical Analysis (2nd Edition), Addison Wesley, 1981.
- 5) Johnson Richard A., Miller and Freund's, "Probability and Statistics (8th Edition)", PHI. (ISBN 0130417734)
- 6) Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics (11th Edition)", Sultan Chand & Sons. (ISBN 8180545288)
- 7) Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed.

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4SE2003S</b>	
<b>Course Title</b>	<b>Structural Analysis I</b>	
<b>Prerequisites</b>	<b>Mechanics and Mechanics of Solids Course/Strength of Material Courses</b>	

## Course Outcomes

After completion of this course, students will be able to,

1. Determine deflection of statically determinate structures under various loading and support conditions.
2. Apply basic concepts of structural mechanics for the analysis of statically determinate structures.
3. Apply concepts of structural mechanics for the analysis of statically determinate arches and stiffened suspension bridges.
4. Apply concept of Influence Line Diagram to statically determinate structures.

## Course Contents

### 1. General theorems

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

### 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 theorems, Deflection of determinate pin jointed trusses and rigid jointed frames by principle of virtual work (unit load method), Strain Energy and Castigliano theorems.

### 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

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 buckling theory of struts with different boundary conditions. Rankine's buckling theory for columns. Struts subjected to eccentric and lateral loads and struts with initial curvature.

### **Text Books**

1. S.B Junnarkar, Structural Mechanics Vol.I, Charotar Publishers, 2016. (ISBN:978-9385039270).
2. D. Menon, Structural Analysis Volume – I, Narosa Publication, 2010. (ISBN- 978-1842653371/1842653377).
3. C.S. Reddy, Basic Structural Analysis, Publisher: Tata McGraw Hill, 2010. (ISBN-1283187140/978-1283187145).

### **Recommended Reading**

1. C.K. Wang, Intermediate Structural Analysis, McGraw Hill, 1984. (ISBN-10:0070666237/978-0070666238).
2. B.G. Neal, Structural theorems and their application, Pergaman Press, 1972. (ISBN:978-1483139029).
3. S.S. Bhavikatti, Structural Analysis Volume – I, Vikas Publishers, 3rd edition, 2011. (ISBN: 9788125942696/8125942696).
4. S. Timoshenko and Young, Theory of Structures, Publisher: Tata McGraw Hill, 1965.(ISBN- 9780070648685/978-0070648685).
5. Norries and Wilbur, Elementary Structural Analysis, Publisher: McGraw Hill, 1990. (ISBN- 0071008365/978-0071008365).
6. H I Laursen, Structural Analysis, Publisher: McGraw Hill, 1988. (ISBN-0070366454/978-0070366459).

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4SE2004T</b>	
<b>Course Title</b>	<b>Soil Mechanics</b>	
<b>Prerequisites</b>	<b>Mechanics of Solids</b>	

## **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.

### **2. Phase relationship and basic soil properties**

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. Discussion on Grain size Analysis, Specific Gravity and Relative Density.

### **3. Plasticity characteristics of soil**

Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, consistency 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 by Laboratory and Field methods. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Graded filters.

## **6. Seepage analysis**

Introduction, stream and potential functions, Laplace equation, 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, types of clay deposits, initial, primary & secondary consolidation, spring analogy for primary consolidation, one dimensional consolidation test results, Terzaghi's theory of consolidation, field consolidation curve and consolidation settlement.

## **10. Shear strength**

Principle planes, Mohr's circle, Mohr-Coloumb theory, Drainage conditions, types of shear test: direct shear test, triaxial compression tests, test, relation between major and minor principal stresses, unconfined compression test, vane shear test. Shear strength of sand and clay, introduction of soil liquefaction.

## **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. G. Ranjan and A.S.R. Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd., 2005 (ISBN: 9788122440393/8122440398).
2. V.N.S. Murthy, Advanced Foundation Engineering, CBS Publishers and Distributors, New Delhi, 2016. (ISBN- 978-8123915067).
3. B. M. Das, Principles of Foundation Engineering, PWS Publishing Company, 2012. (ISBN- 978-8131518786).

### **Recommended Reading:**

1. R F Craig, Soil Mechanics, Chapman & Hall. 2004. (ISBN- 9780415327039/0415327032).
2. C. Venkatramaiah, Geotechnical Engineering, New Age International.2009. (ISBN- 9386649705/978-9386649706).

3. A. Singh, Soil Engineering in Theory and Practice, Standard Publishers and Distributors, New Delhi. 2009. (ISBN-10: 8123900392/978-8123900391).
4. D.W. Taylor, Fundamentals of Soil Mechanics, Asia publications Bombay, 1967. (ASIN: B002XBX0HY)
5. T.W. Lambe and R.V. Whitman (1979). 'Soil Mechanics', John Wiley and Sons, New York, USA. (ISBN: 978-0-471-51192-2).

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4SE2004P</b>	
<b>Course Title</b>	<b>Soil Mechanics Laboratory</b>	
<b>Prerequisites</b>	<b>Mechanics of Solids Laboratory</b>	

### **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**

Prof. Krishna Reddy, “Engineering Properties of Soils Based on Laboratory Testing.”  
Department of Civil and Materials Engineering, University of Illinois at Chicago.

## **Recommended Reading:**

1. R F Craig, Soil Mechanics, Chapman & Hall. 2004. (ISBN-9780415327039/0415327032).
2. C. Venkatramaiah, Geotechnical Engineering, New Age International.2009. (ISBN-9386649705/978-9386649706).
3. A. Singh, Soil Engineering in Theory and Practice, Standard Publishers and Distributors, New Delhi. 2009. (ISBN-8123900392/978-8123900391).
4. D.W. Taylor, Fundamentals of Soil Mechanics, Asia publications Bombay, 1967. (ASIN: B002XBX0HY).
5. T.W. Lambe and R.V. Whitman (1979). ‘Soil Mechanics’, John Wiley and Sons, New York, USA (ISBN: 978-0-471-51192-2).

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4CE2007T</b>	
<b>Course Title</b>	<b>Applied Hydraulics</b>	
<b>Prerequisites</b>	<b>Fluid Mechanics</b>	

### **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'. Hydraulic Channel Design, 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. Hydraulic Machinery:**

Pumps, Turbines basics and classification, design and capacity of pumps, submersible pumps

## **14. Hydraulic Design:**

Pipe flow and channel flow.

### **Text Books**

Dr. P.M. Modi and Dr. S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House.  
Edition: 20th, Year-2015 ISBN - 8189401262

### **Recommended Reading:**

- 1) Dr. P M Modi and Dr S M Seth, Hydraulics and Fluid Mechanics, Standard Book House ( ISBN -8189401262)
- 2) K Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill Publishing co. Ltd. (ISBN - 0074603698)
- 3) Dr A K Jain, Fluid Mechanics, 4th edition, Khanna Publishers (ISBN - 8174091947)
- 4) Ven Te Chow, Open channel Hydraulics, Tata McGraw Hill Publications. 30057th edition (1 January 2009) (ISBN -1932846182)

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4CE2007P</b>	
<b>Course Title</b>	<b>Applied Hydraulics Laboratory</b>	
<b>Prerequisites</b>	<b>Mathematics For Engineers-I, II, Applied Physics</b>	

## 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. Study of different type flow using Reynolds apparatus
2. Study of open channel and control structure
3. Determination of Chezy's constant and Manning's constant
4. Gradually Varied Flow
5. Determination of characteristics of hydraulic jump
6. Determination of coefficient of discharge of control structure
7. Determination of friction factor
8. Determination minor losses in pipeline
9. Hydraulic design of small pipeline system
10. Hydraulic design of small channel

### Text Books

1. Dr. P.M. Modi and Dr. S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House. Edition: 20th, Year-2015 (ISBN - 8189401262)

### Recommended Reading:

1. Dr. P M Modi and Dr S M Seth, Hydraulics and Fluid Mechanics, Standard Book House( ISBN -8189401262)
2. K Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill Publishing co. Ltd. (ISBN - 0074603698)
3. Dr A K Jain, Fluid Mechanics, 4<sup>th</sup> edition, Khanna Publishers (ISBN - 8174091947)
4. Ven Te Chow, Open channel Hydraulics, Tata McGraw Hill Publications. 30057th edition (1 January 2009) (ISBN No-1932846182)

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4CE2006S</b>	
<b>Course Title</b>	<b>Construction Techniques</b>	
<b>Prerequisites</b>	<b>Construction Engineering and Infrastructure Project</b>	

## 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

Prestressing equipments, Hydraulic jack

### 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, Cofferdams 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, types of cranes

## **9 Dragline, clamshell**

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

### **Text Books**

- 1) Construction planning, equipments, and methods-Tata McGraw- hill edition, sixth edition
- 2) B. C. Punmia, Building construction Laxmi publications [P] lt. tenth edition (ISBN 9788131804285)
- 3) R. Srinivasan Harbour dock and tunneling- Charotar publishing house private limited (ISBN 9385039199)

### **Recommended Reading:**

- 1) Dr.V.K.Raina, Concrete Bridge Practice, Tata McGraw Hill Publications, 2nd edition (ISBN - 818404805X)
- 2) Dr.P.Purushothama Raj, Ground Improvement Techniques, Bangalore University Press, 7th edition (ISBN - 9788131805947)
- 3) N.V.Nayak, Foundation Design Manual, Dhanpatrai Prakashan, 3rd edition (ISBN -9383182903)
- 4) Mahesh Varma, Metropolitan Book Co. Constuction Equipment and its Planning and Applications (P) Ltd., New Delhi, India.
- 5) Construction Macinery and Equipment in India, (A compilation of articles Published in Civil Engineering and Construction Review), Publish by Civil Engineering and Construction Review New Delhi,1991

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4CE2006S</b>	
<b>Course Title</b>	<b>Construction Techniques</b>	
<b>Prerequisites</b>	<b>Construction Engineering and Infrastructure Project</b>	

## 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-Single Acting, Double Acting, Pile driving Hammer, Differential Acting hammer, Hydraulic and diesel Hammer, Vibratory Hammer

### 2 Dewatering

Well point system, deep well, selection of pumps, types of pumps- Reciprocating, Centrifugal and Diaphragm, 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.

Pipe Jacking, Selection of Tunnel Alignment, Tunneling using road headers, Cut and fill techniques, Jackdown techniques, Box type tunnelling Techniques

### 4 Bridge construction

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

types and applications Afflux and Scour depth

Launching Girder, Bridge Decks, Offshore platforms, Special Forms for shells, Techniques for Heavy Decks

## **5 Ground improvement techniques,**

Deep Dynamic Compaction, Drainage / Surcharge , Electro-osmosis, Compaction, Grouting, Blasting, Surface compaction,

## **6 Construction Equipments**

Dozers, Graders, Scrappers, Excavators, Trucks and Hauling Equipments , Cranes, Drilling Rock and Earth, Blasting Rock, Concreting Equipments, Tractors, Motor Graders

Maintenance of Construction Equipments, Depreciation methods

## **7 Introduction Prestressing equipments**

Post Tensioning - Le-mcall , Magnell Blaton, Gifford Udall, Freyssinet, Pretensioning- Hoyer System or Long Line method, Shorer System

### **Text Books**

1. Construction planning, equipments, and methods-Tata McGraw- hill edition, sixth edition
2. B. C. Punmia, Building construction Laxmi publications [P] Lt. tenth edition (ISBN 9788131804285)
3. R. Srinivasan Harbour dock and tunneling- Charotar publishing house private limited (ISBN 9385039199)

### **Recommended Reading:**

1. Dr.V.K.Raina, Concrete Bridge Practice, Tata McGraw Hill Publications, 2nd edition (ISBN - 818404805X)
2. Dr.P.Purushothama Raj, Ground Improvement Techniques, Bangalore University Press, 7th edition (ISBN - 9788131805947)
3. N.V.Nayak, Foundation Design Manual, Dhanpatrai Prakashan, 3rd edition (ISBN -9383182903)
4. Mahesh Varma, Metropolitan Book Co. Constuction Equipment and its Planning and Applications (P) Ltd., New Delhi, India.
5. Construction Macinery and Equipment in India, (A compilation of articles Published in Civil Engineering and Construction Review), Publish by Civil Engineering and Construction Review New Delhi,1991

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R42008L</b>	
<b>Course Title</b>	<b>Geospatial Technology</b>	
<b>Prerequisites</b>	<b>Geomatics</b>	

## **Course Outcomes**

After completion of course students will be able to:

1. Design and set out horizontal and vertical curve.
2. Use of various electronic instruments such as Digital Planimeter, Electronic Theodolite, Total station, Auto and Digital Levels and GPS receiver.
3. Apply 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

## **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

## **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

## **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 tachometric survey (Mandatory)
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 Q-GIS, Arc-GIS
8. Geo-registration Geo-Referencing 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) or contour extraction tools 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 Q-GIS, Arc-GIS.
14. Generation of Databases and relation database management system (RDBMS) using MS ACCESS.

### **Text Books**

- 1) Satheesh Gopi, R.Sathikumar , N. Madhu , Advanced Surveying - Total station , GIS and Remote sensing , First edition Pearson education ( ISBN No 9788131700679)
- 2) Lo C P, yeung A K W, Concepts and Techniques of Geographic Information Systems, 2<sup>nd</sup> edition, Prentice Hall India.

### **Recommended Reading :**

- 1) 1 N.N.Basak, Surveying and Leveling, Tata McGraw Hill Publications, 2<sup>nd</sup> Edition. (ISBN - 9789332901537)
- 2) B C Punmiya, Surveying and Leveling, Vol I-16<sup>th</sup> edition & Vol II- 4<sup>th</sup> edition, Laxmi Publications. (ISBN - 9788170088530)
- 3) R. Agor, Surveying, Khanna Publishers- 11<sup>th</sup> edition. (ISBN - 8174092358)
- 4) 4. Concepts and Techniques of Geographical Information System, Lo C.P.Yeung A K W, Prentice Hall India
4. Kang-tsung Chang, Introduction to Geographical Information System Tata McGraw Hill , 8 edition (16 February 2015) (ISBN - 0078095131)
5. K. Anji Rao, Remote sensing and Geographical information system,BS Publications (ISBN -9381075972)

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester - IV</b>
<b>Course Code</b>	<b>R4CE2009L</b>	
<b>Course Title</b>	<b>Construction Material Laboratory</b>	
<b>Prerequisites</b>	<b>Construction Engineering Laboratory</b>	

### **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. Plywood Testing  
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, Fineness Modulus.
5. Methods for Testing Tar and Bituminous Materials, IS 1201 to IS 1220, 1978:  
Penetration Test, Ductility Test, Softening Point Test, Viscosity Test and Specific  
Gravity

### **Text Books**

1. M. L. Gambhir and Neha Agarwal, Building and Construction Materials Testing and  
2) Quality Control, McGraw Hill Education India Private Limited, First Edition, 2014  
(ISBN No- 9781259029660)
- 3) Micheal S Mamlouk and John P Zaniewski, Materials for Civil and Construction  
4) Engineers, Pearson Prentice Hall, Fourth Edition, 2016 (ISBN No- 9332535221.)

### **Recommended Reading:**

Indian Standard Code with number as

- IS 5454: 1978- Methods of sampling of clay building bricks
- IS 3495 (Part 1 to 4)1992 - Methods of tests of burnt clay building bricks
- IS 2430:1986, IS 2386 (Part 1 to5): 1963- Methods for Sampling of Aggregates for  
Concrete
- IS 1201(1978) - Methods for Testing Tar and Bituminous Materials
- IS 1220: 1978- Methods for Testing Tar and Bituminous Materials

<b>Programme Name</b>	<b>Bachelor of Technology in Civil Engineering</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>R4CE4007MA</b>	
<b>Course Title</b>	<b>Indian Constitution and Laws for Civil Engineers</b>	
<b>Prerequisites</b>		

### **Course Outcomes:**

After completion of course students will be able to

1. Acquire knowledge regarding Indian legal system and its relevance for civil engineering works.
2. Identify risk and opportunities arising out of such legal knowledge.

### **Course Contents:**

#### **1 Introduction to Indian Legal System:**

Constitution of India, Sources of law, judicial system, Companies Act, Partnership Act, LLP Act, Income Tax Act, Civil law, Criminal law, Tort, RTI, Direct and indirect taxes,

#### **2 Indian Contract Act:**

Offer, Acceptance, consideration, parties eligible to contract, invalid contract, void, voidable contract, indemnity, guarantee, Model agreement for PPP projects.

#### **3 Environment & heritage Laws:**

Heritage laws, Environment laws, CRZ regulations,

#### **4 Dispute Resolution Mechanism:**

Arbitration, Conciliation, Commercial courts, Real Estate Regulation act (RERA)  
Legal permission under RERA

#### **5 Employment Laws:**

Labour laws, Laws relating to industrial dispute, health and safety of construction workers, compensation

### **Text Books :**

- 1 L.S. Ranaga Rao Contract Management and Dispute Resolutions Engineering, Staff College of India January 2008.
- 2 C. J. Schexnayder and R. E. Mayo, Construction Management Fundamentals, McGraw Hill, New Delhi. 2003
- 3 Dr. Avtar Singh Law of Contract Eastern Book Co. (EBC); 2017 edition (ISBN: 9788193547274)
- 4 FIDIC model document

### **Recommended Reading:**

1. General Conditions of Contract,Central Public Works Department, New Delhi,2010
2. D.S. Berrie and B.c. Paulson,Professional Construction Management including C.M.,Design Construct and general Contracting,McGraw Hill InternationalL,Third Edition 1992..
3. V. K. Raina,Construction & Contract Management Practices,SPD, New Delhi (ISBN - 0074518763)