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
Third Year
of
Four Year Undergraduate Programme 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

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For
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Four Year Undergraduate Programme Leading to
Bachelor of Technology (B Tech)
In
101 Civil Engineering

Programme Educational Objectives (PEO)

1. 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.
2. Develop ability to practice ethically focusing on social relevance, environmental sustainability, optimal solutions and safety of stakeholders.
3. Develop abilities of lifelong learning to continuously strive to enhance decision making abilities to investigate, design and develop complex facilities.

Programme Specific Outcomes (PSO)

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

Programme Outcomes (PO)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **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.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. 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.

11. 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.

12. 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.

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

SEMESTER V

Scheme of Instruction				Scheme of Evaluation				
Sr. No.	**Course Code**	**Course Title**	**L-T-P** (Hours / week)	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1	SE3001S	Structural Analysis – II	3-1-0	4	10	30	60	3
2	SE3002S	Geotechnical Engineering	3-0-0	3	10	30	60	3
3	SE3003S	Numerical Methods in Civil Engineering	2-1-0	3	10	30	60	3
4	CE3001S	Engineering Hydrology	2-1-0	3	10	30	60	3
5	SE3004T	Concrete Technology	3-0-0	3	10	30	60	3
	SE3004P	Concrete and Soil Laboratory	0-0-3	1.5	100%CIE			
6	CE3002T	Building Drawing and Services	3-0-0	3	10	30	60	3
	CE3002P	Building Drawing and Services Laboratory	0-0-2	1	100%CIE			
7	HM2001L	Communications and Presentations Skill Laboratory	1-0-2	2	100%CIE			
8	CE3003L	Computer Applications Laboratory	0-0-3	1.5	100%CIE			
		TOTAL	17-3-10	25				

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 VI

Scheme of Instruction				Scheme of Evaluation				
Sr. No.	**Course Code**	**Course Title**	**L-T-P** (Hours / week)	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1	SE3005T	Design of RCC & PSC Structures	3-0-0	3	10	30	60	3
	SE3005P	Design of RCC Laboratory	0-0-3	1.5	100%CIE			3
2	CE3004S	Environmental Engineering	3-0-0	3	10	30	60	3
3	CE3005S	Water Resources Engineering	2-0-0	2	10	30	60	3
4	CE3006T	Quantity Survey & Estimation	3-0-0	3	10	30	60	3
	CE3006P	Quantity Survey & Estimation Laboratory	0-0-2	1	100%CIE			
5	CE3007T	Pavement Engineering	3-0-0	3	10	30	60	3
	CE3007P	Transportation Engineering Laboratory	0-0-2	1	100%CIE			
6		Elective – I	3-0-0	3	10	30	60	
		Elective – I Laboratory	0-0-2	1	100%CIE			
7	CE3008L	Site Visit	0-0-3	1.5	100%CIE			
8	CE3009A	Disaster Management	2-0-0					
		TOTAL	19-0-12	23				

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

Semester VI List of Elective-I :

Sr. No	Course code	Course Title
1	CE3101T	Geographic Information System
	CE3101P	Geographic Information System Lab
2	CE3102T	Advanced Hydrology
	CE3102P	Advanced Hydrology Lab
3	SE3101T	Advanced Structural Analysis
	SE3101P	Advanced Structural Analysis Lab
4	SE3102T	Advanced Foundation Engineering
	SE3102P	Advanced Foundation Engineering Lab

Programme Name	Bachelor of Technology in Civil Engineering	Semester – V
Course Code	SE3001S	
Course Title	Structural Analysis II	
Prerequisites	Mechanics of Solids, Structural Analysis I	

COURSE OUTCOMES

After completion of this course students shall be able to
CO1: identify the stable and unstable structures and evaluate the degree of static and kinematic indeterminacy.
CO2: calculate deflection of statically determinate and indeterminate structures under various loading and support conditions.
CO3: analyze indeterminate structures by using force method.
CO4: analyze indeterminate structures by using displacement method.

Course Contents

1. General

Types of structures occurring in practice and their classification, stable and unstable structures, static and kinematical determinacy and indeterminacy of structures, symmetric structure, symmetrical and anti-symmetrical loads, distinction between linear and non-linear behavior, material and geometric non-linearity.

2. Deflection of Statically Determinate Structure

Review of general theorems based on virtual work and energy methods, introduction to the concept of complimentary energy, absolute and relative deflections caused by loads, temperature changes application to determinate beams, pin jointed frames and rigid jointed frames

3. Analysis of Indeterminate Structures by Flexibility Method

Flexibility coefficients and their use in formulation of compatibility equations, Castigliano's theorem of least work, application of above methods to propped cantilevers, fixed beams, continuous beams, simple pin jointed frames including effect of lack of members, simple rigid jointed frames and two-hinged arches.

4. Analysis of Indeterminate Structures by Stiffness Method

Stiffness coefficients for prismatic members and their use for formulation of equilibrium equation, direct stiffness method slope deflection method, moment distribution method, applications of the above methods to indeterminate beams and simple rigid jointed

frames, rigid jointed frames with inclined member but having only one translational DoF's in addition to rotational DOF's, including the effect of settlement of supports.

Text Books

1. S.B. Junnarkar, Structural Mechanics Vol. II, Charotar Publishers, 2008.
2. C.S. Reddy, Basic Structural Analysis, Tata McGraw Hill, 2004.
3. C.K. Wang, Intermediate Structural Analysis, Tata Mcgraw Hill, 2010.

Reference Books

1. B.N. Thadani and J.P. Desai, Modern Methods in structural Analysis, Weinall Book Corporation, 1998.
2. Pandit and Gupta, Matrix Method in Structural Analysis, Tata McGraw Hill, 2008.
3. L.S. Negi and R.S. Jangid, Structural Analysis, Tata Mcgraw Hill, 2008.
4. Gupta and Pandit, Structural Analysis Vol. I & II, Tata Mcgraw Hill,2008.
5. Gare and Weaver, Analysis of Framed Structure, CBS Publication, 2nd Edition

Programme Name	Bachelor of Technology in Civil Engineering	Semester – V
Course Code	SE3002S	
Course Title	Geotechnical Engineering	
Prerequisites	Soil Mechanics	

COURSE OUTCOMES

After completion of this course students shall be able to

CO1: evaluate earth pressures and apply to check external stability of retaining structures.

CO2: analyze and design shallow foundations by shear and settlement criteria under different loading and soil conditions

CO3: evaluate the load carrying capacity and settlement of deep foundation by shear and settlement criteria for different soil conditions under axial load.

CO4: apply principles of Three Dimensional Consolidation and soil reinforcement for soft soil improvement.

CO5: interpret and use results of soil investigation for design of Geotechnical systems.

Course Contents

1. Lateral Earth Pressures Theories

Introduction to applications of earth pressure theories, different types of earth pressure at rest, active and passive pressure. Rankine's Earth Pressure Theory: Rankine's earth pressure theory, active earth pressure and passive earth pressure for horizontal and inclined backfill including the direction of failure Planes for cohesionless and cohesive soils. Coloumb's Wedge Theory: Coloumb's active pressure in cohesionless soils, expression For active pressure, coloumb's passive earth pressure. Culmann's graphical solutions for active soils, Wedge Method, passive pressure by friction circle method for cohesionless and cohesive Soils.

2. Earth Retaining Structures

Rigid and flexible retaining structures, stability analysis of cantilever retaining Wall. Sheet Piles in sand and clay.

3. Bearing Capacity of Shallow Foundation

Definitions of ultimate bearing capacity, gross, net and safe pressures, allowable bearing pressure, types of shallow foundations modes of failures. Bearing capacity theories: Terzaghi's approach, Vesic's approach and IS 6403 (1981) method. Bearing capacity based on Standard Penetration Test. Plate load test in detail with reference to IS1888 and its applications and estimation of settlements.Introduction to Bearing capacity of foundation on compact and weathered rock.

4. Axially Loaded Pile Foundations

Introduction to pile foundations, necessity of pile foundation, classification of piles. Pile capacity based on static analysis, piles in sand, piles in clay, dynamic methods and their limitations, in- situ penetration tests and pile load test as per IS 2911 specifications, negative skin friction.Pile groups ultimate capacity of groups, settlement of pile groups in sand and in clay as per IS 2911 and critical depth method. Piles in weathered rock- Coal and Stroud method.

5. Ground Improvement Techniques

Ground improvement techniques: Stone columns and sand/band drains. Geotextile Engineering- types and functions. Basic principle of Geogrid design for Reinforced Earth wall.

6. Planning of subsurface investigation

Purpose and scope, Influence of soil conditions and type of foundation on exploratory programme, Subsurface soundings – static and dynamic methods, Planning of subsurface investigations, Type and sequence of operations, Lateral extent and depth of exploration, Interpretation of field and laboratory data.

Text Books

1. Gopal Ranjan and A.S.R.Rao,Basic and applied soil mechanics, New Age International Pvt. Ltd., 2005
2. V.N.S. Murthy, Advanced Foundation Engineering, CBS Publishers and Distributors, New Delhi, 2016.
3. Braja.M. Das, Shallow Foundation- Bearing Capacity and Settlement, Taylor & Francis, 2009.

Reference Books

1. Karl Terzaghi and Ralph B. Peck, Gholamreza Mesri, Soil Mechanics in Engineering Practice, Wiley and Sons, 1996.
2. Alamsingh, Soil Mechanics and Foundation Engineering, Vol I & Vol II, Standard book House, 2013.
3. H. Winterkorn and F.Y. Fang, Foundation Engineering Handbook, CBS Publishers & Distributors, New Delhi, 1990.
4. Joseph E. Bowles, Foundation Analysis and Design, McGraw-Hill Book Co, 2001.
5. P. Shamsher and H. Sharma, Pile Foundations in Engineering Practice, Wiley and Sons, 1990.

6. James K. Mitchell and Kenichi Soga, Fundamentals of Soil Behaviour, 3rd edition, John Wiley & Sons, New York, 2005.
7. P. Purushothama Raj, Ground Improvement Techniques (HB), Laxmi Publication Pvt Ltd., New Delhi, 2005.
8. Manfred R. Hausmann, Engineering Principles of Ground Modification McGraw-Hill Inc., US, 1990.
9. R.D. Holtz and W.D. Kovacs, An introduction to geotechnical engineering, Prentice Hall, 1981.
10. Braja M. Das, Principles of Foundation engineering, PWS Publishing Company, 2012.
11. IS1892 (1979), Subsurface Investigation for Foundation.
12. IS6403 (1981), Determination of Bearing Capacity of Shallow Foundation.
13. IS8009 Part I (1978), Calculation of Settlement of Foundation and Shallow Foundation Subjected to Symmetrical Static Vertical Loads.
14. IS2911 Part I (2010), Design and Construction of Pile Foundations, Part I Concrete Piles.
15. IS1888 (1982), Method of Load Test on Soil.
16. IS1904 (1986), Design and Construction of Foundation in Soil – General Requirements.
17. IS15284 Part I (2003), Design and Construction for Ground Improvement – Guidelines, Part I – Stone Columns

Programme Name	Bachelor of Technology in Civil Engineering	Semester – V
Course Code	SE3003S	
Course Title	Numerical Methods in Civil Engineering	
Prerequisites	Mathematics for Engineers	

COURSE OUTCOMES

After completion of this course students shall be able to
CO1: identify the attributes and use them to model any phenomenon or situation in the field of civil engineering into a set of mathematical equations.
CO2: identify the optimum methods and obtain the solution of various types of mathematical equations
CO3: perform curve fitting into a data set and perform extrapolation and interpolation of data from a given data set.
CO4: apply the principles of optimization to get optimal solutions to problems in civil engineering.

Course Contents

1. Mathematical Model

Model, Purpose of modeling, Types of model, Steps in modelling process - Problem definition, Purpose definition. Errors in engineering calculations (sources of errors, significant digits, rounding off, propagation of maximum error, propagation of variance, bias & precision)

2. Interpolation and Extrapolation

Langrange's Interpolation, Newton's Interpolation- Forward, Backward, Applications to Civil Engineering like elevation contour map, isohyetal map, .

3. Numerical Differentiation and Numerical Integration

Newton Raphson method, Modified Newton Raphson method ,Trapezoidal rule, Simpson's rule (⅓ rd, ⅜ th)

4. Curve Fitting and Errors

Curve fitting (Interpolation, function that fits given values - approximate and exact, find function where reaches min/max or a specific value, linear regression, quantifying errors in curve fitting)

5. Finite difference and finite element method

Basics of fFinite Difference Method and Finite Element Method (limited to 1D elements),

Finite Element Method (limited to 1D elements).: Basic understanding of finite element method including elements types and their formulation,

6. Optimization

Concept of optimization, Linear programming ,Dynamic Programming

Application of numerical method in the different area of Civil Engineering such as Environmental Engineering, Water resources engineering, Structural engineering

Text Books

1. M. K. Jain , SRK Iyengar, R K Jain , Numerical Methods for scientific and engineering computation, New Age International(P) Ltd. , Fourth Edition, 2003
2. Singiresu S. Rao, Engineering Optimization Theory and practice, New Age international(P) Ltd. Third edition 2004
3. Gupta S.C. and Kapoor.V.K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 1978.
4. Numerical methods for Engineers , Chapra, S.C and Canale, R .P., Mcgraw hill Int.2012.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – V**
Course Code	**CE3001S**	
Course Title	**Engineering Hydrology**	
Prerequisites	**Fluid mechanics, Mathematics for Engineers –I,II**	

COURSE OUTCOMES:-

After completion of course students will be able to

1. Measure and analyze rainfall, runoff and water losses
2. Construct and analyze different hydrographs
3. Use stream gauging techniques
4. Determine ground water flow

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Course Contents

1. Introduction

Hydrological cycle, hydrologic budget, watershed-characteristics and types

2. Precipitation:

Types, measurement, rainfall records, missing data, mass curve analysis, station year method, depth-area-duration analysis.

3. Water losses

Evaporation, interception, transpiration and infiltration, w and ϕ-indices, Horton's equation, determination of water losses.

4. Rainfall – runoff process

Factors affecting runoff, runoff computations, runoff hydrograph, flow duration curve, flow mass curve

5. Hydrograph analysis

Unit hydrograph-derivation, use and limitation, synthetic hydrograph, summation hydrograph, IUH and dimensionless unit hydrograph.

6. Stream gauging:

Techniques, latest methods for measuring depth, current-meter types, calibration, numerical examples on mid/ mean section methods, stage discharge rating curve, coefficient of correlation .

7 Ground water and well hydrology

Forms of sub-surface water, Aquifer properties , methods of ground water exploration, Yield, transmissibility, Darcy's law, Dupuit's theory of unconfined flow, steady flow towards fully penetrating wells in case of confined and unconfined aquifers.

Well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests, design of water wells

Text books:

1. G L Asawa, Irrigation Engineering, Wiley eastern
2. S K Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers
3. P N Modi, Irrigation Engineering & Hydraulic Structures,
4. Elementary Hydrology , V.P. Singh , Prentice Hall of India Pvt. Ltd. , New Delhi-110 001,1994

Reference books:

1. Varshney, Gupta & Gupta, Theory and Design of Irrigation Structures, Nem Chand & Bros
2. Punmia B C & Pande B B lal, irrigation Engineering and Water Power Engineering, Laxmi Publications
3. IS:1192-1981 velocity area methods for measurement of flow of water in open channels (first revision).
4. IS:2800 code of practice for tube well.
5. IS:3910-1992 requirements for water flow measurement in open channels-rotating elements current meters(first revision).
6. IS:3918-1966 code of practice for use of current meter (cup type) for water flow measurement.
7. IS:6936-1992 methods for determination of evaporation from reservoirs.(first revision)

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – V**
Course Code	**SE3004T**	
Course Title	**Concrete Technology**	
Prerequisites	**Elements of Civil Engineering**	

COURSE OUTCOMES

After completion of this course students shall be able to

CO1: identify and enlist the properties of raw materials and additives required to make good concrete.

CO2: define the salient features of normal and special purpose concrete.

CO3: design concrete mix for normal and special purpose concrete.

CO4: use various non-destructive testing procedures for evaluation of concrete properties.

Course Contents

1. Properties of Ingredients

Properties of coarse and fine aggregates and their influence on concrete, types of cement and their use, physical properties of 33 Grade, 43 Grade, 53 Grade ordinary Portland cement, Portland pozzolana cement, rapid hardening Portland cement, hydrophobic cement, low heat Portland cement and sulphate resisting Portland cement as per relevant I.S. codes Stone types and properties, preservative treatments, stone aggregates.

2. Grades of Concrete

Concrete for ordinary work, light weight concrete, high density concrete, workability, durability and strength requirements, effect of w/c ratio, acceptability criteria, laboratory testing of fresh and hardened concrete.

3. Concrete Mix Design

Mix design for compressive strength by I.S. methods, road note method and British method, mix design for flexural strength.

4. High Performance Concrete

Constituents of high grade concrete, various tests and application of high performance concrete.

5. Admixtures

Plasticizers, retarders, accelerators and other admixtures, test on admixtures, chemistry and compatibility with concrete.

6. Ready Mix Concrete

Requirements of ready mix concrete, transit mixer details, mix design of RMC.

7. Concrete for Repairs and Rehabilitation of structures

Polymer concrete, fiber reinforced concrete, polymer impregnated concrete, polymer modified cement concrete and Ferro cement, different tests.

8. Non-Destructive Testing of Concrete

Hammer test, ultrasonic pulse velocity test, load test, carbonation test, half cellpotentio-meter, and corrosion of steel, core test and relevant provision of I.S. codes.

Text Books

1. M.L. Gambhir, Concrete Technology, McGraw Hill Book Company, Fifth Edition, 2014.
2. M.S. Shetty, Concrete Technology, Theory and Practice, S. Chand Publication, Sixth Edition, 2009.
3. B.L. Gupta and A. Gupta, Concrete Technology, Jain Book Agency, 2013.

Reference Books

1. A.R. Santhakumar, Properties of Concrete Technology, Oxford University Press, New Delhi, 2007.
2. A.M. Neville, Properties of Concrete, Pitman Publishing Limited, London, 1999.
3. IS 10262-(2009) Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 2009.
4. IS10262 (2009), Mix Design.
5. IS269 (1989), Ordinary Portland Cement (33 Grade).
6. IS12269 (1987), Ordinary Portland Cement (53 Grade).
7. IS650 (1991), Specification of Standard Sand.
8. IS383 (1970), Specification for Coarse and Fine aggregate.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – V
Course Code	SE3004P	
Course Title	Concrete and Soil Laboratory	
Prerequisites	Elements of Civil Engineering	

COURSE OUTCOMES

After completion of this course students shall be able to

CO1: determine physical properties of fresh & hardened concrete.

CO2: To design concrete mix.

CO3: evaluate shear parameters of soil with appropriate selection of test.

CO4: determine the compressibility parameters and bearing ratio soil.

CO5: compile the experimental results for preparation of technical report.

Course Contents

1. List of Experiments for Concrete Technology

1. Effect of w/c ratio on workability (slump cone, compaction factor,
2. Effect of w/c ratio on strength of concrete
3. Concrete mix design.
4. Non-destructive testing of concrete– some applications (hammer, ultrasonic, carbonation)
5. Secant modulus of elasticity of concrete and indirect tensile test on concrete.
6. Study of admixtures and their effect on workability and strength of concrete.
7. Modulus of rupture of concrete.
8. Permeability test on concrete
9. Tests on polymer modified mortar / concrete Tests on fiber-reinforced concrete
10. Flexural test on concrete beam (central point load and two point load)

2. List of Experiments for Geotechnical Engineering

1. Direct Shear Test under UU/CD condition
2. Soaked California Bearing Ratio
3. Unconfined Compression Strength Test
4. Unconsolidated Undrained Triaxial Test in UU condition
5. Consolidation Test
6. Geotechnical report writing based on test results or real life problems

Text Books

1. IS 2720,Various relevant parts.
2. T.W. Lambe,Soil Testing for Engineers, John Wiley and Sons, New York, 1990.
3. B.M. Das, Soil Mechanics Laboratory Manua, Oxford University Press, Ninth Edition, June 2015, ISBN- 9780190209667.

Reference Books

1. Dante Fratta, Jennifer Aguettant, Lynne Roussel-Smith, CRC Press, May 2007
2. IS10262 (2009), Mix Design.
3. IS269 (1989), Ordinary Portland Cement (33 Grade).
4. IS12269 (1987), Ordinary Portland Cement (53 Grade).
5. IS650 (1991), Specification of Standard Sand.
6. IS383 (1970), Specification for Coarse and Fine aggregate.
7. IS2720 Part (1 to 41), Determination of Physical Properties of Soil.
8. SP36 Part I (1987), Compendium of IS on Soil Engineering, Part I – Laboratory tests of Soils for Civil Engineering Purpose. Part II – Field Testing of Soils for Civil Engineering Purposes.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – V**
Course Code	**CE3002T**	
Course Title	**Building Drawing and Services**	
Prerequisites	**Construction Engineering and Infrastructure Projects**	

COURSE OUTCOMES

After completion of course students will be able to

1. Implement principles of planning of buildings
2. Design and draw various constructional drawing of the buildings.
3. Plan various building services.

Course Contents:-

1 Principles of residential and public buildings :-

Concept of built environment and its application in planning. Recommendation of National building code. Green building , Introduction-Benefits, National priorities, rating system, check list, Site selection and planning, Water efficiency, Energy efficiency, Materials, Indoor environmental quality Innovation and design process

2 Planning of building

Preparation of constructional details and drawings-plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window.

Planning of building such as

- Residential building –Load bearing structure, RCC framed structure.
- Building for Education – school, college. library
- Building for health –Dispensary, Hospital
- Industrial structure
- Building for entertainment-Theatre, club house, sports club.
- Other structure-Office, Hostel, Guest house.

3 Building Water Supply and Drainage :-

Design of water supply, waste water and storm water collection system for various types of buildings. Pumps and Pump House

4 Building's Solid Waste Collection and disposal system:-

Wet and dry solid waste segregation, Vermi-composting etc. Provision of Chutes.

5 Electrical Services:-

Domestic Supply, Distribution Circuits, basic wiring systems. Design and planning: - Lighting of staircase, corridors. Automatic Water Level controller, Closed Circuit Security Monitors with Intercom/ EPBX facility, Common Dish TV antenna, Use of Solar Panels as source of power, Lightening Conductor for High-rise Buildings.

6 Fire Protection System:-

Introduction, Fire protection, requirement of water quantity estimation. Systems of fire fighting external and internal. Wet and dry risers, smoke alarm, Sprinkler system. Safety corridors in High-rise structures.

7 Elevators:-

Introduction, types of elevators. Essential features of lifts its size and requirement of minimum numbers, norms for safety doors, Operation and maintenance, Safety norms. Control systems, electrical requirement, and generator back-up, Escalators in Industry and in malls-multiplex

8 Heating Ventilation and Air Conditioning-

Ventilation, functional requirement, Heat balance system of ventilation, General rules and regulations in artificial ventilation system, Central air conditioning: - ducting and glass claddings. Operation and maintenance.

9 Domestic Gas Supply

Introduction, Characteristics of Pipe-gas service and distribution, flow, quantity, pressure and gas meters, safety precautions.

10 Building management system :-

Security Guard's Cabin, Postage collection boxes, Parking space.

Text Books

1. M.G.Shah, Kale, Patki, Building Drawing with an integrated approach to built environment Tata McGraw Hill, 2002
2. Y.S.Sane, Building Drawing, Allied Book Stall & Engineering Book Publishing Co, 4th edition Green Home, BDS Publisher
3. Patil S. M. , Building Services ,2008

Reference Books

1. National Building Code of India, 2005

2. IS 779-1978 Specification for water meter.

3. IS 909-1975 Specification for fire hydrant

4. IS 1172-1983 Code of basic requirement for water supply ,drainage & sanitation.

5. IS 1742-1983 code of practice for building drainage.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – V**
Course Code	**CE3002P**	
Course Title	**Building Drawing and Services Laboratory**	
Prerequisites	**Construction Engineering and Infrastructure Projects** **Construction Engineering Laboratory**	

COURSE OUTCOMES

After completion of course students will be able to

1. Draw various constructional drawings of buildings.
2. Use CADD for preparing construction drawings.
3. Prepare layout of various building services.

Course Contents:-

1 Preparation of constructional details and drawings-plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window

2 Concept of perspective drawing- one point , two point , three point and uses

3 Building Water Supply and Drainage :- Design of water supply, waste water and storm water collection system for buildings.

4 Building's Solid Waste Collection and disposal system:- Wet and dry solid waste segregation, Vermi-composting etc. Provision of Chutes.

5 Electrical Services:- Design and planning

6 Fire Protection System :- Fire protection, requirement of water quantity estimation. Systems of fire fighting

7 Domestic Gas Supply system layout

Text Books

1. Building Drawing with an integrated approach to built environment, M.G.Shah, Kale, Patki, Tata McGraw Hill, 2002

2. Beginning AutoCAD, Cheryl Shrock, BPB Publication, 1st edition

3. Introduction to AutoCAD 2005:2D and 3D Design, Alf Yarwood

Reference Books

1. National Building Code of India, 2005
2. AutoCAD 14: The Complete Reference: Cohn, David S, Osborne Publishers,
3. IS 779-1978 Specification for water meter.
4. IS 909-1975 Specification for fire hydrant
5. IS 1172-1983 Code of basic requirement for water supply ,drainage & sanitation.
6. IS 1742-1983 code of practice for building drainage.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – V
Course Code	HM2001L	
Course Title	Communication and Presentation Skills	
Prerequisites		

COURSE OUTCOMES

After completion of course students will be able to

1. Apply the principles and practices of business communication for communicating in a professional environment.
2. Design a technical document with correctness of language, appropriate vocabulary and style.
3. Deliver formal presentations employing effective range of verbal and nonverbal skills.
4. Recognize the attributes of a suitable candidate for a job, through participation in group discussion, interview and resume writing.

Course Contents

1. Basics of Business Communication
   a. Concept and meaning of communication
   b. Verbal and non-verbal communication
   c. barriers to the process of communication
   d. Channels of communication
   e. Role of communication in the age of information technology
2. Professional grooming and etiquette; cross-cultural communication
3. Grammar, vocabulary and summarization techniques
   a. Common errors
   b. Use of articles, prepositions, subject - verb agreement
   c. Punctuation and capitalization
   d. Technical vocabulary: business idioms, phrasal verbs
   e. Summarization
4. Speaking
   a. Intonation
   b. Modulation
   c. Basics of public speaking
   d. Gaining confidence

5 Presentation Skills
   a. Public speaking
   b. Oral presentation
   c. Graphic presentation

6 Career Oriented Communication
   a. Resume, Language and format of job application

b. Job Interviews
    i. Purpose and process
    ii. How to prepare for interviews
    iii. Language and style to be used in interview
    iv. Types of interview questions and how to answer them
c. Group Discussion: structure, dynamics and techniques of effective participation

7 Technical Writing
a. Technical writing process
b. Style and organization in technical writing
c. objectivity, clarity, precision as defining features of technical communication
d. Language and format of various types of business letters, reports; proposals, e-mails, minutes of meeting, research paper

8 Language Laboratory
a. Listening and comprehension skills
b. Reading Skills
c. Sound Structure of English
d. Intonation patterns

Text Books

1. *Business Communication* Hory Shankar Mukharjee,OUP
2. *Effective Technical Communication* Asharaf Rizvi, The McGraw Hill
3. *Business Communication* Meenakshi Raman, Prakash Singh,OUP

Reference Books

1. Basic Managerial Skills for All E.H. McGrath, PHI Learning Pvt Ltd
2. Professional Ethics R. Subramanian,OUP
3. *https://learnenglish.britishcouncil.org/en/english-grammar*

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – V**
Course Code	**CE3003L**	
Course Title	**Computer Application Laboratory**	
Prerequisites	**Applied Hydraulics, Elements of Civil Engineering**	

COURSE OUTCOMES:-

After completion of course students will be able to

1. use spreadsheets in Ms Excel to solve problems in civil engineering
2. use programming tool to solve problems in civil engineering
3. design water supply system by using software tools
4. design waste-water collection system by using software tools

Course Contents

1 Practice session for exploring worksheet functions, Creating tables in worksheet, entering formulas, statistical functions, Using worksheets to data sorting, filtering, creating charts, linking worksheets ,Preparing presentation slides, formatting, inserting figures & tables

2 Practice session for designing and constructing database , running query, Use of databases to create reports

3 Write programmes in C++, Sci lab or similar tools to solve at least 2 problems of Mechanics, Geomatics, Fluid mechanics, Mechanics of solids Concrete technology , soil mechanics

4 Design of water supply system using software tools.

5 Design of waste water and storm water collection system using software tools

Recommended Text Books:

1. Object oriented programming with C++, E Balguruswamy, 4th Edition, Tata McGraw Hill Publications.
2. Object Oriented Programming with C++, M P Bhave and S A Patekar, Publisher :Pearson Education

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**SE3005T**	
Course Title	**Design of Reinforced and Pre-stressed Concrete**	
Prerequisites	**Mechanics of Solids ,Structural Analysis I & II**	

COURSE OUTCOMES

After completion of this course students shall be able to

CO1: implement concept of working stress method for analysis and design of RCC structural elements.

CO2: implement concept of limit state method for analysis and design of RCC structural elements.

CO3: apply principles of pre-stressed concrete for design of PC sections.

Course Contents

1. Working Stress Method and Ultimate Load Method of Design

Reinforced Concrete Fundamentals (working Stress Method): Concept of reinforced concrete, stress strain characteristics of concrete and steel reinforcement, elastic theory, singly reinforced, balanced section, under reinforced section and over reinforced section, analysis and design of singly reinforced doubly reinforced rectangular and T-sections.

2. Limit State method of Design

Concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to limit states of collapse in flexure, direct compression, shear and limit states of serviceability in deflection and cracking, design of singly and doubly reinforced rectangular and T sections for flexure.

Design of members in shear and bond. Design of columns for Axial Load, Uni-axial bending moment and Bi-axial bending moment as per IS Code method. Design of one-way and two-way slabs. Design of beam subjected to bending and torsion. Design of Isolated square and rectangular footings subjected to axial load and moments, Design of combined foundations.

Design of Doglegged, Open well type staircases.

3. Pre-Stressed Concrete

Basic principles of pre-stressed concrete: materials used and their properties, methods and systems of pre-stressing.

Losses in pre-stress, analysis of various types of sections subjected to pre-stress and external loads

Text Books

1. O.P. Jain and Jai Krishna, Plain and Reinforced Concrete, Nem Chand & Bros., 1958.
2. V.L. ShahandS.R.Karve, Limit State Theory and Design of Reinforced Concrete, Structures Publication, 7th Edition, 2015.
3. N. Krishna Raju, Prestressed Concrete, Tata McGraw Hill Publishing Co., 2006.

Reference Books

1. P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford & IBH, 1996.
2. T.Y. Lin and Ned Burns, Design of Pre-stressed Concrete Structures, John Wiley and Sons Inc., 1981.
3. P.D. Arthur and V. Ramkrishnan, Ultimate Strength Design for Structural Concrete, Pitman, 1969.
4. B.P. Huges, Limit State Theory for Reinforced Concrete Design, Pitman, 1980.
5. A.K. Jain, Limit State design - Reinforced Concrete, Nem Chand & Bros, 7th Edition, 2012.
6. R.F. Warner, B.C. Rangan and A.S. Hall, Reinforced Concrete, Pitman, 1989.
7. H.J. Shah, Reinforced Concrete, Charotar Publisher, 9th Edition.
8. Shina and Roy, Theory of Reinforced Concrete, S. Chand & Co.,2013.
9. R.H. Evans and E.W. Bennett, Prestressed Concrete, Champman and Hall, London, 1964.
10. V.L. Shah and S.R. Karve, Illustrated Reinforced Concrete Design, Structures Publications, 2010.
11. IS456 (2000), Plain and Reinforced Concrete.
12. IS 875 (1987), Part I- Design Loads (Other than earthquake) for Buildings and Structures (Dead Loads).
13. IS 875 (1987), Part II- Design Loads (Other than earthquake) for Buildings and Structures (Imposed Loads).
14. IS 875 (1987), Part III- Design Loads (Other than earthquake) for Buildings and Structures (Wind Loads).
15. IS 875 (1987), Part IV- Design Loads (Other than earthquake) for Buildings and Structures (Snow Loads).

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**SE3005P**	
Course Title	**Design of RCC Laboratory**	
Prerequisites	**Mechanics of Solids ,Structural Analysis I & II**	

COURSE OUTCOMES

After completion of this course students shall be able to

CO1: implement concept of working stress method for analysis and design of RCC water tank.

CO2: implement concept of limit state method for analysis and design of Retaining Wall structures.

CO3: implement concept of limit state method for analysis and design of staircase.

CO4: prepare detailed construction drawings for RCC structures.

Course Contents

1. Design and Drawing of G+7 Storied Residential Building (limit state method of design)

Design and Drawing of G+7 Storied Residential Building for gravity and lateral loads (Wind and Earthquake) as per relevant I.S Codes.A design report and at least three A1 (imperial) size drawings sheets covering the above design shall be submitted as term work.

2. Design of Prestressed Concrete Girders

Design of Pre tensioned and Post tensioned prestressed concrete girders.A design report and at least one A1 (imperial) size drawings sheets covering the design of at least one prestressed concrete large span girder shall be submitted as term work.

3. Design of water tanks: (working stress method)

Design of Circular and a rectangular overhead water tank both by IS coefficient and approximate methods, supporting structure for overhead water tanks.A design report and at least one A1 (imperial) size drawings sheets covering the design of at least one overhead water tank shall be submitted as term work.

Text Books

1. O.P. Jain and Jai Krishna, Plain and Reinforced Concrete, Nem Chand & Bros., 1958.
2. V.L. Shah and S.R. Karve, Limit State Theory and Design of Reinforced Concrete, Structures Publication, 7th Edition, 2015.
3. N. Krishna Raju, Prestressed Concrete, Tata McGraw Hill Publishing Co., 2006.

Reference Books

1. P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford & IBH, 1996.
2. T.Y. Lin and Ned Burns, Design of Pre-stressed Concrete Structures, John Wiley and Sons Inc., 1981.
3. P.D. Arthur and V. Ramkrishnan, Ultimate Strength Design for Structural Concrete, Pitman, 1969.
4. B.P. Huges, Limit State Theory for Reinforced Concrete Design, Pitman, 1980.
5. A.K. Jain, Limit State design - Reinforced Concrete, Nem Chand & Bros, 7th Edition, 2012.
6. R.F. Warner, B.C. Rangan and A.S. Hall, Reinforced Concrete, Pitman, 1989.
7. H.J. Shah, Reinforced Concrete, Charotar Publisher, 9th Edition.
8. Shina and Roy, Theory of Reinforced Concrete, S. Chand & Co.,2013.
9. R.H. Evans and E.W. Bennett, Prestressed Concrete, Champman and Hall, London, 1964.
10. V.L. Shah and S.R. Karve, Illustrated Reinforced Concrete Design, Structures Publications, 2010.
11. IS456 (2000), Plain and Reinforced Concrete.
12. IS 875 (1987), Part I- Design Loads (Other than earthquake) for Buildings and Structures (Dead Loads).
13. IS 875 (1987), Part II- Design Loads (Other than earthquake) for Buildings and Structures (Imposed Loads).
14. IS 875 (1987), Part III- Design Loads (Other than earthquake) for Buildings and Structures (Wind Loads).
15. IS 875 (1987), Part IV- Design Loads (Other than earthquake) for Buildings and Structures (Snow Loads).

Programme Name	Bachelor of Technology in Civil Engineering	Semester VI
Course Code	CE3004S	
Course Title	Environmental Engineering	
Prerequisites	Applied Hydraulics, Environmental Studies	

Course Outcomes

After completion of course students will be able to

1. Identify and describe various elements of the water supply, sewerage , solid waste and air & noise pollution.
2. Use and apply knowledge of various types of pollutions with their sources, effects on environment and quantifications.
3. Analyze various types of pollution with their plans to control / treatment measures.
4. Design and compare sewerage systems and storm water drains.

Course Contents

1. Water:

Water Supply systems: Need for planned water supply schemes, Sources of Water, Water demand and Potable, industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design.

2. Sewage:

Sewage: Domestic and Storm water, Quantity of Sewage, Sewage flow variations.
Conveyance of sewage: Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage , Sewer appurtenances, Design of sewerage systems
Storm Water: Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, recycling of sewage – quality requirements for various purposes.

3. Air :

Composition and properties of air
Quantification of air pollutants, Monitoring of air pollutants, Air pollution - Occupational hazards, Urban air pollution: automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship.
Air quality standards, Control measures for Air pollution, construction and limitations

4. Noise

Basic concept, measurement, effects and various control methods

5. Solid waste management:

Municipal solid waste: Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW.
Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes,
Effects of solid waste on environment: effects on air, soil, water and health hazards.

Disposal of solid waste: segregation, reduction at source, recovery and recycle Disposal methods; Integrated solid waste management.

Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

Government authorities and their roles along with the legal aspects related to water supply, sewage disposal, solid waste management and monitoring and control of environmental pollution,

Text Books

1 Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson / Brooks/Cole; Second Edition 2008

2 Introduction to Environmental Engineering, Vesilind, PWS Publishing Company 2000

Reference Books

1 Water Supply and Sewerage, E.W. Steel

2 CPHEEO Manual on Water Supply & Treatment

3 Manual on Water Supply and Treatment, (latest Ed.), Ministry of Works & Housing, New Delhi.

4 Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication

5 Environmental Engineering by H.S.Peavy, D.R.Rowe, G.Tchobanoglous; 1991, Tata-Mcgraw Hill

6 IS 10500: 2012 Drinking Water – Specification

7 IS 3025 Method of Sampling and Test (Physiical and Chemical) For Water and Waste Water.

8 IS 656: 2006 Hazard Identification and risk analysis

9 IS: 2296-1982 Tolerance Limits for Inland Surface waters subject ed to pollution. (Surface water quality standards)

10 IS 14489:1998 - Occupational health and safety audit

Programme Name	Bachelor of Technology in Civil Engineering	Semester – VI
Course Code	CE3005S	
Course Title	Water Resources Engineering	
Prerequisites	Engineering Hydrology	

COURSE OUTCOMES:-

After completion of course students will be able to

1. Compute the water requirement of crops.
2. Carry out reservoir planning.
3. Describe different types of dams and spillways.
4. Design canals.
5. Describe hydraulic structures for distribution systems.

Course Contents:-

1 Water requirement of crops:

Irrigation systems: Need,minor and major, command area development , Crops and crop seasons in India, cropping pattern, duty and delta, Quality of irrigation water, Soil-water relationships: soil characteristics significant from irrigation considerations, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation, Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation

2 Reservoirs:

Types, capacity of reservoir, fixing of control levels , yield of reservoir, reservoir regulation, erosion and sedimentation, economic height of dam, selection of suitable site.

3 Dams and spillways:

Embankment dams: Classification, selection of site for dam, design considerations, estimation and control of seepage, slope protection

Gravity dams: forces on gravity dams, causes of failure, elementary and practical profile, structural joints, keys and water seals, galleries, outlets, Arch and buttress dams: types

Spillways: components of spillways, types, terminal structures, types of gates for spillway crests

Weir and barrage- types of weirs, Theories of seepage for design of weirs

4 Distribution system:

Canal systems, alignment of canals, canal losses, estimation of design discharge

Design of channels: Kennedy's and Lacey's theory of regime channels Canal outlets: non-modular, semi-modular and modular outlets

Water logging: causes, effects and remedial measures, Lining of canals: economics of lining, types of lining, Drainage of irrigated lands: necessity, methods

5 Hydraulic structures for distribution system:

Surface and sub-surface flow considerations for design of canal structures: hydraulic jump, seepage forces, uplift forces

Canal falls, cross regulator, distributary head regulator, canal escapes: types, components and design considerations

Cross drainage works: need, types, design considerations

different units of headworks, sediment control in canals, river training for canal headworks,

Text books:

1. G L Asawa, Irrigation Engineering, Wiley eastern

2. S K Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers

3. P N Modi, Irrigation Engineering & Hydraulic Structures

Reference books:

1. J D Zimmerman, Irrigation, John Wiley & Sons
2. Varshney, Gupta & Gupta, Theory and Design of Irrigation Structures, Nem Chand & Bros
3. Punmia B C & Pande B B lal, irrigation Engineering and Water Power Engineering, Laxmi Publications
4. IS:3860-1966 precast cement concrete slabs for canal lining.(superseded by IS:10646).
5. IS:3872-1966 code of practice for lining of canals with burnt clay tiles.
6. IS:4410 glossary of terms relating to the river valley projects.
7. IS :4877-1968 canals structures, drains outlets jungle clearance, plantation and regulations(second revision).
8. IS: 5477 methods for fixing the capacities of reservoirs.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**CE3006T**	
Course Title	**Quantity Survey, Estimation & Valuation**	
Prerequisites	**Elements of Civil Engineering,Construction Techniques**	

COURSE OUTCOMES

After completion of course students will be able to

1. Estimate quantities of different items of civil engineering works
2. Prepare specifications for different items of civil works
3. Analyze rates for various items of works
4. Prepare tender documents for civil works
5. Perform valuation of different civil engineering structures.

Course Contents

1. Introduction: Estimate, purpose, types , comparison, units of measurements, rules for deductions as per IS 1200

2. Approximate Estimates: Various types, their relative importance. factors to be considered, purpose, different methods. Estimation by various methods

3. Detailed Estimates: Methods of preparation of estimates for projects such as, Building R.C.C and load bearing ,Roads , miscellaneous works like Manhole, water storage tank, septic tanks etc. Bar bending schedules, Mass haul Diagrams , Earthwork Calculations, work charged establishment, schedule of rates, provisional sum, Bill of quantities, centage charges , contingencies, Administrative approval, technical sanction, Market survey of basic materials, thumb rules for computation of different materials for buildings. Percentage break up of costs

4. Specifications: Types, requirements and importance, drafting of specifications, detailed specifications for the buildings, roads, minor bridges and industrial structures

5. Rate analysis: Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment, rate analysis of common building items

6. Contract and Tender: Preparation of tender documents, importance of inviting tenders, tender notice, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and items, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance , insurance, claims, price variation,

7. Valuation: Different terms used, the role of a valuer, purpose and necessity of the same. Capitalised Value, Years purchase ,sinking fund, depreciation, types of values, Purpose of valuation

Different methods of valuation for

i. open plots , ii. open plots with existing residential & commercial structures

iii. lease hold properties Use of valuation tables and formulae

Text Books:

1. Estimating, Costing Specifications & Valuation, M Chakraborti, 21B,Bhabananda Road, Kolkata-700 026, 23rd Edition.
2 .Joy P K, Handbook of Construction Management, Macmillan
3. B.S. Patil , Building & Engineering Contracts

Reference Books:

1.Relevant Indian Standard Specifications
2.World Bank approved contract documents
3.FIDIC contract conditions
4.Bare Acts related to Minimum wages, Workman's compensation, Contract, and Arbitrat

Programme Name	Bachelor of Technology in Civil Engineering	Semester – VI
Course Code	CE3006P	
Course Title	Quantity Survey, Estimation Laboratory	
Prerequisites	Elements of Civil Engineering,Construction Techniques	

COURSE OUTCOMES

After completion of course students will be able to

1. Formulate specifications for different items of civil engg. works and analyze the rates
2. Prepare Estimate of civil engineering structures.

Course Contents

1. Estimate of residential building
2. Compute the quantities of reinforcement from bar bending schedules
3. Estimate of septic tank
4. Estimate of road work
5. Draft the specifications for various civil engineering works
6. Analyze the rates for various items of works

Text Books

1 M Chakraborti , Estimating, Costing Specifications & Valuation, , 21B, Bhabananda Road Kolkata-700 026, 23rd Edition.

2 Joy P K, Handbook of Construction Management, Macmillan

3 B.S. Patil , Building & Engineering Contracts

Reference Books:

1 Relevant Indian Standard Specifications

2 Bare Acts related to Minimum wages, Workman's compensation, Contract, and Arbitratio

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**CE3007T**	
Course Title	**Pavement Engineering**	
Prerequisites	**Construction Engineering and Infrastructure Projects**	

COURSE OUTCOMES

After completion of course students will be able to

1. Gain basic knowledge on Traffic study, highway planning, geometric design of pavements.
2. Acquire the basic knowledge of Construction techniques of Flexible and Concrete pavements.
3. Plan of various highway cross sectional element.
4. Carry out structural design flexible and rigid pavements.
5. Conduct design pavement material mix for flexible and rigid pavements.

Course Contents:-

1 Highway planning

Classification of roads, brief history of road development in India, present status of roads in India, road patterns, saturation systems, highway alignment: basic requirements for an ideal alignment, factors governing highway alignment, highway location surveys and studies, highway alignment in hilly areas, drawings and reports, highway project preparation

2 Geometric desin of highways

Terrain classification, design speed, vehicular characteristics, highway cross-section elements Sight distance: introduction to sight distance, reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance

Design of horizontal alignment: horizontal curves, design of super elevation and its provision, radius at horizontal curves, widening of pavements at horizontal curves, analysis of transition curves

Design of vertical alignment: different types of gradients, grade compensation on curves, analysis of vertical curves, summit curves, valley curves

Intersection: at grade and grade separated intersections, speed change lanes, Canalization, Design of rotary intersection and mini roundabout

3 Traffic engineering & control

Traffic engineering definitions: functions, organization and importance, necessity of understanding the behaviour of road user and vehicle characteristics, human factors governing the road user behaviour- power performance and other vehicular characteristics

Traffic studies and surveys:

Speed studies: presentation of data, journey time and delay studies, uses and various methods, relative merits and demerits

Vehicular volume counts: types, various available methods, relative merits and demerits, planning of traffic counts, vehicle occupancy surveys

Origin: destination surveys, need and uses, various available methods, checks for accuracy, presentation of data

Parking surveys: needs and types

Study of various photographic techniques available for traffic studies

Traffic signs and marking: types, location, height etc., miscellaneous traffic control aids like roadway delinators, hazard markers, object marker, speed breakers, rumble strips etc.,

Street lighting: needs, definitions, laws of illumination, methods of discernment, glare problem, light lantern arrangement, types of lamps, planning and designing

4 Pavement materials

Stone aggregates: desirable properties, tests, requirements of aggregates for different types of pavements

Bituminous materials: types, tests on bitumen, desirable properties, selection of grade of bitumen

Bituminous mix design: principle, methods, modified binders

5 Design of pavements

Types of pavements, comparison of different types of pavements, functions of pavement components, pavement design factors, design wheel load, equivalent single wheel load, repetition of loads, equivalent wheel load factors, strength characteristics of pavement materials, climatic variation;

design of flexible highway pavement as per IRC approach, design of flexible airport pavements, Stresses in rigid highway pavements, critical load positions, stresses due to loads, stresses due to temperature change, combined loading and temperature stresses, Joints in rigid pavements: transverse joints, longitudinal joints, fillers and sealers

6 Highway construction

Equipment used for construction, embankment design and construction, construction of different Types of roads: water bound macadam, different types of bituminous pavements, cement concrete pavements,

Construction of soil stabilized roads: different soil stabilization methods, use of geo-textiles and geo-grids

7 Highway drainage

Necessity, surface draining, highway sub drainage, draining of city streets

8 Highway maintenance & rehabilitation

Pavement failures: flexible pavement failures, rigid pavement failures, maintenance of different types of pavements: assessment and need for maintenance, pavement management system, evaluation of pavements: structural evaluation of pavements, functional evaluation of pavements, strengthening of existing pavements: object of strengthening, types of overlays, design of different types of overlays

Text Books

1. L R Kadiyali, N B Lal, Principles and practice of highway engineering, Khanna Publications, 2005
2. Principles Of Transportation Engineering, Partha Chakroborty, PHI Learning, 1st edition
3. Principles of Highway Engineering and Traffic Analysis, 4th Edition, Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, John Wiley

Reference Books

1. Morlok, E. R. (1970). An Introduction to Transportation Engineering and Planning, McGraw Hill Kagakusha International Student Edition.
2. Hay, W. W. (1988). 2nd Ed. Introduction to Transportation Engineering. John Wiley and Sons, New York.
3. Papacostas, C. S. (1987). Fundamentals of Transportation Engineering, Prentice Hall of India, New Delhi

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**CE3007P**	
Course Title	**Transportation Engineering Lab**	
Prerequisites	**Construction Engineering Laboratory**	

COURSE OUTCOMES

After completion of course students will be able to

1. Perform quality control tests needed for pavement construction and maintenance.
2. Describe types of pavements.
3. Prepare mix design reports of pavements.
4. Plan and conduct traffic studies for estimating traffic flow characteristics.
5. Conduct physical evaluation of pavements using modern tools and equipments.

Course Contents

1. Aggregates:

Sieve analysis, crushing value, shape test, impact test, abrasion test, soundness test, Specific Gravity Test, Fineness Modulus Test.

2. Bitumen:

Penetration test, Ductility test, Softening point test, Viscosity test, Flash & fire point test

3. Bituminous / Asphalt Pavement Design:

Mix design for pavements: Water Bound Macadam, Bituminous Macadam, and Asphalt Concrete.

4. Traffic Studies:

Spot Speed Study

5. Physical Evaluation of Pavements:

Roughness Index Measurement: Benkelman Beam Test, Bump Integrator Test.
Skid Resistance Test, Ground Penetration Radar: Underground utility mapping test.

Text Books

1. Khanna S.K, Justo C.E.G. and Veeraraghavan A, Highway Material Testing, New Chand Publications, New Delhi, 2009.
2. Ministry of Road Transport and Highways, fifth revisions, by Indian Road Congress.
3. Asphalt Institute Manual Series No.2 (MS-2) Mix design methods for Asphalt concrete and other hot mix types Lexington Ky, 1993.

Recommended Reading

Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, Principles of Highway Engineering

Programme Name	Bachelor of Technology in Civil Engineering	Semester – VI
Course Code	CE3101T	
Course Title	Geographical Information System (Elective-I)	
Prerequisites	Geomatics , Geospatial Laboratory	

COURSE OUTCOMES

After completion of course students will be able to

1. Acquire a basic understanding of GIS modeling concepts, components, requirements and applications
2. Create spatial and non-spatial models for presentation, analysis and decision-making
3. Achieve competency in the use of the GIS software modules
4. Design and execute a workflow using GIS techniques appropriate to an applied field

Course Contents

1 Basic concepts of GIS

Information systems, spatial and non-spatial information, geographical concepts and terminology, advantages of GIS, basic components of GIS, commercially available GIS hardware and software, organization of data in GIS

2 GIS data

Field data, statistical data, Maps, aerial photographs, satellite data, points, lines and areas features, vector and raster data, advantages and disadvantages, data entry through keyboard, digitizers and scanners, digital data, preprocessing of data-rectification and registration, interpolation techniques

3 Data management

DBMS, various data models, run-length encoding, quadtrees, data analysis-data layers, analysis of spatial and non-spatial data, data overlay and modeling, data processing: raster based and vector based, data presentation –hardcopy devices, softcopy devices

4 Remote sensing and GIS integration

Principles of electromagnetic remote sensing, imaging characteristics of remote sensing systems, extraction of metric and descriptive information from remotely sensed images, integration of remote sensing and GIS

5 Application of GIS

Map revision, land use, agriculture, forestry, archeology, municipal geology, water resources, soil erosion, land suitability analysis, change detection

Text Books

1. Lo C P, yeung A K W, Concepts and Techniques of Geographic Information Systems, 2nd edition, Prentice Hall India.
2. Kang-tsung Chang, Introduction to Geographic Information Systems, Tata mcGraw Hill, 2007

Reference books:

1. Concepts and Techniques of Geographical Information System, Lo C.P.Yeung A K W, Prentice Hall India
2. Introduction to Geographical Information System, Kang-tsung Chang, Tata McGraw Hill
3. Remote sensing and Geographical information system, K. Anji Rao , BS Publications

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**CE3101P**	
Course Title	**Geographical Information System Laboratory (Elective-I)**	
Prerequisites	**Geomatics , Geospatial Laboratory**	

COURSE OUTCOMES

After completion of course students will be able to

1. Create Geospatial models for presentation of thematic Maps
2. Achieve competency in the use of GPS receiver Mapping the GIS software modules
3. Design the decision model for Proximity Analysis, Buffer zoning, identifying Shortest Path using GIS techniques appropriate to an applied field of Civil Engineeing.

Course Contents

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.

Practical's:

1. Geo-registration of map and its digitization by using suitable GIS software.
2. Generation of Thematic Maps of suitable spatial data class in Vector model and Raster Model
3. Collection of field data like point data, line data and area data by using surveying and mapping GPS receiver
4. Post-processing the GPS data by using post processing software such as Pathfinder software.
5. Generation of Databases and relation database management system (RDBMS) using MS ACCESS.
6. Study of satellite images and its interpretation, false color combination etc.

7. Mini project on Application of GIS / GPS for Civil Engineering projects based on for Proximity Analysis, Buffer zoning, identifying Shortest Path

Text Books

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

Reference books:

1. Concepts and Techniques of Geographical Information System, Lo C.P.Yeung A K W, Prentice Hall India

2. Introduction to Geographical Information System, Kang-tsung Chang, Tata McGraw Hill

3. Remote sensing and Geographical information system, K. Anji Rao , BS Publications

Programme Name	Bachelor of Technology in Civil Engineering	Semester – VI
Course Code	CE3102T	
Course Title	Advanced Hydrology (Elective-I)	
Prerequisites	Engineering Hydrology	

COURSE OUTCOMES

After completion of course students will be able to

1. Measure and analyze the meteorological data
2. Model surface and subsurface water flow
3. Optimize the water resource system.

Course Contents:-

1 Introduction and Basic Concepts :

System Components, Planning and management , Concept of a system, Advantages and limitations of systems approach, Modeling of Water Resources Systems , Simulation and optimization, Economics in water resources, Challenges in water sector

2 Measurement and Processing of meteorological Data

Measurement and Processing of Rainfall Data , Stream flow Data , Meteorological Data, Ground Water data , Data acquisition and management of spatial data, Hydrological databases and Dissemination of Data , Statistical Analysis of Data : Regression, Correlation and Data Generation

3 Measurement of flow

Techniques, latest methods for measuring depth, current-meter types, calibration, numerical examples on mid/ mean section methods, stage discharge rating curve, coefficient of correlation.

4 Surface flow modeling techniques

Hydrological and hydraulics flow model, Reservoir routing, channel routing, general operation of flood forecasting, forecasting methods adopted in India, forecasting by unit hydrograph method.

5 Subsurface flow modeling techniques

Yield, transmissibility, Darcy's law, Dupuit's theory of unconfined flow, steady flow towards fully penetrating wells in case of confined and unconfined aquifers.

6 Optimization

Economics in water resources, Modeling of water resources systems, Constrained and unconstrained optimization, Linear programming with applications to reservoir sizing, reservoir operation, Dynamic programming with applications to water allocation, capacity expansion, reservoir operation

Text books:

1. G L Asawa, Irrigation Engineering, Wiley eastern

2. S K Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers

3. P N Modi, Irrigation Engineering & Hydraulic Structures,

4. Elementary Hydrology , V.P. Singh , Prentice Hall of India Pvt. Ltd. , New Delhi-110 001,1994

Reference books:

1. J D Zimmerman, Irrigation, John Wiley & Sons

2. Varshney, Gupta & Gupta, Theory and Design of Irrigation Structures, Nem Chand & Bros

3. Punmia B C & Pande B B lal, irrigation Engineering and Water Power Engineering, Laxmi Publications

Programme Name	Bachelor of Technology in Civil Engineering	Semester – VI
Course Code	CE3102P	
Course Title	Advanced Hydrology Laboratory (Elective-I)	
Prerequisites	Engineering Hydrology	

COURSE OUTCOMES

After completion of course students will be able to

1. Collect and analyze the meteorological data.
2. Model and simulate surface and subsurface water flow.

Course Contents:-

1 Measurement and Processing of Data

Acquisition and management of spatial data and temporal data

Statistical Analysis of Data : Regression, Correlation and Data Generation

Measurement and Processing of Meteorological Data obtained from weather station

2 Measurement of flow

Techniques, latest methods for measuring depth, current-meter types, calibration,

Measurement and Processing of stream flow data obtained from stream flow gauging station

3 Surface flow modeling techniques

Hydrological and hydraulics flow model using SWMM, HEC-HMS, HEC-RAS.

4 Subsurface flow measurement and processing of data

Measurement and Processing of Ground Water and subsurface data

5 Optimization

Constrained and unconstrained optimization, Linear programming with applications to reservoir sizing, reservoir operation,

Dynamic programming with applications to water allocation, capacity expansion, reservoir operation

Text books:

1. G L Asawa, Irrigation Engineering, Wiley eastern

2. S K Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers

3. P N Modi, Irrigation Engineering & Hydraulic Structures,

4. Elementary Hydrology , V.P. Singh , Prentice Hall of India Pvt. Ltd. , New Delhi-110 001,1994

Reference books:

1. J D Zimmerman, Irrigation, John Wiley & Sons

2. Varshney, Gupta & Gupta, Theory and Design of Irrigation Structures, Nem Chand & Bros

3. Punmia B C & Pande B B lal, irrigation Engineering and Water Power Engineering, Laxmi Publications

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Programme Name	Bachelor of Technology in Civil Engineering	Semester – VI
Course Code	SE3101T	
Course Title	Advanced Structural Analysis (Elective-I)	
Prerequisites	Mechanics of Solids, Structure Analysis I and II	

COURSE OUTCOMES

CO1: to analyze frames using stiffness method and moment distribution method.

CO2: to analyze frames and trusses using flexibility method in matrix form

CO3:to analyze indeterminate structures using Muller Breslau's Principle

CO4:to analyze building frames using simplified and approximate method

CO5:to analyze and design steel structures using plastic analysis concept.

Course Contents

1. Introduction to Stiffness Method in Matrix Form

Basic concepts of stiffness coefficients, member stiffness matrix for truss and beam elements, properties of stiffness matrix, co-ordinate transformation matrix, stiffness matrix in local and global co-ordinate axes system. Assemblage of structure stiffness matrix and application of boundary conditions, equivalent joint loads. Method of solution for displacements and computation of internal forces in members. Application of stiffness method to beams, pin jointed trusses and rigid jointed plane frames.

2. Conventional form of Stiffness Method, Moment Distribution Method

Application to frames involving sideways, consideration of symmetry and antisymmetry of loads on symmetrical structures, modification of stiffness and carryover factors for symmetric and antisymmetric loads.

3. Flexibility Method in Matrix Form

Review of concepts of flexibility coefficients, selection of primary structure, concept of structure flexibility matrix, compatibility equations. Solution for redundant forces, computation of internal forces and jointed displacements. Applications to continuous beams, pin jointed trusses and rigid jointed plane frames

4. Conventional Form of Flexibility Method

Elastic centre method and its application to rectangular box, rigid jointed portal frames, and fixed arches. Introduction to column analogy method and its application to the determination of stiffness coefficients, carry over factors and fixed and moments for non prismatic member.

5. Muller Breslau's Principle

Use of Muller Breslau's Principle for drawing influence line diagrams for statically indeterminate structures. Influence line diagrams for propped cantilevers, fixed beams and continuous beams.

6. Approximate Methods for Analysis of Building Frames

Substitute frame, cantilever and portal methods

7. Introduction to Plastic Analysis of Steel Structures

Concept of plastic hinge and plastic moment carrying capacity, shape factor, determination of collapse load for single and multiple span beams.

Text Books

1. C.S. Reddy, Elementary Structural Analysis
2. Gupta and Pandit, Structural Analysis Vol I and Vol II, Tata McGraw Hill

Recommended Reading

1. R.K. Livesley, Matrix Methods of Structural Analysis.
2. J.M. Gere and W. Weaver, Analysis of Framed Structure.
3. Wilber, Elementary Structural Analysis.
4. S.A. Raz, Analytical Methods in Structural Analysis, New Age Int. Publishers.
5. B.N. Thadani, Modern Methods in Structural Mechanics.
6. B.G. Neal, Plastic Methods of Structural Analysis.
7. Laursen, Structural Analysis.
8. C.K. Wang, Intermediate Structural Analysis, Tata McGraw Hill.
9. Pandit and Gupta, Matrix Method in Structural Analysis, Tata McGraw Hill.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**SE3101P**	
Course Title	**Advanced Structural Analysis Laboratory (Elective-I)**	
Prerequisites	**Mechanics of Solids, Structure Analysis I and II**	

COURSE OUTCOMES

After completion of course students will be able to

Course Contents

Application of software packages to analyze and evaluate 2-Dimensional and 3-Dimensional structural systems in civil engineering.

Application of software packages to perform plastic analysis on 2-Dimenssional and 3-Dimensional structural systems in civil engineering

List of Software Packages: ANSYS, ABAQUS, ETABS, SAFE, STAAD, MIDAS

Text Books

1. C.S. Reddy, Elementary Structural Analysis
2. Gupta and Pandit, Structural Analysis Vol I and Vol II, Tata McGraw Hill

Recommended Reading

1. R.K. Livesley, Matrix Methods of Structural Analysis.
2. J.M. Gere and W. Weaver, Analysis of Framed Structure.
3. Wilber, Elementary Structural Analysis.
4. S.A. Raz, Analytical Methods in Structural Analysis, New Age Int. Publishers.
5. B.N. Thadani, Modern Methods in Structural Mechanics.
6. B.G. Neal, Plastic Methods of Structural Analysis.
7. Laursen, Structural Analysis.
8. C.K. Wang, Intermediate Structural Analysis, Tata McGraw Hill.
9. Pandit and Gupta, Matrix Method in Structural Analysis, Tata McGraw Hill.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – VI
Course Code	SE3102T	
Course Title	Advanced Foundation Engineering (Elective-I)	
Prerequisites	Soil Mechanics & Geotechnical Engineering	

COURSE OUTCOMES

After completion of this course students shall be able to

CO1: evaluate shear strength behavior of soil under different drainage conditions and compressibility potential under complex pore pressure conditions.

CO2: determine stresses due to applied loads for the analysis of settlement.

CO3: explain the advanced methods of computation of bearing capacity for homogenous, layered and sloping soil deposit under the axial or eccentric/inclined loads and settlement for different types of soil.

CO4: evaluate techniques of axial load carrying capacity of piles embedded in soil and weathered rock and lateral load capacity in granular soil.

CO5: illustrate the methods of ground improvement technique for improvement of weak soil.

Course Contents

1. **Consolidation**

   Terzaghi's theory of One Dimensional Consolidation – derivation of equation (solution in detail need not be covered), Field consolidation curves, Consolidation settlement of NC and OC clays, practical applications

2. **Stress and strain behavior of soil**

   Failure criteria in soils – only Mohr – Coulomb's criteria, Ideal, plastic and real soil behavior, Shear strength of sand and clays. Skemton's pore pressure parameters. Soil elastic modulus

3. **Estimation of stresses**

   Boussinesq's theory, Westergard's theory, Newmarks charts.

4. **Bearing capacity and settlement analysis of shallow foundations:**

   Bearing Capacity theories – Terzaghi solution (detailed approach), Vesic's theory. IS 6403 (1981) method and Skempton's method. Assumptions in estimates of ultimate loads, Effect of shape, embedment of footing, eccentricity and inclination in loading. Effect of compressibility (including critical rigidity index), Bearing capacity of non-uniform soils (Meyerhof &Hamnna). Foundation on Sloping Ground. Elastic settlement use of Steinbrenner and Fox Theory, Schmertmman's method. Bearing capacity of foundation on compact and weathered rock. Raft foundation. Foundations on collapsing and swelling soils, compressible soils and on rock, R.C.C. design of isolated and combined footings

5. **Pile foundations:**

   Use of load tests, Estimation of single pile capacity by static formulae using β methods and dynamic methods, Group capacity, Separation of skin friction and end bearing capacity, Settlement of single and group of piles. Capacity from in-situ tests (SPT and SCPT). Piles in weathered rock. Piles subjected lateral load. Elastic –p-y curve analyses. pile subjected to uplift loads

6. **Ground improvement:**

   Ground improvement of soft soil: Sand Drains/Band Drains,Stone columns and Dynamic consolidation. Geological properties of reinforced soils, Design of Reinforced Earth wall using Geogrid using BS 8006 or other relevant codes and use of Geocell. Instrumentation – mainly pore pressure gauges and settlement gauges and their applications. Introduction to Grouting techniques.

7. **Introduction to Soil Structures Interaction**

   Introduction to soil - Foundation interaction problems, Soil behaviour, Foundation behaviour, Interface, behaviour, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behavior.

Text Books

1. B.M. Das, Shallow Foundation- Bearing Capacity & Settlement, Taylor & Francis.
2. B.M. Das, Principles of Foundation engineering, PWS Publishing Company, 2012.
3. Ranjan, Gopal andA.S.R. Rao, Basic and applied soil mechanics, New Age International Pvt. Ltd., 2004
4. V.N.S. Murthy, Advanced Foundation Engineering, CBD Publishers and Distributors, New Delhi, 2010.
5. H.G. Poulos and E.H. Davis, Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
6. A.P.S. Selvadurai, Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.
7. R.M. Koerner, Designing with Geosynthetics, (Third Edition), Prentice Hell, 1997.

Recommended Reading

1. K. Terzaghi and R.B. Peck, Soil Mechanics in Engineering Practice, Wiley and Sons, 1996.
2. Alamsingh, Soil Mechanics and Foundation Engineering, Vol I & Vol II, Standard book House, 2013.
3. R.D. Holtz andW.D. Kovacs, An introduction to geotechnical engineering, Prentice Hall, 1981.
4. H. Winterkorn and F.Y. Fang, Foundation Engineering Handbook, CBS Publishers & Distributors, New Delhi, 1990.
5. J.E. Bowles, Foundation Analysis and Design, McGraw-Hill Book Co, 2001.

6. P. Shamsher and H. Sharma, Pile Foundations in Engineering Practice, Wiley and Sons, 1990.
7. R. Purushothama, Ground Improvement Techniques (HB), Laxmi Publication Pvt Ltd., New Delhi, 2005.
8. M.R. Hausmann, Engineering Principles of Ground Modification McGraw-Hill Inc., US, 1990.
9. IS1892 (1979), Subsurface Investigation for Foundation.
10. IS6403 (1981), Determination of Bearing Capacity of Shallow Foundation.
11. IS8009 Part I (1978), Calculation of Settlement of Foundation and Shallow Foundation Subjected to Symmetrical Static Vertical Loads.
12. IS2911 Part I (2010), Design and Construction of Pile Foundations, Part I Concrete Piles.
13. IS1888 (1982), Method of Load Test on Soil.
14. IS1904 (1986), Design and Construction of Foundation in Soil – General Requirements.
15. IS15284 Part I (2003), Design and Construction for Ground Improvement – Guidelines, Part I – Stone Columns.

Programme Name	Bachelor of Technology in Civil Engineering	Semester – VI
Course Code	SE3102P	
Course Title	Advanced Foundation Engineering Laboratory (Elective-I)	
Prerequisites	Soil Mechanics & Geotechnical Engineering	

COURSE OUTCOMES

After completion of this course students shall be able to

CO1: evaluate shear parameters under specific drainage condition
CO2: determine the elastic modulus and ultimate strength of rock samples.
CO3: Analyze and design shallow and deep foundations.
CO4: design an appropriate ground improvement scheme for weak soil.
CO5: analyze and design reinforced earth retaining structures.

Course Contents

1. Tri-axial test under C-U condition
2. Cyclic Tri-axial test
3. Unconfined compression test on rock samples
4. Modulus of elasticity of rock sample
5. Field penetration (SPT) test (optional)
6. Design report based on shallow foundation
7. Design report based on pile foundation
8. Design of Ground Improvement scheme
9. Design of Reinforced Earth. wall

Text Books

1. IS 2720, Various relevant parts.
2. T.W. Lambe, Soil Testing for Engineers, John Wiley and Sons, New York, 1990.
3. B.M. Das, Soil Mechanics Laboratory Manual. Oxford University Press, June 2012, ISBN-10: 0199846375.

Reference Books

1. Dante Fratta et al, Introduction to Soil Mechanics Laboratory Testing, CRC Press, May 2007.
2. IS2720 Part (1 to 41), Determination of Physical Properties of Soil.
3. SP36 Part I (1987), Compendium of IS on Soil Engineering, Part I – Laboratory tests of Soils for Civil Engineering Purpose. Part II – Field Testing of Soils for Civil Engineering Purposes.

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**CE3008L**	
Course Title	**Site Visit**	
Prerequisites	**Construction Engineering and Infrastructure Projects, Construction Engineering Laboratory**	

COURSE OUTCOMES

After completion of course students will be able to

CO1: Describe the process of construction activities

CO2: Examine the quality checks for various items of work

CO3: Relate the construction activities with working drawings

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Course Contents

The sites should be selected in such a way that during various visits, they should be able to observe / study most of the activities related to building construction like, concreting of footings and columns, bar bending, concreting of slab, flooring, plastering, plumbing, painting, cladding, false ceiling, air conditioning and interpret the working drawings.

The entire class will be divided in to a group of 5-6 students .They will be assigned one ongoing project site .The group will visit the site alternate week & will do presentation alternate week on progress of work on site.

In addition to this ,two to three common site visits will be arranged amongst the following sites:

- High rise building
- Flyover Bridge site
- Metro road / rail project
- Structural steel fabrication and erection
- Ground improvement methods
- Tunneling by conventional method or by TBM
- Cassion foundations and piling.
- Asphalt laying and concreting of roads
- Ready mix concrete plant / ready mix asphalt plant
- Earth work for dam or transport project
- Fabrication and erection of pre-cast concrete elements
- Mass concreting (roller compacted concrete / hot weather concrete / cold weather concrete / under water concrete)
- Mechanized canal construction (excavation, leveling and lining)
- Repairs, rehabilitation works
- Pre-stressing
- Any other ongoing construction site

The students are expected to observe method of work, operations involved, tools used, quality checks, record keeping, site layouts, productivity of workmen, gang size, equipment used etc.

The student shall prepare and submit detail report for every site visited during Semester VI. The report should clearly indicate observations made during such visits supplemented with ample sketches / drawings/photographs.

Text Books

1 A to Z of Practical Building construction and its Management, Mantri Institutions of development and Re Pune

2 Joy P K, Handbook of Construction Management, Macmillan

Programme Name	**Bachelor of Technology in Civil Engineering**	**Semester – VI**
Course Code	**CE3011A**	
Course Title	**Disaster Management**	
Prerequisites	**Soil Mechanics, Environmental Engineering, Engineering Hydrology**	

COURSE OUTCOMES

After completion of course students will be able to

1. classify different types of disasters.
2. calculate disaster impact.
3. plan disaster risk mitigation.

Course Contents

1. Introduction –

Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation..

2. Disasters –

Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires, blast.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

3. **Disaster Impacts** - Disaster impacts (environmental, physical, social, ecological, economical, political); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

4. Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and nonstructural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

5. Disasters, Environment and Development –

Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text Books

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B.K., 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.